Schedule A

General Description of Equipment and Specifications

1. GENERAL

1.1 SYSTEM DESCRIPTION

.1 Provide emergency power system for supply of power in the event of failure of normal supply as indicated and in accordance with Canadian Electrical Code Section 46 and local inspection authority. System to be automatic, unattended, emergency power supply consisting of:

.1 Diesel fuel powered, electric generating unit with control panel

.2 Accessories and equipment as specified in this Specification.

1.2 DESIGN CRITERIA

.1 System to consist of complete standby power supply unit, self-contained liquid cooled, diesel engine directly coupled to ac alternator complete with fittings, connections, auxiliaries, control panels, safety devices, meters, etc. as indicated for a complete operating system.

.2 Design equipment suitable to meet the following criteria:

.1 Total Rated Load: 500 KW

.2 Voltage: 600V; Three Phase, four wire

.3 Frequency: 60 Hz

.4 Power Factor: 0.8

.5 Maximum Rotational Speed: 1800 rpm

.6 Duty Rating: Full continuous standby

.7 Performance: Automatic

.8 Elevation above sea level: 1020 m

.9 Ambient temperature: -40°C to 40°C

.10 Relative humidity: 60%

.11 Mounted on slab on grade outside of building

.3 Unit must be capable of starting, attaining settled voltage and frequency limits and accepting full rated load with voltage and frequency settling to the specified steady state bands, all within 15 seconds for any temperature between -40 °C. to 40 °C.

.4 Use engine manufacturer's standard, published continuous (prime) horsepower rating in assessing engine capacity and derate this rating for the specified conditions and engine driven accessories in accordance with latest revisions of ISO 3046/1.

.5 Description of generating set operation upon power failure:

.1 Automatic starting on contact closure from automatic transfer switch.

.2 When the emergency supply has reached settled voltage and frequency preset limits (adjustable) the transfer switch will transfer the load to the emergency supply.

.3 The set will continue to supply the load until utility supply returns or the set is shut down manually or under failure conditions.

.4 An adjustable time delay relay shall allow the engine to run unloaded to cool down and subsequently to shut down, ready for the next cycle.

.5 The engine shall be equipped with a key switch with the following positions: Auto-off-crank-start, key removable in auto positions only.

.6 Automatic shut down on:

.1 Overcranking

.2 Overspeed

.3 High engine temperature

.4 Low lubricating oil pressure

.5 Over and under frequency

.6 Unit to be equipped with a double wall secondary containment sub-base fuel tank which will contain fuel to support the generator set for a minimum period of 24 hours at 100% rated load. Additional criteria as follows:

.1 The above ground steel secondary containment tank for use as a sub base for diesel generators is manufactured and intended to be installed in accordance with the Flammable and Combustible Liquids Code – NFPA 30, the Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines – NFPA 37 and Emergency and Standby Power Systems – NFPA 110.

.2 For normal venting the unit shall be furnished with an appropriate sized vent cap.

.3 The emergency vent opening shall be sized to accommodate the total capacity of both normal and emergency venting and shall be not less than stipulated in NFPA

30 based on the wetted surface area of the tank. The wetted area of the tank shall be calculated on the basis of 100 percent of the primary tank.

.4 Emergency venting shall be provided for the secondary tank.

.5 There shall be a 2" NPT opening within the primary tank for fuel fill. The fuel fill shall be furnished with a lockable manual fill cap.

.6 A local fuel level indication (0-100%) shall be provided. The indication shall be visible from the fuel fill location.

.7 A fuel level transmitter capable of providing a 4-20mA DC signal for remote indication shall be provided. The transmitter shall be capable of 0-100% of fuel level.

.8 A low fuel level switch shall be provided for remote annunciation.

.9 A leak detection switch shall be provided for remote annunciation of the presence of fuel in the secondary tank.

.10 A drain shall be provided on the secondary tank.

.7 The unit shall be housed in an outdoor enclosure as follows:

.1 Weatherproof Sound attenuating enclosure (<70 dBA at 7 meters)

.2 Winter package rated for – 40 deg C operation

.3 Automatic Louvers to modulate enclosure heat.

.8 Unit to be equipped with a second generator breaker to allow for periodic connection of a load bank for testing.

.9 Communication

.1 The Generator shall be able to communicate via Ethernet for remote monitoring purposes.

1.3 MANUFACTURE

.1 Generator: Volvo, Blue Star, Cummins, Caterpillar, MTU, or approved equivalent.

1.4 SUPPLIER QUALIFICATIONS AND QUALITY ASSURANCE

.1 Qualifications: service and parts facilities in close proximity with 24 hour service, experienced in installation and operation of set of comparable size.

.2 A minimum of five years experience in the design, manufacture, assembly and testing of diesel fuel generator systems is required.

.3 All work shall meet requirements of Quality Standard CSA Z299.3.

1.5 SHOP DRAWINGS

.1 Submit within 3 weeks of contract award an electronic copy (PDF format) of shop drawings for review to Engineer.

.2 An electronic copy will be returned to the Contractor within 2 weeks of receipt as reviewed, reviewed as noted, or rejected. Contractor shall incorporate changes identified on the drawings and resubmit the drawings for further review within two weeks.

.3 Do not proceed with fabrication of equipment until review process is completed.

.4 Shop drawings and specifications shall include, but not be limited to, the following:

.1 Engine: make, model, rating and performance curves.

.2 Starter motor, make, model.

.3 Generator: make, model and rating complete with generator saturation curves, heat damage curves, reactive capability and special data.

.4 Voltage Regulator: make, model, type.

.5 Governor: type, model.

.6 Battery: make, type, voltage, capacity.

.7 Charger: make, model, input and output rating.

.8 Submit a general outline drawing of the complete assembly showing engine and generator mounting , exhaust, recirculating and intake air louvre arrangement, exhaust gas silencer and pipe arrangement, locations of fuel and lubricating oil filters, fuel supply and return line connections, lubricating oil drain valve, air cleaner, engine instrument panel, starting motor, power and control junction boxes, engine and generator mounting feet. Indicate on drawings horizontal and vertical dimensions, minimum door opening required for moving the unit, head room required for removal of piston and connecting rod, and weight of engine, generator, baseplate and exhaust silencer.

.9 Baseplate construction details and materials.

.10 Type and layout of all panels.

.11 Schematic and wiring diagrams of engine, generator and control panel.

.12 Single line diagram showing all breakers, switches, metering and protective relays.

.13 Field wiring diagrams.

.14 Complete bill of materials, including manufacturer's name, catalogue numbers and capacity.

.15 Type of Ethernet interface and protocol used.

.5 Device Numbering System shall be in accordance with IEEE 200-1975 Reference Designations for Electrical and Electronics Parts and Equipment.

.6 Responsibility for errors and omissions in the drawings submittal is not relieved by review of submittals by Owner or the Engineer

1.6 MAINTENANCE DATA AND INSTRUCTION MANUALS

.1 Provide, but not be limited to, the following in English for incorporation into instruction manuals:

.1 Complete set of reviewed shop drawings.

.2 Factory test data of engine, generator, exciter, control logic, metering and all other pertinent test data.

.3 Maintenance and operation bulletins for:

.1 Engine and Accessories.

.2 Generator.

.3 Voltage Regulator and Accessories.

.4 Exciter.

.5 Permanent magnet generator if installed.

.6 Battery Charger.

.7 Speed Governor.

.8 Starting Motor.

.9 Batteries.

.10 Ventilating Equipment.

.11 Timers, Relays, Meters.

.12 Power Circuit Breakers.

.13 Other Accessories.

.2 If brochures are submitted, these shall be originals; photocopies are not acceptable. Brochures shall contain all technically relevant data.

.3 Complete sequence of system operation.

.4 Complete bill of materials including nameplate data of equipment and accessories.

.5 Forward, two weeks prior to the factory tests, one copy of instruction manual.

.6 Forward, within two weeks after the factory tests, three copies of instruction manuals, with updated drawings.

1.7 GUARANTEE

.1 Provide a written guarantee signed and issued to the Owner stating that the complete assembly consisting of the generator unit and all equipment and accessories is guaranteed against defects and malfunction for a period of two years from the date of installation.

1.8 SPARES

.1 For panels provide the following:

.1 One spare control circuit breaker per rating.

.2 One spare control relay and socket per rating and contact arrangement.

.2 Provide for the generator unit, a standard set of engine manufacturer's spare parts for one year normal operation 1,000 operating hours. Spares to include as a minimum:

.1 Two fuel filter elements for each type of fuel filter/water separator.

.2 Two lubricating oil filter elements.

.3 Three air cleaner elements.

.3 Provide conclusive evidence that a Canadian distributor has been established and will stock in Canada spare parts likely to be required during the normal life of the engine.

1.9 ACCEPTANCE TESTS

.1 General: before acceptance, assemble and setup the unit, complete with specified equipment, for tests at the supplier's plant. Tests may be witnessed by the Engineer on a

date mutually agreed on. Provide suitable test area with adjustable loading facilities. Supplier shall ensure that the engine has run in sufficiently prior to load test, all test forms filled in, system debugged and recorders connected.

.2 Examination of product: A complete mechanical and electrical examination to determine compliance with specification and drawings with respect to materials, workmanship, dimensions and marking.

.3 Non-operational tests and checks: perform following test and checks before starting the unit:

.1 Shaft alignment, end float, angular and parallel.

.2 Cold resistance of generator windings.

.3 Belt tensioning.

.4 Equipment grounds.

.5 Electrical wiring.

.6 Personnel safety guards.

.7 Air cleaner.

.8 Lubricating oil type and level.

.9 Type of fuel.

.10 Vibration isolator adjustment.

.11 Temperature and pressure sensors.

.12 Engine exhaust system.

.13 Tools.

.14 Spares.

.15 All lubricating points.

.4 Operation test and check: on completion of paragraph 1.10.3, start the unit cold. Provide multi-channel recorder and record the following:

.1 Time for unit to start and reach settled voltage and frequency.

.2 Time from initiation of start to full load application, with voltage and frequency settled.

.3 Voltage and frequency transient and steady state limits for full load to no load, ¾ load to no load, ½ load to no load and ¼ load to no load and vice versa.

.4 Record battery voltage drop during cranking.

.5 Protection and control demonstration: on completion of paragraph 1.10.4, demonstrate the following:

.1 Overheat protection.

.2 Low oil pressure protection.

.3 Cranking cut out.

.4 Overcrank protection (3 tries).

.5 Overspeed protection.

.6 Under and over frequency.

.7 Under and over voltage.

.8 All control functions.

.6 Factory Load Test:

.1 Perform torsional analysis test of engine and generator compatibility.

.2 Perform a four hour load test using a portable test bank. Perform test for three hours with load applied in 20% steps every 30 minutes until full load is applied and one hour at 110% full load. Record following at 30 minute intervals during the entire test:

.1 Kilowatts

.2 Amperes

.3 Voltage

.4 Frequency

.5 Oil Pressure

.6 Coolant Temperature

.3 Test response of governor (droop or isochronous) applying 20% load and 100% load in one step. Use a storage oscilloscope or strip chart recorder to determine response time, voltage and frequency fluctuations during test.

.4 Test voltage regulator and compare for conformance to manufacturer's product data.

.5 Record noise level measurements in dB at various locations around unit and area surrounding exhaust port.

.6 Submit certified tests results for approval by owner representative.

.7 Field Load Test:

.1 Perform a four hour load test using a portable test bank. Perform load test with load applied in 20% steps every 30 minutes until full load is applied. Record following at 30 minute intervals during the entire test:

.1 Kilowatts

.2 Amperes

.3 Voltage

.4 Frequency

.5 Oil Pressure

.6 Coolant Temperature

.2 Test all alarm and shutdown circuits by simulating conditions. Closing or opening of appropriate sensor contacts mechanically is not acceptable.

.3 Record noise level measurements in dB at various locations in generator room and area surrounding exhaust port.

.8 Interpretation of ambient room temperature: consider ambient room temperature as that temperature, which is the lowest temperature registered out of a group of three thermometers when placed in engine enclosure as follows:

.1 One thermometer located on each side of the engine block, approximately two-thirds of the length of the block back from front end of block, 900 mm out from block and at a height equal to height of block. A third thermometer located over end of exciter on the unit centreline, approximately 150mm above top of exciter.

.2 Take the thermometer showing the lowest temperature to give true ambient air temperature. Adjust temperature to maintain this thermometer at 40 degree C during the heat test.

.9 Voltage and frequency regulation tests: on completion of load tests take the hot reading of generator windings. Subject the unit to hot voltage and frequency regulation tests for full load to no load, 3/4 load to no load, 1/2 load to no load, 1/4 load to no load and vice versa.

.10 Panel performance and functions: check sequence of operation under service conditions. Make provision for supplying and connecting required levels of voltage for primary circuits. Test overcurrent relays by impressing current in secondary circuits.

.11 Hi-pot tests: perform over potential tests on primary and secondary wiring in accordance with appropriate EEMAC Standard.

.12 Additional tests: perform any tests, consistent with the contract, to satisfy the Owner of the adequacy and satisfactory operation of the unit.

.13 Supplier shall record all test data on manufacturer's test forms and be complete with diagrams and description of test results, deficiencies and corrective action. Test data sheets shall be signed by the supplier and Owner's representative.

1.10 REFERENCES

.1 Each assembly shall be constructed and tested in accordance with all applicable sections of the latest revision of the following codes.

.1 Canadian Standards Association (CSA).

.2 Electrical and Electronic Association Manufacturers of Canada (EEMAC).

.3 National Electrical Manufacturers Association (NEMA).

.4 American National Standards Institute (ANSI).

.5 Institute of Electrical and Electronic Engineers (IEEE).

.6 American Society of Mechanical Engineers (ASME).

.7 American Society for Testing and Materials (ASTM).

.8 Society of Automotive Engineers (SAE).

.9 Canadian Government Specifications Board (CGSB).

.10 International Standards Organization (ISO).

.11 Provincial Electrical Protection Act.

2. PRODUCTS

2.1 ASSEMBLY

.1 Provide the following items plus such other items as necessary to make the unit complete as implied or intended:

.1 Engine.

.2 Engine Accessories.

.3 Baseplate and Drip Pan.

.4 Vibration isolators.

.5 Governor.

.6 Engine Exhaust System.

.7 Engine Cooling System.

.8 Engine Ventilating System.

.9 Starting Motor(s).

.10 Batteries and Rack.

.11 Battery Charger.

.12 Generator and Exciter.

.13 Voltage Regulator and Accessories.

2.2 GENERAL CONSTRUCTION

.1 Mount on common steel rail base complete with steel spring vibration isolators between rail base and concrete base pad.

.2 Provide semi-flexible couplings between generator and engine and protective guards over moving parts.

.3 Machine enamel finish to be approved by the Engineer.

.4 Provide fuel shut-off valve.

2.3 WIRING AND CONNECTIONS

.1 Provide all conduit, wiring and connections required and recommended by unit supplier.

.2 Install all control and alarm wiring in rigid steel conduit.

.3 Connect neutral point of generator and generator frame to ground by #1/0 copper conductor.

2.4 TOOLS

.1 Provide a complete set of specialized tools required for the proper care, adjustment and maintenance of equipment supplied.

2.5 SIGNS

.1 Provide and attach to the unit in a prominent location a warning sign indicating that generator starts automatically.

2.6 FINISHING AND PAINTING

.1 Properly clean, finish and paint equipment with a smooth and durable finish. Use grey gloss 501.108 except inside of panel to be painting with white gloss 513-101 in accordance with CGSB 1GP-12c schedule of paint colours.

2.7 WORKMANSHIP

.1 Manufacture and construct the equipment with new materials, and in the best workmanship manner.

.2 Give particular attention to freedom from blemishes, defects, burrs and sharp edges; accuracy of dimensions and marking of parts and assemblies; thoroughness of welding, brazing, painting and wiring, alignment of parts and tightness of assembly screws and bolts.

3. EXECUTION

3.1 COORDINATION WITH OTHER SECTIONS OF WORK

.1 Coordinate to ensure proper execution of work covering ventilation, field supply and products-of-combustion exhaust, to form an efficient and well-coordinated layout.

END OF SECTION

1. GENERAL

1.1 REGULATORY REQUIREMENTS

.1 Manufacture unit to CEMA standards.

2. PRODUCTS

2.1 COMPONENTS

.1 Provide generator, drip proof, single bearing and close coupled to engine with SAE housing. Generator to have a full amortisseur winding, direct connected brushless exciter with easily removable bolt-on diodes with surge protection, and meet or exceed EEMAC MGI-22 and current IEEE standards.

.2 Maximum deviation of open circuit terminal voltage waveform not to exceed 5%.

.3 Provide permanent magnet generator (PMG) for generator short circuit sustaining capability not less than 2.4 times rated current.

.4 Generator winding insulation shall be Class F; winding temperature rise not to exceed 80 degree C as measured by resistance in an ambient temperature of 40 degree C.

.5 Identify generator windings with metal tags. Bring windings to insulated terminals in a metal junction box mounted on the side or top of generator. Size junction box to permit mounting of engine and generator low voltage controls and wiring terminals blocks. Provide barrier in junction box to separate low and high voltage wiring.

.6 Provide a voltage regulation system complete with auto/manual control module. Voltage regulator shall be capable of withstanding continuous vibration, 15G shock and temperature up to 50 degrees C while maintaining accuracy to plus/minus 1%.

.7 Steady-state voltage regulation not to exceed 1%. Transient voltage regulation, when full load is applied or removed, not to exceed 10% when measured by oscilloscope or high speed strip chart recorder with recovery time to steady-state less than 3 seconds.

.8 Design equipment to minimize radio frequency interference (RFI) under all operating conditions. Balanced telephone influence factor (TIF) to meet or better requirements of EEMAC Standard MGI-22.43.

.9 A resettable line current sensing circuit breaker with inverse time versus current response shall be furnished which protects the generator from damage due to its own high current capability. This breaker shall not trip within the 10 seconds to allow selective tripping of down-stream fuses or circuit breakers under a fault condition. This breaker shall not automatically reset, preventing restoration of voltage if maintenance is being performed.

3. EXECUTION

3.1 INSTALLATION

.1 Provide terminal box for generator and exciter leads.

.2 Install unit complete and make operational.

3.2 MOUNTING

.1 Connect engine flywheel housing rigidly to generator stator housing with SAE adapter. Mount unit on a common, heavy duty, fabricated steel baseplate. Design and materials of baseplate must be approved by engine manufacturer.

.2 Baseplate of sufficient rigidity to maintain alignment of engine-generator shafts and frames under all conditions incident to shipping, installation and service.

.3 Machine engine-generator feet and baseplate sole plates parallel and true. Shimming to be steel type and only permitted underneath the generator feet.

.4 Support baseplate on spring type isolating fixtures from welded side brackets located in such a manner that bottom of baseplate will be approximately 25mm above supporting floor. Isolators shall have cast iron housings and be complete with leveling bolts, adjustable oil proof snubbers and minimum 6mm sound pads. Isolation efficiency to be not less than 95%.

.5 Determine quantity and location of isolators in such a manner that each isolator will carry equal proportion of weight and that the pressure exerted on the floor by each isolator does not exceed 345 kPa.

.6 Isolators shall be shipped loose for installation at project site.

.7 Unit to be suitable for mounting directly on a concrete floor slab base with suitably sized Hilti anchors.

END OF SECTION

1. GENERAL

.1 Not Applicable

2. PRODUCTS

2.1 DESIGN/COMPONENTS

.1 Diesel fuel, heavy duty, cold start, liquid cooled, vertical in line or vee, and current manufacture of a type and size that has been service as a prime mover for electric power generation for not less than two years. Turbocharged engine acceptable providing brake mean effective pressure (BMEP) at rated output does not exceed 1800 kPa. Mechanically driven superchargers not acceptable.

.2 Capacity: Section – Engine Generators Basic.

.3 Circulation heater located in cooling jacket complete with immersion thermostat for 208 VAC operation.

.4 Accessories: Provide all replaceable type oil filters, dry type air cleaners, automatic, lubricating oils and greases, etc.

.5 Engine shall have a minimum of four (4) cylinders.

.6 Engine with auxiliary starting aids (e.g., glow plug assist start) not acceptable.

.7 Equip engine air intakes with dry type heavy duty air cleaners located close to the inlet manifold. Cleaner element to be directly replaceable with elements of Canadian manufacture.

.8 Provide engine wiring for auto-marine type with plastic shield. Use stranded, minimum No. 14 AWG, TEW 105 ^{o}C and coloured coded wires. Terminal wiring with coded, insulating terminals flanged fork. Terminal blocks heavy duty, screw type. Wire markers of slip on oil proof type. Maximum of two wires per terminal block.

.9 Provide high quality gauges and instruments as specified in Section – Alarms and Instrumentation and provide other standard gauges and instruments. Calibrate and scale gauges and instrument in both metric and imperial units and symbols. Oil temperature sensors to be mounted on engine full flow pressure line. Hoses or tubing for gauges shall be high pressure reinforced type.

.10 Provide engine control panel complete with:

.1 Tachometer.

.2 Lubricating oil pressure gauge.

.3 Lubricating oil temperature gauge.

.4 Low Coolant level gauge.

.5 Engine switch auto-off-crank-start selector switch and crank pushbutton.

.6 Terminal blocks for connection to D.C. power supply, engine monitoring and shutdown device.

.7 Low pressure, high coolant temperature, and overspeed protection to shut down engine on automatic and manual operation.

.11 Mount unit accessories, including gauges, instruments, and protective sensors, in such a manner that machine vibrations are isolated or dampened.

.12 Dynamically balance complete engine-flywheel generator arrangement after assembly. Guarantee no torsional or other harmful vibration within 10% above or below rated speed of unit, when operating unloaded or connected to any load within its rating. Cyclic irregularity to be no greater than 1/250.

.13 Provide engine flywheel with graduated marking around its periphery to facilitate fuel injunction and valve timing.

.14 Provide personnel safety guards for exposed moving parts and exhaust manifolds. Provide platform for servicing upper part of engine where applicable.

2.2 SPEED GOVERNOR

.1 Provide full electronic governor with speed changer and dry type actuator. Governing System shall be in accordance with ISO 3046/4-1978(E).

.2 Governor shall provide the following features:

.1 Ten turn locking type manual speed adjustment.

.2 Speed regulation, steady state, no-load to full load and vice versa: +/-0.25%, three cycles maximum with two second maximum recovery to steady state.

.3 Transient peak, no-load to full-load and vice versa: +/-0.10%.

.4 Recovery time to steady state condition on application of full load from no load not to exceed three seconds.

.5 Frequency shall be externally adjustable from zero to 5% while engine is running.

.6 Class A accuracy.

2.3 LUBRICATION SYSTEM

.1 Provide a full pressure lubricating system complete with filter and oil cooler.

.2 Oil pump shall be engine driven gear type complete with strainer.

.3 Equip engine oil sump with oil drain pipe, gate valve and pipe cap. Permit complete drainage in a convenient manner.

.4 All metallic oil hoses shall be of the steel reinforced rubber type with crimped or swaged end fittings.

.5 Provide the initial fill of all required fluids and lubricants for the generator.

.6 Engine crankcase breather to be equipped with device to minimize emission of oil vapors.

3. EXECUTION

3.1 INSTALLATION

.1 Install unit complete and make operational.

END OF SECTION

1. GENERAL

.1 Not Applicable

2. PRODUCTS

2.1 COMPONENTS

.1 Engine to include self-contained liquid cooling complete with fan maintaining safe operating temperature for unit under full load conditions.

.2 Enclosure to be equipped with motorized dampers.

END OF SECTION

1. GENERAL

.1 Not Applicable.

2. PRODUCTS

2.1 COMPONENTS

.1 Muffler and piping: hospital type, completely sealed, metal, primed finish.

3. EXECUTION

3.1 INSTALLATION

.1 Coordinate size and installation of exhaust piping with mechanical section and generator set supplier.

.2 Install muffler horizontally on spring type compensating hangers as close to unit as practical.

.3 Provide 12 mm copper drain line from bottom of muffler to drain cock for periodic draining of muffler.

.4 Provide flexible connection from manifold to muffler.

END OF SECTION

1. GENERAL

1.1 SYSTEM

.1 Unit to be for automatic starting upon power failure.

2. PRODUCTS

2.1 COMPONENTS

.1 Provide a complete starting system including cranking starting motor, batteries, battery stand, heavy-duty battery cables and wall mounted battery charger.

.2 Provide positive engaging type cranking motor. Cranking motor and flywheel ring gear arrangements which may permit tooth to tooth abutment not acceptable.

.3 Provide lead acid battery with sufficient capacity to crank the unit at engine manufacturer's recommended cranking starting speed for a period of 3 minutes. Voltage measured at starting motor terminals at end of 3 minutes cranking, with cranking current flowing, to be not less than 1.75 V per cell. Size battery on the basis of engine and battery manufacturer's published data. Battery termination shall be bolt-on or study type. Terminals and all exposed electrical connections shall be protected from accidental short circuit by falling conductive objects on the battery. Such protection shall be transparent.

.4 Provide battery stand coated with acid resistant paint and fabricated from angle irons with 20 mm plywood bottom.

.5 Provide battery charger with 120 volt AC input and output equal to 1.20 of the ampere-hour capacity of the battery based on an 8 h rate. Output voltage ripple shall be 3% or less. Provide an AC input circuit breaker and a 24 h terminating equalizer timer with approximately 4 m of connecting cord and permanent connectors for connecting to battery terminals. Provide 5 spare fuses inside charger panel. Charger to be CSA approved.

.6 Provide necessary heavy duty, maintenance-free battery cables and connectors. Select cable wire size on the basis of allowing not more than 5% voltage drop at time of peak load. Cable length to be sufficient to allow battery to be located on either side of the engine.

3. EXECUTION

3.1 OPERATION

.1 Stop/Start Sequence: See Section – Alarms and Instrumentation.

.2 Battery Charger: adjustable rate of charge, "floating" on batteries at all times with full charging period of 24 hours maximum.

END OF SECTION

1. GENERAL

1.1 SYSTEM

.1 Provide a digital solid state controller complete with all control and power modules for sensing, timing, logic and instrumentation to control the diesel generator set and automatic transfer system in accordance with Section 46 of the Canadian Electrical Code and the electrical inspection authority.

2. PRODUCTS

2.1 CONTROLLER

.1 The controller shall include, but not be limited to, the following features:

.1 Set-mounted controller capable of facing right, left or rear shall be vibration isolated on the generator enclosure. The controller shall be capable of being remote mounted. The microprocessor control board shall be moisture proof and capable of operation from -40ºC to 85ºC.

.2 Fused DC circuit.

.3 Complete 2-wire start/stop control, which shall operate on closure of a remote contact.

.4 Speed sensing and independent starter motor disengagement systems shall protect against starter engagement with a moving flywheel.

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

.6 Cranking cycler with 15 second ON and OFF cranking periods.

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

.8 Circuitry to shut down the engine if high coolant temperature, low oil pressure or overspeed. Shutdown to occur in either automatic or test modes.

.9 Engine cooldown timer set at 5 minutes to permit unloaded running of the generator after transfer of the load to normal.

.10 3-position (Auto-Off-Test) selector switch. In the Test position, the engine shall start and run regardless of the position of the remote starting contacts. In the Auto position, the engine shall start when contacts in the remote control circuit close and stop 5 minutes after those contacts open. In the Off position, the engine shall not start even if the remote start contacts close. The Off position

shall also provide for immediate shutdown in case of an emergency. Reset of any fault shall also be accomplished by putting the switch to the Off position.

.11 Ethernet connection for remote monitoring of equipment. Monitoring software, if required, is to be provided with unit.

.12 Controller enclosure heater where the genset is located outdoors in non-heated enclosure.

2.2 INSTRUMENT PANEL

.1 The instrument panel shall include, but not be limited to, the following features:

.1 Standard indication by means of indicating lights (colours shown) or display screen as follows:

.1 Not-in-Auto (flashing red).

.2 System Ready (green).

.3 Overcrank (red).

.4 Emergency Stop (red).

.5 Prealarm High Engine Temperature (yellow).

.6 High Engine Temperature (red).

.7 Prealarm Low Oil Pressure (yellow).

.8 Low Oil Pressure (red).

.9 Overcrank (red).

.10 Battery Charger Malfunction (red).

.11 Low Battery Voltage (red).

.12 Low Fuel (red).

.13 Fuel Tank Leak (red).

.2 Test button required for indicating lights where indicating lights used.

.3 Voltage indication per phase via gauge or display screen, +/- 2% accuracy.

.4 Current indication per phase via gauge or display screen, +/- 2% accuracy.

.5 Frequency indication via meter or display screen, +/- 0.5% accuracy, scale 45 Hz to 65 Hz.

.6 Battery charging voltage indication via gauge or display screen.

.7 Coolant temperature indication via gauge or display screen.

.8 Oil pressure indication via gauge or display screen.

.9 Running-time meter via gauge or display screen.

.10 Voltage-adjustment via control panel or rheostat.

2.3 FUEL LEVEL INDICATION

.1 Provide local (to generator) fuel level indication (0% to 100%).

.2 Provide remote fuel level indication (0% to 100%). This is to be a 4-20mADC signal used for station Control System.

2.4 REMOTE CONTROL AND ALARM/STATUS INDICATION

.1 Provide dry contacts for each of the following alarm/status indications:

.1 Run Status.

.2 Not-in-Auto.

.3 Common Prealarm.

.4 Common Fault.

.5 Battery Charger Fault.

.6 Fuel Tank Leak.

.2 Run Relay to provide a three-pole, double-throw relay with 10 amps at 250 VAC contacts for indicating that the generator is running.

.3 Provide data communication interface using Ethernet.

END OF SECTION