.1 General

.1 New buildings are to be provided with a new diesel fired emergency/standby power generator complete with sub-base fuel tank, sound attenuated weatherproof enclosure.

.2 Generators shall generally be mounted outdoors on a reinforced concrete slab.

.3 The fuel tank shall have a volume capable of 72 hours of run time at full load.

.4 Where buildings require both emergency and standby power distribution, two auto-transfer switches will be required in order to separate the two distribution sets.

.5 The generator enclosure is to be vandal and rodent proof.

.6 All equipment shall be new and of current production by a national firm who manufacturers the generator and control panel and who assembles the standby generator set as a matched unit having a service and parts organization within British Columbia.

.7 Single supplier: the supplier shall be the manufacturer's authorized distributor, who shall provide initial start-up services, conduct field acceptance testing, and warranty service. The supplier shall have 24-hour service availability and factory-trained service technicians authorized to do warranty service on all warrantable products.

.2 Operation and System

.1 The standby power system is to be designed to energize the complete power service automatically on failure of normal power or when being tested.

.2 The transfer switch shall include an automatic energizing mode that will cycle the emergency power system to run for an adjustable period on pre-selected days and time annually.

.3 All signals shall be indicated remotely via annunciator in the electrical room. Annunciator shall be compliant with all requirements of CSA C282-(latest edition) and have all required indicators displayed on the annunciator.

.4 The generator system shall be a liquid cooled diesel electric generating unit with control panel, with combined control, transfer and power isolating and by-pass panel.

.5 All operating and maintenance data is to be provided in operating and maintenance manuals, at substantial completion stage of the project. The data must also include all testing and verification reports.

.3 Warranty

.1 Contractor shall hereby warrant the diesel generating unit, equipment and accessories against defects and malfunction for five years from the date of substantial completion commissioning stage.

.4 Maintenance - Extra Materials

.1 Provide spare materials for generator systems as noted in the following clauses.

.2 For panels provide following:

- .1 One spare control circuit breaker per rating.
- .2 Twenty four spare indicating light bulbs per rating.
- .3 One spare control relay and socket per rating and contact arrangement.
- .4 One spare contactor operating coil.
- .5 One set of contacts (3) for transfer contactor.

.3 Provide generator unit with standard set of engine manufacturer's spare parts for one year normal operation 1,000 operating hours. Spares to include:

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

.2 Six lubricating oil filter elements.

.3 Three air cleaner elements.

.4 Where metric size nuts and bolts are used, provide one set of sockets complete with ratchet handle and set of combination wrenches, to fit sizes used.

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

.5 Maintenance - Tools

.1 Supply suitable engine barring device and battery manufacturer's standard set of tools for battery service.

.1 Battery service tools to include hydrometer, one plastic bottle for topping up purposes and one insulated battery terminal wrench.

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

.6 Generator Plant

.1 The generation plant shall consist of a fully automatic #2 diesel engine driven electrical generation plant completely equipped with the following:

.1 Fuel system and sub-base fuel tank

.2 Exhaust system

.3 Cooling system

.4 Battery starting system, including battery charger

.5 All automatic controls

.6 Radio suppression to commercial standards

.7 Block heater

.8 Surge suppression

.9 Fully rated breakers for emergency power, standby power, fire pump power and load bank power connection.

.2 The unit shall be designed to provide a minimum of 25% spare capacity.

.7 Diesel Engine – Generator Set

.1 Diesel engine-generator set fueled with #2 diesel. Diesel engines requiring premium fuels shall not be considered.

.2 Performance:

.1 Voltage regulation shall be ±1.5% for any constant load between no load and rated load.

.2 Maximum transient voltage dip shall not exceed 25% below rated voltage on application of the single largest surge load step at a 0.8 power factor.

.3 Maximum transient voltage rise shall not exceed 12% above rated voltage on removal of full load at 0.8 power factor.

.4 Transient recovery time is 1 second.

.5 Stability plus or minus 0.25%.

.6 Frequency regulation shall be isochronous from steady state no load to steady state rated load.

.7 The diesel engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, with the engine-generator set at operating temperature.

.8 Motor starting capability shall be a minimum of two 5 horsepower motors. The generator set shall 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.

.9 The unit shall be capable of delivering 10% overload for one hour in every twelve hours of continuous operation, without exceeding maximum permissible temperature rise.

.10 The unit shall be capable of providing stable voltage and pick up of essential loads within 10 seconds.

.11 The generator shall be equipped with surge suppression and the excitation system shall include an instantaneous overcurrent shutdown capability after 10 seconds.

.12 A wide range of load power factors can be expected on campus. Generator design and performance shall accommodate extreme power factors applicable to specified install locations. Consult with FMEL for generator selection.

.3 AC Generator

.1 The AC generator shall be: synchronous, four pole, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc(s).

.2 All insulation system components shall meet NEMA MG1 temperature limits for Class H, 125°C insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 80°C at 40°C ambient.

.3 A permanent magnet generator (PMG) shall provide excitation power for immunity from voltage distortion caused by non-linear loads. The PMG shall sustain excitation power for optimum motor starting and to sustain short circuit current at approximately 300% of rated current for not less than 10 seconds.

.4 The automatic voltage regulator shall be temperature compensated, solid-state design. The voltage regulator shall be equipped with three-phase RMS sensing the regulator shall control buildup of AC generator voltage to provide a linear rise and limit overshoot.

.5 Voltage control is to be in accordance with applicable CSA Bulletins.

.4 Engine-Generator Set Control

.1 Provide cycle cranking of 15 SEC (ON)/15 SEC (OFF) for three attempts (75 SEC). If engine fails to start, indicate overcrank on the alarm status panel, but continue attempts to start.

.2 The engine shall comply with all requirements of SCAQMD Rule 1470 and be Tier 3 approved in Canada. Provide all supporting documentation showing that this criteria is met.

.3 The control shall shut down and lock out upon: overspeed, low lubricating oil pressure, high engine temperature, or operation of a remote manual stop station. A panel mounted switch shall reset the engine monitor and test all the lamps.

.4 The CSA Type 3 weatherproof enclosed control panel shall be mounted on the generator set with vibration isolators. A front control panel illumination lamp with on/off switch shall be provided.

.5 Engine generator set control shall be of solid state design. Relays will be acceptable only for high current circuits. Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine.

.5 Base

.1 The engine-generator set shall be mounted 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 The generator set shall be equipped with factory installed vibration isolators mounted between the set and fabricated steel base to prevent distortion of alignment between generator and engine when installed. Base channel and all parts to withstand this force without damage.

.3 The base is to have earthquake restraint as required by local codes.

.4 The exhaust flex-connector and all exposed exhaust components, including muffler, shall be fully insulated by means of a thermofibre blanket-type heat resistant wrapping, 25mm thick, with SS mesh inner liner and silicone/aluminized outside cover secured by stainless steel lacing hooks and wire.

.5 The engine shall be radiator cooled and equipped with a pusher fan. The cooling system shall be filled with a solution of 50 percent ethylene glycol. Provided shall be a translucent overflow coolant recovery reservoir.

.6 A 115 VAC engine jacket heater, sufficient to maintain coolant at 40°C, shall be provided complete with thermostat and electrical disconnect on engine start, if required to prevent element damage.

.7 Motorized (spring open/power close) air inlet and (gravity close) exhaust shutters shall be sealed to minimize air leakage and shall automatically open whenever the engine is started.

.8 Circuit Breaker:

.1 Shall be mounted on the generator and shall be a non-automatic trip free thermal magnetic moulded case circuit breaker in CSA type 3 (weatherproof) enclosure complete with neutral bar isolated from ground.

.2 Circuit breakers shall be 3 pole fully rated 3Ø, 4 wire operation.

.8 Remote Annunciator

.1 Supply a remote annunciator suitable for surface mounting, with audible alarm and status indicator. (Locate in main electrical room)

.2 Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings or in a location that can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by CSA 282 (latest edition) NFPA Standard 110 for level 1 systems for the local generator control panel.

.9 Generator Enclosure

.1 The sound attenuated genset housing shall be a rigid, free-standing, vandal-resistant cabinet, fabricated to EEMAC 3 standards with sufficient bracing to form a structure capable of withstanding wind, snow and ice loading. The roof shall have a minimum 100 mm overhang and provide rain gutters over all doors and openings. External hinges shall each feature a waterproof cap and lower grease fitting to permit pressure lubrication.

.2 After fabrication the metal surfaces of the enclosure shall be prepared to SSPC-SP6 commercial blast. Immediately following surface preparation, a 3 mil coating of zinc rich epoxy metal primer shall be applied. Primer coating material shall be Amercoat 68HS. After curing, two additional 2 mil coats of aliphatic polyurethane shall be applied, Amercoat 450HS approved, for a total 7 mil film thickness.

.3 Alternatively, galvanized metal surfaces shall be prepared with an etching primer, Metaprime 39103/39104 approved. Following this, two separate 2 mil coats of aliphatic

polyurethane shall be applied, Amercoat 450HS coating material approved, for a total 4 mil film thickness.

.4 Access to all regularly serviced items within the enclosure shall be provided by at least two hinged lockable doors on each side.

.5 The enclosure must be vandal resistant. Externally accessible fasteners shall preferably be blind head (e.g. stove bolts) although Allen head will be permissible. Air inlet and outlet openings shall be designed such that objects of any size directed at the enclosure from vertically downward to horizontally flat cannot enter and shall be sized such that inlet air velocity is below the level at which water penetration will occur. No other enclosure openings will be allowed

.10 Generator Noise

.1 The engine exhaust system shall incorporate a seamless, stainless steel flex-connector and critical silencing type muffler, all mounted within the genset enclosure. Discharge shall be into the air outlet hood, downstream of the radiator. Sound attenuated air inlet and discharge hoods with opening bird screens shall be rectangular in shape and match the profile of the enclosure.

.2 Genset overall full load operating noise level shall be less than 65 dbA when measured at a distance of 7 meters from any side of the enclosure and 1 meter above ground. This shall be demonstrated during shop testing.

.3 Ducting and sound attenuation components shall be designed and supplied by an approved manufacturer specializing in this type of work. Manufacturer shall be Excel Engineering, Alum-Tekko Industries or Sonic Engineering

.11 Transfer Switch Equipment

.1 New automatic transfer switch shall be Thomson Technology. Transfer switches shall be rated to carry 100% of rated current continuously in the enclosure. Transfer switches shall also be continuously rated in ambient temperatures of -10°C to +30°C, relative humidity up to 95% (non-condensing), and altitudes up to 3,048 meters. Transfer switch equipment shall have a withstand and closing rating (WCR) in RMS symmetrical amperes greater than the available fault currents shown on the drawings.

.2 Transfer switches are to be complete factory assembled transfer equipment with electronic control designed for surge voltage isolation, voltage sensors on all phases of both sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts. Transfer switches rated through 1000 amperes shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-centre contact mechanisms suitable for safe manual operation under load.

.3 Automatic Controls shall be solid-state and designed for a high level of immunity to power line surges and transients. Solid-state under-voltage sensors shall simultaneously monitor all phases of both sources. Pick-up and drop-out settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage. Voltage sensors shall be temperature compensated. Automatic controls shall signal the engine-generator set to start upon signal from normal source sensors. Solid-state time delay start, adjustable from 0 to 5 seconds (factory set at 2 seconds) shall avoid nuisance start-ups. Battery voltage starting contacts shall be gold, dry type contacts factory wired to a field wiring terminal block. The maximum reaction time of 10 seconds permitted under CSA standard C282-(latest edition) shall include the adjustable 0 to 5 second delay. The switch shall retransfer the load to the normal source (after normal power restoration) after a time delay transfer, adjustable from 0 to 120 seconds. Retransfer time delay shall be immediately bypassed if the emergency power source fails. Factory set at one minute.

The switch shall retransfer the load to the normal source if the generating set output interrupts after normal source restores voltage. Controls shall signal the engine-generator set to stop after a time delay, adjustable from 0 to 30 minutes, beginning on return to the normal source. Power for transfer operation shall be from the source to which the load is being transferred.

.4 Retransfer - Momentary position to override retransfer time delay and cause immediate return to normal source.