

2.2 DIESEL ENGINE
(Cont'd)

- .4 Cooling System: (Cont'd)
 - .2 To maintain manufacturer's recommended engine temperature range at 10% continuous overload in ambient temperature of 40 degrees C.
 - .3 Block heater: thermostatically controlled lube oil or liquid coolant heater connected to line side of automatic transfer switch to allow engine to start in room ambient 0 degrees C.
 - .1 Switch and fuse in heater circuit, mounted in engine-alternator control cubicle and fed from line side of automatic transfer switch.
 - .5 Fuel: to CAN/CGSB-3.6, Type A, Arctic Grade ultra-low sulphur.
 - .6 Fuel system: solid injection, mechanical fuel transfer pump, fuel filters and air cleaner, fuel rack solenoid energized when engine running.
 - .7 Governor: mechanical hydraulic with:
 - .1 Steady state speed band of plus or minus 0.5%.
 - .2 Speed regulation no load to full load 5% maximum.
 - .3 Electronic load sharing 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 pump.
 - .2 Lube oil filter: replaceable, full flow type, removable without disconnecting piping.
 - .3 Lube oil cooler.
 - .4 Engine sump drain valve.
 - .5 Oil level dip-stick.
 - .9 Starting system:
 - .1 Positive shift, gear engaging starter 12 or 24V dc.
 - .2 Cranking limiter to provide three (3) cranking periods of 10s duration, each separated by 5 s rest.
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- 2.2 DIESEL ENGINE (Cont'd) .9 Starting system: (Cont'd)
- .3 12 or 24V storage battery with sufficient capacity to crank engine for 1 min at 0 degrees C without using more than 25% of ampere hour capacity.
 - .4 Battery charger : constant voltage, solid state, two stage from trickle charge at standby to boost charge after use.
 - .1 Regulation: plus or minus 1% output for plus or minus 10% input variation.
 - .2 Automatic boost for 6 hours every 30 days.
 - .3 Equipped with dc voltmeter, dc ammeter and on-off switch.
 - .4 Minimum charger capacity: 7 A.
 - .10 Vibration isolated engine instrument panel with:
 - .1 Lube oil pressure gauge.
 - .2 Lube oil temperature gauge.
 - .3 Lube oil level gauge.
 - .4 Coolant temperature gauge.
 - .5 Coolant level gauge.
 - .6 Running time meter: non-tamper type.
 - .11 Guards to protect personnel from hot and moving parts.
 - .1 Locate guards so that normal daily maintenance inspections can be undertaken without their removal.
 - .12 Drip tray.
- 2.3 ALTERNATOR .1 Alternator: to NEMA MG1.
- .2 Rating: 3 phase, 347/600 V, 4 wire, 230 kW, 60 Hz, at 0.8 PF.
 - .3 Output at 40 degrees C ambient:
 - .1 100% full load continuously.
 - .2 110% full load for 1 hour.
 - .4 Revolving field, brushless, single bearing.
 - .5 Drip proof.
 - .6 Amortisseur windings.
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- 2.3 ALTERNATOR .7 Synchronous type.
(Cont'd)
- .8 Dynamically balanced rotor permanently aligned to engine by flexible disc coupling.
- .9 Exciter: rotating brushless.
- .10 NEMA Class F insulation on windings.
- .11 Thermistors embedded in stator winding and connected to alternator control circuitry.
- .12 Alternator: capable of sustaining 300% rated current for period not less than 10 s permitting selective tripping of down line protective devices when short circuit occurs.
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- 2.4 CONTROL PANEL .1 Totally enclosed, isolated from generator.
- .2 Instruments:
- .1 Digital 100% solid state circuitry indicating type 2 % accuracy, rectangular face, flush panel mounting:
- .1 Voltmeter: ac, scale 0 to 600 V.
- .2 Ammeter: ac, scale 0 to 600 A.
- .3 Wattmeter scale 0 to 600 kW.
- .4 Frequency meter: scale 55 to 65Hz.
- .5 kW.h meter.
- .2 Instrument Transformers
- .1 Potential-dry type for indoor use:
- .1 Ratio: 250 to 120.
- .2 Rating: 250 V, 60Hz, BIL 125 kV.
- .2 Current-dry type for indoor use:
- .1 Ratio: 250 to 5.
- .2 Rating: 250 V, 60Hz, BIL 125 kV.
- .3 Positive action automatic short-circuiting device in secondary terminals.
- .3 Generator Control System to control ventilation dampers. Coordinate with mechanical.
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2.7 STEEL MOUNTING BASE .1 Complete generating set mounted on 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.

.3 Sound insulation pads for installation between isolators and concrete base.

2.8 EXHAUST SYSTEM .1 Heavy duty residential type exhaust silencer with condensate drain, plug and flanged couplings.

.2 Fittings and accessories as required.

.3 Expansion joints: stainless steel, corrugated, of suitable length, to absorb both vertical and horizontal expansion.

2.9 FUEL SYSTEM .1 Refer to mechanical.

2.10 FABRICATION .1 Shop assemble generating unit including:

- .1 Base.
- .2 Engine and radiator.
- .3 Alternator.
- .4 Control panel.
- .5 Battery and charger.
- .6 Automatic transfer equipment.

2.11 ACCEPTABLE PRODUCTS .1 Acceptable manufacturers for the Generator assembly:

- .1 Cummins Power Generations.
 - .2 Kohler Power Systems.
 - .3 Wajax (MTU) Power Systems.
 - .4 Caterpillar.
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2.12 SOURCE QUALITY .1
CONTROL

Factory test generator set including engine, alternator, control panels, transfer switch and accessories.

.2 Tests:

.1 With 100% rated load, operate set for 23 hours, taking readings at 30 minutes intervals, and record following:

- .1 Time of reading.
- .2 Running time.
- .3 Ambient temp in degrees C.
- .4 Lube oil pressure in kPa.
- .5 Lube oil temp in degrees C.
- .6 Engine coolant temp in degrees C.
- .7 Exhaust stack temp in degrees C.
- .8 Alternator voltage: phase 1, 2, 3.
- .9 Alternator current: phase 1, 2, 3.
- .10 Power in kW.
- .11 Frequency in Hz.
- .12 Power Factor.
- .13 Battery charger current in A.
- .14 Battery voltage.
- .15 Alternator cooling air outlet temp.

.2 After completion of 24 hours run, demonstrate following shut down devices and alarms:

- .1 Overcranking.
- .2 Overspeed.
- .3 High engine temp.
- .4 Low lube oil pressure.
- .5 Short circuit.
- .6 Alternator over voltage.
- .7 Low battery voltage, or no battery charge.
- .8 Manual remote emergency stop.
- .9 High alternator temperature.

.3 Next install continuous strip chart recorders to record frequency and voltage variations during load switching procedures. Each load change delayed until steady state conditions exist. Switching increments to include:

- .1 No load to full load to no load.
 - .2 No load to 70% load to no load.
 - .3 No load to 20% load to no load.
 - .4 20% load to 40% load to no load.
 - .5 40% load to 60% load to no load.
 - .6 60% load to 80% load to no load.
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- 2.12 SOURCE QUALITY CONTROL .3 In lieu of the above 100% tests, prototype test results for the same specifications are acceptable.
(Cont'd)
- .4 Demonstrate:
- .1 Automatic starting of set and automatic transfer of load on failure of normal power.
 - .2 Automatic shut down of engine on resumption of normal power.
 - .3 That battery charger reverts to high rate charge after cranking.
- .5 Demonstrate low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.

- 2.13 LOAD BANK TEST .1 Generator docking station for load bank test, quick connect, UL 1008 listed.
- .2 Hinged lockable access doors and dead front panel, heavy duty stainless steel enclosure, wall mounted.
- .3 Connection fittings color coded for easy connections.
- .4 Identification nameplate Size 7.

PART 3 - EXECUTION

- 3.1 INSTALLATION .1 Locate generating unit and install as indicated.
- .2 Complete wiring and interconnections as required.
- .3 Start generating set and test to ensure correct performance of components.
- .4 Install remote annunciator in IT Equipment Room.

3.3 CLEANING .5 Waste Management: separate waste materials
(Cont'd) for reuse and recycling in accordance with
Section 01 74 21 - Construction/Demolition
Waste Management and Disposal and Section 01
35 21 - LEED Requirements.

3.4 MAINTENANCE .1 Provide clearance around systems, equipment
CLEARANCES and components for observation of operation,
inspection, servicing, maintenance and as
recommended by manufacturer and CSA B-139.