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**TAB 7: TECHNICAL DISCIPLINES**

Electrical

and shall be provided with signals for indication of UPS general alarms and with dial-in remote monitoring control, plus a remote alarm to the station alarm system.

Diesel is the preferred fuel for back-up generators. Where site and operational conditions do not allow for the use of diesel fuel, natural gas fuel powered generators are acceptable with GO approval.

**Natural Gas**

Natural Gas option is acceptable with approval from Metrolinx. The emergency fuel supply must meet the operation requirements written above, from the fuel supplier. The Design must include the hazardous fuel designations and appropriated steps taken with regard to fitting and equipment to make the area safe.

Rectifiers shall be used for backup DC power in maintenance and layover facilities where required.

**ESSENTIAL LOADS**

The following table shows a list of items that are considered to be essential. The table shows both backup power system conditions (i.e. Generator + UPS OR UPS only) and provides an estimated power draw for each item. The actual power draws shall be considered in the detail design and specification must be verified on a project by project basis.

<b>ESSENTIAL LOADS</b>				
<b>Essential Load</b>	<b>Estimated Power Draw</b>	<b>With Generator</b>		<b>With NO Generator</b>
		<b>Diesel Generator</b>	<b>UPS System</b>	<b>UPS System</b>
	<b>(Watts)</b>			
<i>Life Safety</i>				
Exit signs - buildings, tunnels and similar structures (LED type)	100	x		x + Life Safety
Public Address System	2,000	x	x	x
CCTV System	2,000	x	x	x
Any additional rack in the Comms Room	2,000 ea.	x	x	x + Life Safety
GO Transit telephone System	500	x	x	x
All Passenger Elevators and shafts	4,500 ea.	x		
Elevator controls	2,000	x		
Alarm Monitoring Systems	400	x	x	x + Life Safety
<i>Lighting</i>				



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<b>ESSENTIAL LOADS</b>				
<b>Essential Load</b>	<b>Estimated Power Draw</b>	<b>With Generator</b>		<b>With NO Generator</b>
		<b>(Watts)</b>	<b>Diesel Generator</b>	<b>UPS System</b>
Tunnels, bridges and stairwell illumination (at least 1 fixture on normal power)	2,000	x		x + Life Safety
Electrical Room Illumination (at least 1 fixture on normal power)	100	x	x	x
Communications Room Illumination (at least 1 fixture on normal power)	100	x	x	x
Service Area Illumination	300	x		x
Waiting Area Illumination - minimal	1,000	x		x + Life Safety
Platform Lighting (Train and Bus)	9,000	x		
Main Parking Lots (Surface Parking)	Project Specific	x		
Parking Structures	Project Specific	x		
PPUDO (Passenger Pick up and Drop off)	Project Specific	x		
Bus Loop Lighting	Project Specific	x		
<i>Systems</i>				
Ticket Sales Equipment	3,000	x	x	x
Communications Equipment (white board, Pins etc...)				
Presto	4,500	x		
Door Operators (Building, vestibules, Shelters)	Project Specific	x		
<i>Mechanical</i>				



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**ESSENTIAL LOADS**

Essential Load	Estimated Power Draw	With Generator		With NO Generator
		Diesel Generator	UPS System	UPS System
	(Watts)			
Sump/Sanitary Pump	3,000	x		
HVAC for electrical & communication room	7,500	x		
HVAC for Service Counter and Waiting Area	Project Specific	x		
Water Heater Equipment	Project Specific	x		
HVAC and Exhaust of Elevator Shafts	Project Specific	x		
<b>Estimated Total Power Draw in Watts</b>		<b>280,000</b> <b>(Varies with site conditions)</b>	<b>15,000</b>	<b>15,000</b>

\* Public washrooms shall have their own dedicated plug-in emergency light fixture x

\*\* CHUBB security to be considered if automatic locking system is implemented

\*\*\* Tunnels, Bridges and stairwell assumed to be single tunnel and stair structure at both ends; separate conduit for emergency lighting

\*\*\*\* Satellite lots not to be included in emergency lighting

\*\*\*\*\* Presto system is backed up by its own UPS systems ( 20 and 30 amp receptacles.)



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**GENERATOR REQUIREMENTS**

The generator shall be provided as a factory tested single unit and rated kW, 120/208 or 347/600 Volts, 3 phase, 4 wire, 60Hz, 1800 rpm. The generator shall be certified to CSA C22.2 No. 100, EEMAC MG1-22.40, and NEMA MG1, and shall meet the requirements of Ontario Electrical Safety Code, ESA, EPA, MOE, TSSA, along with all applicable local codes and regulations.

The generator shall be self ventilated and shall be a single bearing type direct coupled to the engine. Under short circuit conditions, the generator shall be capable of delivering sufficient current to enable protective breakers to trip.

Ambient working temperature: -35°C to 40°C

Acceptable noise level: MOE standards or as per table below at 7 °C or whichever is the most stringent.

**1. Noise Matrix Table**

Generators noise levels:

kW	dB(A)	meters
≤ 150	65	7.0
175 to 500	75	7.0
600 to 1200	80	7.0

**A. Diesel Engine**

1. The engine shall be EPA compliant with maximum nox plus hc of 3.87g/kw-hr.
2. ULC/CSA labelled double wall construction sub-base mounted steel fuel tank with an enough storage capacity to run the generator set at full load for 24 hours without refuelling. The tanks and fuelling system has to be accepted by TSSA and equipped with fuel paddling system.

**B. Natural or propane Gas Engine**

1. Include liquid cooled, spark ignition engine.
2. Furnish engine and cooling system capable of driving generator at specified load for minimum of 120 minutes, taking into account fuel type and altitude duration and at maximum ambient temperature of 122 deg F (50 deg C).
3. Isochronous Governor: Speed regulation plus or minus 0.25 cycle from no load to full load with two second recovery to steady state.
4. Integral 10-amp system battery charging system, unit mounted to maintain emergency system batteries at required charge levels.
  - a. Flexible engine connection fuel line.
  - b. Electric fuel solenoid valve.
  - c. Fuel line strainer.

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5. Dual Fuel Systems: Include the following:
  - a. cUL Listed Natural gas regulator for 7-14" water column gas pressure entering complete with the following cUL Listed installation accessories:
    - i. Flexible engine connection fuel line.
    - ii. Electric fuel solenoid valve.
    - iii. Fuel line strainer.
  - b. cUL Listed LP vapour regulator complete with the following cUL Listed installation accessories:
    - i. Flexible engine connection fuel line.
    - ii. Electric fuel solenoid valve.
    - iii. Fuel line strainer.
6. Accessories: Include replaceable type oil filters, dry type air cleaners, automatic choke, lubricating oils, greases, and coolant.

**2. Alternator**

- The alternator (generator) shall be 120/208 or 347/600 Volt, 3 phase, 4 wire, 60 Hz AC, drip proof, rotating field type with an integral exciter of the brushless or static type and a static voltage regulator utilizing silicon rectifiers on solid-state amplifiers.
- Voltage regulation shall be within plus or minus 2% of rated voltage for all loads from no load to full load. Output voltage shall be manually adjustable over a range of plus or minus 5% of rated voltage.
- Rotors shall be salient pole type with amortisseur windings. The generator shall include for 300% short circuit capability for 10 seconds.

**3. Engine-generator mounting**

- The engine and generator shall be aligned and mounted on a common fabricated steel base of sufficient rigidity to maintain adequate alignment. Approved adjustable steel spring vibration isolators shall be supplied with such set by the set manufacturer.

**4. Control panel**

- Environmentally sealed, solid state, microprocessor-based module for engine control, monitoring, protection and metering.
- The controller shall meet the CSA (Z462). The controller shall be listed under ULC and UL-508. Set-mounted controller capable of facing right, left, or rear shall be vibration isolated on the generator enclosure. Remote-mounted controller shall also be supplied.
- The microprocessor control board shall be moisture proof and capable of operation from -40°C to 85°C. Relays will only be acceptable in high-current circuits.
- Staging the load:  
When sizing a generator, stage the loads in the following order: Life safety equipment, Critical Loads and essential loads, and Elevators, Heaters, etc.
- The unit must be able to interface easily to provide remote monitoring and control capabilities over the METROLINX Windows based Network. Monitoring shall include, but not be limited to, the following:
  - a. Dual range voltmeter +/- 2% accuracy



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- b. Maximum demand ammeter +/- 2% accuracy
- c. Voltmeter-ammeter 3 phase selector switch
- d. Battery charging voltmeter and AMP
- e. Coolant temperature reading
- f. Oil pressure reading
- g. Running time
- h. Direct reading frequency meter 0.5% accuracy on 45 to 65 Hz

#### 5. System protection

- Circuitry to shut down the engine when signal for high coolant temperature, low coolant level, low oil pressure, or over speed is received. 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. The controller shall include:
  - a. Indicating Lights to signal:
  - b. Standard (Not-in-Auto (flashing red))
  - c. Equipment (Over crank (Red))
  - d. UPS + Generator Stop (Red)
  - e. High Engine Temperature (Red)
  - f. Over speed (Red)
  - g. Low Oil Pressure (Red)
  - h. Air Damper (Red)
  - i. Battery Charger Malfunction (Red)
  - j. Low Battery Voltage (Red)
  - k. Low Fuel (Red)
  - l. Auxiliary Pre-alarm (Yellow)
  - m. Auxiliary Fault (Red)
  - n. System Ready (Green)
  - o. Optional (Prealarm High Engine Temp. (Yellow))
  - p. Anticipatory (Prealarm Low Oil Pressure (Yellow))
  - q. Group (Low Coolant Temp. (Red))
  - r. Push to test button for indicating lights
  - s. Alarm horn with silencer switch per CSA (Z462).

**Note:** Terminals shall be provided for each signal in above, plus additional terminals for common fault and common pre-alarm

#### 6. Minimum required accessories

- Line circuit breakers
- Dedicated load bank of 100% capacity for each generator (On Site)

There should be a load bank for testing available on site rather than bringing a load bank onto site and connecting and disconnecting it. This load bank shall be able to be added in steps for testing up to 110 of the generators capacity. The controller shall have provisions for disconnecting a load bank (during exercise) if there is a loss of normal power by an Electrical and Mechanical interlock through ATS.



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**7. Exterior enclosure**

**A. Exterior weatherproof enclosure:**

- a. Common keyed padlockable doors.
- b. Compliant with CSA Standard.
- c. Sound Attenuated.
- d. Capable of withstanding 150mph sustained winds.
- e. Designed to resist rainfall angles of up to 45 degrees without interior flooding.
- f. Enclosure to be rodent and serpent proof.

**B. Construction:**

- a. Aluminum panel construction.
- b. Power baked paint.

**C. Roof:**

- a. One piece pitched roof designed to prevent water accumulation.

**D. Exhaust System:**

- a. Internally mounted muffler and sound insulating Panels.
- b. Catalytic Converter: Include catalytic converter when defined by local codes.

**E. Doors:**

- a. Door Hardware:
  - i. Corrosion resistant, zinc plated or stainless steel.
  - ii. Hardware locks to be keyed the same.
- b. Door drip caps designed to keep moisture accumulation off the top of doors.
- c. Doors hinged to allow 180 degree opening.

**F. Sound Attenuation:**

- a. Generator to be sound attenuated.
- b. Average dB level, measured at 7 meters from generator center, at full load, not to exceed 73 db.

**G. Block Heater:**

- a. 1500 watt.

**H. Space Heater:** Include inside enclosure, thermostatically controlled to maintain 10 deg C, except when engine is running, in accord with CSA C282, 208v.

**I. Motorized Louvers:** Include on air intake to meet CSA C282, level 2 sound attenuated.

**J. Emergency Lighting:** Include inside enclosure, 50 lumens, DC battery powered, two hour operation, in accord with CSA C282.

**K. Engine Fluid Containment Pan:** Sized to 110 percent of available fluid in accord with CSA C282.



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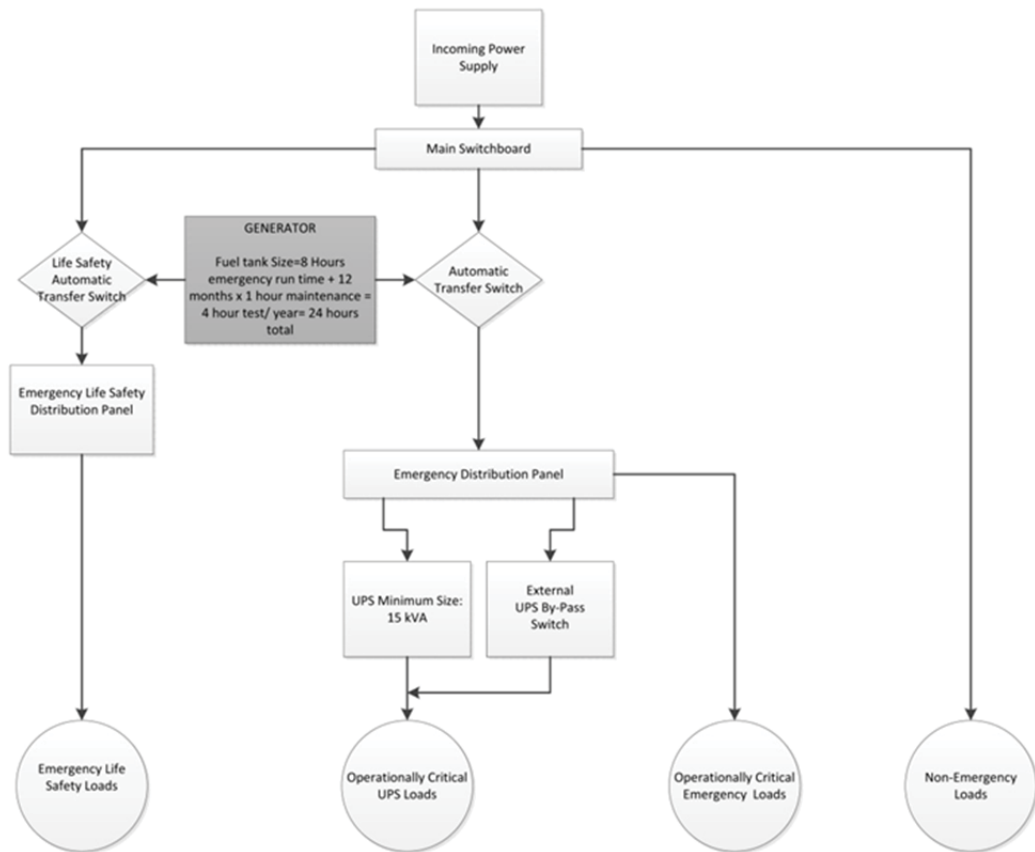
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FIGURE: EMERGENCY POWER DISTRIBUTION WITH GENERATOR

SECTION:

Tab 7:  
Technical  
Disciplines

FIGURE:  
Emergency  
Power  
Distribution  
with  
Generator







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**INTERIOR LIGHTING SOURCES AND CONTROLS**

Location	Light Source	Control and Backup
	mounted LED vandal resistant lenses	luminary on UPS + Generator
Public Washroom	LED, vandal resistant luminaries or valance or cove lights for large facilities	On/Off switch with occupancy sensor, one fixture on UPS + Generator
Electrical, Comms., Mechanical, Janitor, and Storage Rooms.	Linear LED 1219 mm long or surface mounted luminaries vandal resistant	On/Off switch with occupancy sensor, 50% on UPS + Generator in Mechanical, Electrical and Comms. Rooms only
Shop	Linear LED 2438 mm long, suspended. Task lights over equipment and workbenches to suit functions	Local switching or to suit particular application, 10% on UPS + Generator
Garage Maintenance Shop	LED for shops. LED Task lights where required	Panel or central switching to suit particular application. 10% on UPS + Generator or to Code requirements
Dispatch	LED, and supplementary illumination for maintenance with task lights to suit	Local switches, dimmers, 10% on UPS + Generator.
Office	Per IES	10% on UPS + Generator

**EXTERIOR LIGHTING SOURCES AND CONTROLS**

Location	Light Source	Control and Backup
Parking Lot, Passenger Drop-off and Pick-up Areas, and Bus Loop Areas including Bus Platforms.	LED area lights or down lights on 6 or 12 m high galvanized steel poles or 30m high masts (use of LED on 30m high masts approved by GO Transit on a case by case basis). See Notes below.	Circuited and dimmed for 30% in operation during station closed hours (photo-control only) and to have manual override of the photo control and time-clock (the manual override shall not be digital) on generator.
Access Roads	LED area lights or down lights on 6 or 12 m high galvanized steel poles or 30m high masts (use of LED on 30m high masts approved by GO Transit on a case by case basis). See Notes below.	Circuited for 30% in operation during station closed hours (photo-control only) and to have manual override of the photo control and time-clock (the manual override shall not be digital)
Parking Structure	LED	Day light harvesting and occupancy sensor control of two light levels and timer on generator



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**EXTERIOR LIGHTING SOURCES AND CONTROLS**

Location	Light Source	Control and Backup
Rail Platform	LED on 6 m hinged poles on 300 mm high concrete bases or in canopy.	Both timer and photo cell controlled, on Generator. During station closed hours 100% off. Override switch (snow removal use): 100% on
Mini-Platform	Same as Rail Platform	Controlled as part of Rail Platform
Tunnel, enclosed bridges and canopies	LED , 1219 mm long, c/w vandal resistant lenses, lights should be dimmable, when space not occupied. Allow for at least 2 circuits, alternate circuits every other pole	Breaker control, 50% on UPS + Generator
Internal Stairwell (tunnel, parking structure)	LED luminaries, semi-recessed in walls, below handrails	Breaker control, 30% on UPS + Generator
Exterior Stair and Walkway	Same as parking lot, Pole location to suit	Same as parking lot