

System	Utilization	Voltage
Heating	Greater than 5 kW 5 kw or less	600/347 V 3 phase 120/208 V 1 phase
Life Safety Fire Pumps		600/347V or 208/120 V 3 phase interior, + Life safety emergency power
Motors	Greater than ½ HP ½ HP or less	120/208V, or 600/347V 3 phase 120V 1 phase
Elevators	Motors and Controls	120/208V, or 600/347V 3 phase + emergency power
P.A.		120V 1 phase + emergency power
Telephone System		120V 1 phase + emergency power
CCTV		120V 1 phase + emergency power to each exterior camera
Security/Alarm		120V 1 phase + emergency power
Passenger Information		120V 1 phase + emergency power
Fire Alarm		120V 1 phase + Life safety emergency power
Proof-of-Payment Fare Collection System		120V 1 phase + emergency power
Electronic Payment		120V 1 phase + emergency

System	Utilization	Voltage
Systems		power
Intercom		120V 1 phase + Life safety emergency power
Video Transmission		120V 1 phase + emergency power
Digital Clock System (network)		120V 1 phase + emergency power
Signage and Display System		120V 1 phase + emergency power
Wayside Power System:		600V 3 phase
Building Automation System		120V 1 phase + emergency power
Computers		120V 1 phase + emergency power
Fuel Management Systems		120/208V, or 600/347V 3 phase + emergency power
Sand Distribution Systems		120/208V, or 600/347V 3 phase + emergency power
Electric Vehicle Charging Systems		120V/208 1 phase
Car counting Systems		120V1 phase + emergency power

### Backup Power Systems

This subject describes the functional requirements for Metrolinx facilities backup power system. The power generated by the backup system shall be either true sinusoidal 60 Hz or DC, depending on the requirements.

The intent is to ensure the continuing operation of essential equipment and services, and to

effectively move passengers from station buildings and train platforms to outside parking areas in the event of a sustained power failure.

The final design of the backup power system must include an as-built schematic drawing of the system distribution. It shall also include a checklist for commissioning, operation, and maintenance, respectively.

Back-up power generators shall be installed in accordance with the Electrical Safety Authority (ESA), Technical Standards and Safety Authority (TSSA) and the regulations of the electrical inspection agency having jurisdiction. The back-up power generator shall be protected from surface deterioration caused by exposure to conditions (i.e: condensation, weather and winter maintenance) producing corrosion. Flat surfaces which may retain water are not permitted.

Provide safe access around the equipment (min 1 m). Necessary environmental controls are required.

~~Back-up power generators are a mandatory requirement, for providing the majority of our operational elements/ systems for 8 hours system operational duration (and additional 16 hours of testing capacity), in the event of a power failure at the following GO facilities:~~

- ~~• GO Rail Line Stations (including Parking Structures)~~
- ~~• GO Bus Terminals (facilities with a station building only)~~
- ~~• GO Rail Layover Facilities~~
- ~~• GO Operational Support Facilities (i.e. Wolfdale, GTCC, Middlefield)~~
- ~~• GO Bus Maintenance Facilities~~
- ~~• GO Rail Maintenance Facilities~~

**Backup Required Time**

Back-up power generators are a mandatory requirement, for providing the majority of our operational elements/ systems for 48 hours system operational duration (and additional 16 hours of testing capacity), in the event of a power failure at the following GO facilities:

- GO Rail Line Stations (including Parking Structures)
- GO Bus Terminals (facilities with a station building only)
- GO Rail Layover Facilities
- GO Operational Support Facilities (i.e. Wolfdale, GTCC, Middlefield)
- GO Bus Maintenance Facilities
- GO Rail Maintenance Facilities

Backup Power System's design can include components such as Generator, UPS, Inverter, Rectifier, etc. As a minimum, the backup Power System shall include diesel or natural gas generator complete with UPS systems having a minimum of 30-minute duration or UPS systems with 90-minute minimum duration if there is no diesel/natural gas generator set.

In each case, the UPS shall be double conversion continuous duty type to provide the electronic communications systems with clean sine wave power. The UPS shall be rated for life safety applications 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 backup 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.

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

**Design Requirements**

The following table shows a list of items that are considered 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.

**Table F-3: Backup Power Systems–Design Requirements**

<b>Backup Power Systems–Design Requirements</b>				
<b>Essential Load</b>	<b>Estimated Power Draw (Watts)</b>	<b>WITH Generator</b>		<b>No Generator</b>
<b>Life Safety</b>		<b>Diesel Generator</b>	<b>UPS System</b>	<b>UPS System</b>
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
<b>Lighting</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		
Kiss n Ride (PPUDO)	Project	x		

<b>Backup Power Systems–Design Requirements</b>				
(Passenger Pick up and Drop off)	Specific			
Bus Loop Lighting	Project Specific	x		
<b>Systems</b>				
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			
<b>Mechanical</b>				
Sump/Sanitary Pump	3,000	x		
HVAC for electrical & communication room	7,500	x		
HVAC for Service Counter and Waiting Area	Project Specific			
Water Heater Equipment	Project Specific			
HVAC and Exhaust of Elevator Shafts	Project Specific			
<b>Estimated Total Power Draw In Watts</b>		<b>44,000</b>	<b>15,000</b>	<b>13,500</b>

## Diesel Generators

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

## Noise Matrix Table

**Table F-4: Generators Noise Levels**

<b>kW</b>	<b>dB(A)</b>	<b>Metres</b>
<b>≤ 150</b>	<b>65</b>	<b>7.0</b>
175 to 500	75	7.0
600 to 1200	80	7.0

## Diesel Engine

The engine shall be EPA compliant with maximum NOx plus HC of  $3.87 \frac{g}{kw/hr}$ .

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 refueling. The tanks and fueling system has to be accepted by TSSA and equipped with fuel paddling system.

## Natural or Propane Gas Engine (For Standby Generators ≤ 150 kVA)

Include liquid cooled, spark ignition engine.

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 °F (50 °C).

Isochronous Governor: Speed regulation plus or minus 0.25 cycle from no load to full load with two-second recovery to steady state.

Integral 10-amp system battery charging system, unit mounted to maintain emergency system batteries at required charge levels.

### Listed Fuel Systems

Include CSA Certified Listed Natural Gas regulator for 7-14" water column gas pressure entering, complete with the following cUL Listed installation accessories:

- Flexible engine connection fuel line
- Electric fuel solenoid valve
- Fuel line strainer

### Dual Fuel Systems

~~Include the following:~~

~~cUL Listed Natural gas regulator for 7-14" water column gas pressure entering complete with the following cUL Listed installation accessories:~~

- ~~• Flexible engine connection fuel line~~
- ~~• Electric fuel solenoid valve~~
- ~~• Fuel line strainer~~

~~cUL Listed LP vapour regulator complete with the following cUL listed installation accessories:~~

- ~~• Flexible engine connection fuel line~~
- ~~• Electric fuel solenoid valve~~
- ~~• Fuel line strainer~~

### Accessories

Include replaceable type oil filters, dry type air cleaners, automatic choke, lubricating oils, greases, and coolant.

### 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.

### 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.

### 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.

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:

- Dual range voltmeter +/- 2% accuracy
- Maximum demand ammeter +/- 2% accuracy
- Voltmeter-ammeter 3 phase selector switch
- Battery charging voltmeter and AMP
- Coolant temperature reading
- Oil pressure reading
- Running time

- Direct reading frequency meter 0.5% accuracy on 45 to 65 Hz

**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:

- Indicating Lights to signal
- Standard (Not-in-Auto [flashing red])
- Equipment (Over crank [Red])
- UPS + Generator Stop [Red]
- High Engine Temperature (Red)
- Over speed (Red)
- Low Oil Pressure (Red)
- Air Damper (Red)
- Battery Charger Malfunction (Red)
- Low Battery Voltage (Red)
- Low Fuel (Red)
- Auxiliary Pre-alarm (Yellow)

**Exterior Enclosure**

**Table F-5: Exterior Enclosure**

Exterior Enclosure	
Exterior Weatherproof Enclosure:	<ul style="list-style-type: none"> <li>• <u>Owner's</u> Common keyed <a href="#">pad-lockable doors</a></li> <li>• Compliant with CSA Standard</li> <li>• Sound Attenuated</li> <li>• Capable of withstanding 150mph sustained winds</li> <li>• Designed to resist rainfall angles of up to 45 degrees without interior flooding</li> <li>• Enclosure to be rodent and serpent proof</li> </ul>
Construction:	<ul style="list-style-type: none"> <li>• Aluminum panel construction</li> <li>• Power baked paint</li> </ul>
Roof:	<ul style="list-style-type: none"> <li>• One piece pitched roof designed to prevent water accumulation</li> </ul>

- Auxiliary Fault (Red)
- System Ready (Green)
- Optional (Pre-alarm High Engine Temp. [Yellow])
- Anticipatory (Pre-alarm Low Oil Pressure [Yellow])
- Group (Low Coolant Temp. [Red])
- Push to test button for indicating lights
- 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

**Minimum Required Accessories**

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

There shall 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.

Exhaust System:	<ul style="list-style-type: none"> <li>Internally mounted muffler and sound insulating Panels</li> <li>Catalytic Converter: Include catalytic converter when defined by local codes</li> </ul>
Doors:	<ul style="list-style-type: none"> <li>Door Hardware:</li> <li>Corrosion resistant, zinc plated or stainless steel</li> <li>Hardware locks to be keyed the same</li> <li>Door drip caps designed to keep moisture accumulation off the top of doors</li> <li>Doors hinged to allow 180 degree opening</li> </ul>
Sound Attenuation:	<ul style="list-style-type: none"> <li>Generator to be sound attenuated</li> <li>Average dB level, <del>measured at 7 meters from generator center, at full load, not to exceed 73 dB</del> <a href="#">refer to Table F-4</a></li> </ul>
Block Heater:	<ul style="list-style-type: none"> <li>1500 watt <u>minimum</u></li> </ul>
Space Heater:	<ul style="list-style-type: none"> <li>Include inside enclosure, thermostatically controlled to maintain 10 °C, except when engine is running, in accord with CSA C282, 208v</li> </ul>
Motorized Louvers:	<ul style="list-style-type: none"> <li>Include on air intake to meet CSA C282, level 2 sound attenuated</li> </ul>
Emergency Lighting:	<ul style="list-style-type: none"> <li>Include inside enclosure, 50 lumens, DC battery powered, two hour operation, in accord with CSA C282</li> </ul>
Engine Fluid Containment Pan:	<ul style="list-style-type: none"> <li>Sized to 110 percent of available fluid in accord with CSA C282</li> </ul>