

UNINTERRUPTIBLE POWER SUPPLY (UPS) SYSTEMS FOR “LED” TRAFFIC SIGNALS

DEFINITIONS

Defective UPS battery: means the battery is not charging or showing cracks, swelling or leaking.

Degraded Performance: means the operation of any Electrical System or subsystem with less than 100% performance of the operational System Components.

Distribution Assembly: means low voltage equipment within an enclosure with switching and control devices used to provide source of power for Electrical Systems.

Down Time: means the time during which an Electrical System is de-energized or not under full operation.

Electrical System: means the system encompassed by all Contract items for Electrical Work in the Contract.

Electrician: means a person in possession of a certificate of qualification for the trade of Electrician, Construction and Maintenance issued by the Ministry of Education and Training, Ontario.

Non Routine Maintenance: means non-scheduled maintenance or repairs to address: unexpected failure of equipment components; operational problems; response to accidents and cable locates. It requires immediate action and takes precedence over Routine Maintenance activities for the duration of the incident.

Pad: means a concrete footing with a level surface used to mount electrical equipment.

Routine Maintenance: means preventive and / or scheduled maintenance carried out on equipment at specified intervals and including checking, testing, cleaning, tightening, lubricating, etc. of equipment as well as minor repairs. The purpose of Routine Maintenance is to ensure that problems are solved before failures occur. Minor maintenance problems that cannot be corrected “on the spot” are normally logged and reported for further follow-up.

Routine Maintenance includes Minor and Major Maintenance Work as follows:

- a) **Minor Maintenance:** means inspection and checking of items, elementary testing, cleaning, lubricating and minor repairs.
- b) **Major Maintenance:** means overhauling, testing and replacement of components which may require a scheduled power outage.

Police Supervision: means control of the intersection by the police directing traffic through the intersection or standing by during maintenance or repair operations.

System Components: means all hardware and software components, devices, parts and materials included in the Electrical System.

Temporary Repairs: means work which is done to serve a specific temporary function and removed upon completion of the temporary usage required for the Contract.

ANNUAL ROUTINE MAINTENANCE OF UPS SYSTEMS

1.0 Standards for Routine Maintenance

1.1 Routine Maintenance Standards

The Contractor shall inspect the UPS system components. During the inspection, the Contractor shall complete the specified action and report all deficiencies to the Contract Administrator. Routine Inspection shall not be undertaken in winter.

Table 1 shows intervals for maintenance of UPS system equipment

Equipment	Minor Maintenance	Major Maintenance
UPS control unit	26 weeks	Annually
UPS Backup Batteries	26 weeks	Annually
UPS cabinet	26 weeks	Annually
Brackets/pads/Poles	Annually	5 years
Cables and conduits	Annually	5 years
Grounding	Annually	5 years

Table 1 – Maintenance Intervals for UPS System Equipment

2.0 UPS Control Unit

2.1 General Guidelines

Inspect and replace damaged surge protection equipment and advise Contract Administrator of the occurrence.

2.1.1 Standards for Minor Maintenance

- Inspect wiring for physical damage.

- Record in the Log Book the number of events from UPS event counter.
- Record in the Log Book the amount of time the UPS has been in Battery mode from the UPS event timer.
- Clean fan filter by removing it in accordance to manufacturer's instructions, rinsing the filter with water, air dry then re-install.

2.1.2 Standards for Major Maintenance

- Repair or replace as required damaged wiring and connections.
- Advise Contract Administrator of the occurrence of damage to surge protection equipment.
- Perform UPS operational test as follows:
 - Place the UPS Unit into self-test in accordance to manufacturer's instructions.
 - After passing the self-test disconnect the AC input to the UPS so that the UPS operates in backup mode.
 - Let the UPS operate in backup mode for approximately 10 minutes.
 - Verify the Low Battery LED is not ON
 - Reconnect the AC input.

3.0 UPS Backup Batteries

3.1 General Guidelines

When batteries are in storage, charge them at least once every 13 weeks for optimum performance and to extend their lifetime.

Always replace batteries with ones of identical type and rating. Never install old or untested batteries. Never mix old with new batteries.

Use insulated tools for servicing.

Use recycling for the disposal of batteries.

3.1.1 Standards for Minor Maintenance

- Inspect the batteries for cracks or swelling.
- Inspect the battery terminals for corrosions. Clean and apply a corrosion prevention compound.
- Re-torque the battery terminal bolts to 5.8 Newton Metre.

3.1.2 Standards for Major Maintenance

- If batteries are found to be defective, replace and report deficiency to the Contract Administrator to replace all 4 batteries if any of the batteries are cracked or swollen
- Label batteries 1,2,3,4. The battery negative cable from the UPS is connected to battery number one and the battery positive cable from the UPS is connected to battery number four.
- Perform Battery Conductance Testing as follows:
 - Place the Conductance Meter probes across battery number one.
 - Record the Voltage and Siemens values in your logbook.
 - Repeat for batteries two, three, and four.

When one or more of the batteries measures 2 volts or higher, or 2 volts or lower than the other batteries in the string there is either a shorted or open cell in one or more of the batteries. Replace all four batteries.

If the recorded conductance (Siemens) drops to 70% of the new battery reference value, then the battery is marginal and should be replaced.

An example, if a new battery has a conductance reference value of 1100 Siemens at 25° C. When temperature of the batteries is not between 20° C and 30° C, use the following temperature compensation values.

Battery Temperature	Reference Value New Battery (Siemens)	Marginal Battery (70% of reference value)
35° C or higher	1183	828
30° C	1140	798
25° C	1100	770
20° C	1063	744
15° C	1028	720
10° C	995	697
5° C	965	675
0° C or colder	936	655

Conductance Testing can be performed with the batteries connected to the UPS. The UPS must be operating in Line mode.

4.0 UPS Cabinet

4.1 UPS Cabinet Mounting

4.1.1 General Guidelines:

Seal all holes in the gasket placed around the bottom of the pedestal and between the pedestal and cabinet where rodents or insects may enter except those openings intended for drainage.

4.1.1.1 Standards for Minor Maintenance

- Inspect for loose or missing nuts, washers. Tighten or replace all nuts that are loose or missing.

4.1.1.2 Standards for Major Maintenance

- Inspect for loose or missing nuts, washers. Tighten or replace all nuts that are loose or missing.
- Repaint all components that are corroded or paint damaged.

4.2 UPS Cabinet Enclosures

4.2.1 Standards for Minor Maintenance

- Check for water or heat damaged metal work.
- Check door hinges and locks
- Remove all debris by vacuum

4.2.2 Standards for Major Maintenance

- Check for water or heat damaged metal work and advise the Contract Administrator of any damage detected.
- Repair any deficiencies in the foam cabinet insulation.
- Inspect and lubricate door hinges. Inspect door locks and replace if defective.
- Inspect door gaskets and apply silicone spray. Repair or replace gaskets if defective.
- If excess humidity is evident, apply foam insulation spray in bottom of cabinet to seal ducts or other openings.

4.3 Brackets

4.3.1 Standards for Minor Maintenance

- Inspect brackets for loose or missing bolts, nuts, washers. Tighten or replace all nuts that are loose or missing.

4.3.2 Standards for Major Maintenance

- Inspect brackets for loose or missing bolts, nuts, washers. Tighten or replace all nuts that are loose or missing. Report to Contract Administrator any cracks.

4.4 Cables and Conduit

4.4.1 Standards for Minor Maintenance

- Inspect conduits and make repairs so that attachments are secure and couplings are intact.

4.4.2 Standards for Major Maintenance

- Inspect cable at entry points for deterioration of insulation or damage due to vibration report the occurrence to the Contract Administrator.

4.5 Grounding Components

4.5.1 Standards for Minor Maintenance

- Maintain components as described in Chapter 9, Part 2 of the Electrical Maintenance Manual
- Check grounding connection to ground bus of cabinet and repair any deficiency.
- Test resistance to ground. This testing must not be carried out when the ground is frozen. Report any deficiency to Contract Administrator.

4.5.2 Standard for Major Maintenance

- Test resistance to ground and remake connections if necessary.
- If system has not been upgraded to standard current practices, report to Contract Administrator