TRAFFIC SIGNAL CONTROLLERS - Item No.

Special Provision No. 622F01

February 2016

Amendment to OPSS 622, September 1993

622.02 REFERENCES

Section 622.02 of OPSS 622 is amended by the addition of the following:

International Municipal Signal Association (IMSA)

MTO 170/332 Training Manual

and under Others:

Ontario Traffic Signal Control Equipment Specifications (OTSCES)
Caltrans Transportation Electrical Equipment Specifications (TEES)

622.05 MATERIAL

Section 622.05 of OPSS 622 is amended by the addition of the following subsections:

622.05.09 Uninterruptible Power Supply (UPS) System

The Uninterruptible Power Supply system shall be according to the MATERIAL SPECIFICATION FOR UNINTERRUPTIBLE POWER SUPPLY SYSTEMS FOR “LED” TRAFFIC SIGNALS.

622.05.10 Forced Flash Relay

The forced flash relay shall be 10 Amp, 60 Hz, Double Pole Double Throw (DP DT) relay.

622.05.11 Heater/Fan breaker

The heater/fan breaker shall be 15 Amp breaker mounted on the service panel.

622.07 CONSTRUCTION

622.07.02 Controller Supplied by the Contractor

Subsection 622.07.02 of OPSS 622 is amended by the addition of the following:

Each traffic signal controller cabinet shall be a model 332 traffic signal controller cabinet capable of 2 to 8 phase operation. Each traffic signal controller cabinet shall be complete with mounting pedestal base, uninterruptible power supply (UPS), 170 type traffic signal controller, conflict monitor, and all other equipment required to perform its intended function, either in standalone operation or as part of the ministry’s traffic signal control system, according to the timing sheets, PHM-125 drawing, and the Contract Documents. Without limiting the foregoing, each traffic signal controller cabinet shall include the components listed in Table 1.
All traffic signal control equipment shall be according to the Ontario Traffic Signal Control Equipment Specifications (OTSCES) OR the Caltrans Transportation Electrical Equipment Specifications (TEES). Each traffic signal controller cabinet shall be supplied fully assembled and tested. The testing shall be carried out according to the MTO Operation Guidelines and Procedures in the MTO 170/332 Training Manual. The MTO 170/332 Training Manual may be purchased from the Ontario Section of the International Municipal Signal Association.

The title of subsection 622.07.04 of OPSS 622 is amended as follows.

622.07.04 Signal Controller Cabinet and UPS Cabinet

622.07.04.02 Pad Mounted Controller Cabinet

Clause 622.07.04.02 of OPSS 622 is amended by deleting the second paragraph.

Subsection 622.07.04 of OPSS 622 is amended by the addition of the following clauses:

622.07.04.06 Pad Mounted UPS Cabinet

The pad mounted UPS cabinet shall be installed on a pedestal manufactured of the same material as the 332 cabinet and supplied with the same lock and key. The pedestal shall be anchored to the pad and secured in place at the location specified according to the Contract Documents. The UPS control unit shall be installed in the UPS cabinet and the UPS automatic switch shall be installed in the signal controller cabinet according to the Contract Documents. A 10 Amp Double Pole Double Throw (DPDT) 60 Hz relay shall be installed in the traffic signal controller cabinet to allow flash operation when initiated by the UPS control unit. All wiring shall be according to the Contract Documents.

622.07.04.07 Pole Mounted UPS Cabinet

The pole mounted UPS cabinet, including batteries and heating pads, shall be installed complete with all mounting brackets, hardware, stainless steel strapping and pole mounting conduits and fittings. The edges of the cabinet shall not protrude over a sidewalk or roadway pavement. The cabinet shall not obstruct access to the pole handhole and pedestrian pushbuttons. The UPS control unit shall be installed in the UPS cabinet and the UPS automatic switch shall be installed in the signal controller cabinet according to the Contract Documents. A 10 Amp DPDT 60 Hz relay shall be installed in the traffic signal controller cabinet to allow flash operation when initiated by the UPS control unit. All wiring shall be according to the Contract Documents.

622.07.04.08 UPS Automatic Switch, Forced Flash Relay and Heater/Fan breaker

The UPS automatic switch, forced flash relay, heater/fan breaker and terminal block shall be installed in the signal controller cabinet according to the Contract Documents. The installation and placement of these components shall in no way interfere with access to existing components.

622.07.06 Quality Control

622.07.06.01.01 General

Clause 622.07.06.01.01 of OPSS 622 is amended in that the second sentence is replaced by the following:
Traffic signal controllers, UPS systems, and other components shall be inspected prior to installation to ensure that they are according to the Contract Documents.

622.07.06.02.01 **General**

Clause 622.07.06.02.01 of OPSS 622 is amended by the addition of the following:

The Contract Administrator and ministry electrical staff shall be notified of the time and location of all testing 3 Working Days prior to the start of each test.

The work shall be inspected and tested to ensure that it is according to the requirements of the contract, 3 Working Days prior to the actual "switch on" of the signals. In particular, and without limiting the foregoing, all components shall be installed, tested and proven as indicated in the Contract Documents; all cables are energized and in working order and that the signal timing is consistent and complete, without activating the traffic signals for public display.

Subsection 622.07.06 of OPSS 622 is amended by the addition of the following clause:

622.07.06.03 **Testing of UPS System**

The UPS system shall be activated according to the manufacturer’s recommendations. The Contractor is responsible for all testing and documentation required to establish acceptance of the installation and operation of material supplied.

The following identifies the specific quality control requirements:

622.07.06.03.01 **Pre-installation Testing and Inspection**

Prior to the installation of the UPS system, the UPS system shall be tested and inspected to verify that it performs according the manufacturer’s specifications and the Contract Documents. In particular, and without limiting the foregoing, the UPS system shall be operated and tested to verify the following:

i)  Transfer time in case of power failure is less than 60 milliseconds.

ii) Voltage regulation at 120 VAC is +/- 3 percent.

iii) Frequency regulation at 60 Hz is +/- 3 Hz.

iv) Thermostat controlled battery heating mats operate according to the manufacturer’s specifications.

v) When powered by the batteries alone, the UPS system provides full signal operation at full load for a minimum of 4 hours, and then switches over to flashing operation and provides flashing operation for a further 6 hours.

Prior to installation the Contractor shall submit to the Contract Administrator certification from the manufacturer that the product is according to the Contract Documents. This certification shall include an explicit certification that, when powered by the batteries alone, the UPS system provides full signal operation at full load for a minimum of 4 hours, and then switches over to flashing operation and provides flashing operation for a further 6 hours.
Proof of Performance Testing and Inspection

The UPS system shall be tested and inspected to verify that it performs according to the manufacturer’s specifications and the Contract Documents. The proof of performance testing and inspection shall include all testing and inspection identified under pre-installation testing and inspection. The Contractor shall ensure that all components are installed, tested and proven as indicated in the Contract Documents.

In particular, and without limiting the foregoing, the Contractor shall test and verify that when powered by the batteries alone, the UPS system provides full signal operation at full load for a minimum of 4 hours, and then switches over to flashing operation and provides flashing operation for an additional 6 hours.

In addition, the Contractor shall perform visual inspection on the installed UPS system and perform all tests on grounding of equipment according to OPSS 609.

The inspection, testing and test results shall be witnessed by the Quality Verification Engineer. The Quality Verification Engineer shall issue a Certificate of Conformance that the work has been inspected and tested, and that the material and installation are in General Conformance with the requirements of the contract.

Testing for New UPS System “Switch On”

A new UPS system, at a location not previously equipped with a UPS system, or a new UPS system to replace an existing UPS system, shall be initially switched on for operation according to the following requirements:

i) The Contract Administrator shall be given a minimum of 3 Working Days notice of when the UPS system will be installed or switched over, and shall reconfirm that the work will be done as scheduled 24 hours prior to doing the work.

ii) All repairs or replacement of defective components shall be completed prior to activation.

iii) UPS “Switch On” for operation will not be permitted on Fridays, Saturdays, Sundays, Mondays, or statutory holidays.

iv) Traffic shall be under police supervision during this operation.

Traffic Signal Control Programming and Timing

Subsection 622.07.08 of OPSS 622 is deleted and replaced with the following:

The Contractor is responsible for ensuring that all controller and conflict monitor programming is installed, and is responsible for the setting of all timing controls, switches and programming controls.

Traffic signal interval timing shall be obtained from the Contract Administrator and installed into the traffic signal controller. The Contractor is responsible for verifying to his own satisfaction that the signal timing is consistent and complete.

OPSS 622 is amended by the addition of the following section:

QUALITY ASSURANCE

The Contract Administrator and the Ministry’s electrical coordinator may witness the testing of the traffic signal controller and UPS system performed by the Contractor. The Contract Administrator will advise the
Contractor if remote monitoring is to be connected to the traffic signal controller. The Contract Administrator will also be in attendance during the “Switch On” of the traffic signals.

622.10.02 Individual Item Method

Clause 622.10.02.01 of OPSS 622 is deleted and replaced with the following:

622.10.02.01 Traffic Signal Controllers - Item

Payment at the Contract price for the above items shall be full compensation for all labour, Equipment and Materials to do the work.

Table 1
Traffic Controller Components

<table>
<thead>
<tr>
<th>Item Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>170 type traffic signal controller</td>
<td></td>
</tr>
<tr>
<td>Conflict Monitor</td>
<td></td>
</tr>
<tr>
<td>412C Prom Module with McCain’s MTO 233ON1.C local intersection control program</td>
<td></td>
</tr>
<tr>
<td>412C Prom Module with McCain’s MTO 245FM0.8 field master control program local intersection control program</td>
<td></td>
</tr>
<tr>
<td>412C Prom Module with the latest MTO approved McCain PROM Chip</td>
<td></td>
</tr>
<tr>
<td>Loop Detector, Model 222</td>
<td></td>
</tr>
<tr>
<td>Load Switch, Model 200</td>
<td></td>
</tr>
<tr>
<td>DC Isolator, Model 242</td>
<td></td>
</tr>
<tr>
<td>AC Isolator, Model 252</td>
<td></td>
</tr>
<tr>
<td>Uninterruptible Power Supply (UPS) system</td>
<td></td>
</tr>
<tr>
<td>Bell Mobility Sierra GX400 Modem with I/O module Note: To be supplied by the Owner.</td>
<td></td>
</tr>
<tr>
<td>170 Communication board M33329 Rev B or later (Serial to Ethernet).</td>
<td></td>
</tr>
<tr>
<td>Cat 5E Ethernet Cable – 2 metres</td>
<td></td>
</tr>
<tr>
<td>BMAX 824/1850 Antenna</td>
<td></td>
</tr>
<tr>
<td>GSPSMS-MSMA/MSMA (stud mount) Antenna base.</td>
<td></td>
</tr>
</tbody>
</table>
MATERIAL SPECIFICATION FOR UNINTERRUPTIBLE POWER SUPPLY SYSTEMS FOR “LED” TRAFFIC SIGNALS

1.0 SCOPE

This specification covers the requirements for Uninterruptible Power Supply (UPS) system for Traffic Signals utilizing “LED” Modules.

2.0 REFERENCES

This specification refers to the following standards, specifications, or publications:

CSA Standards

C22.1-06 Canadian Electrical Code
C22.2 No. 94-M91 (R2001) Special Purpose Enclosures

Electrical Safety Authority


3.0 DEFINITIONS

CSA Enclosure Type 3 means an enclosure for either indoor or outdoor use, constructed so as to provide a degree of protection against rain, snow, and windblown dust, undamaged by the external formation of ice on the enclosure.

UPS means uninterruptible power supply.
**AGM VRLA Battery** means sealed battery using Absorbed Glass Mat & Valve Regulated Lead Acid technology

**Gel Cell Battery** means sealed battery containing acid in a gel form so it does not leak.

4.0 DESIGN AND SUBMISSION REQUIREMENTS

4.1 Design Requirements

Each UPS system shall be designed for the traffic signal controller cabinet and equipment to which the UPS system will be connected. A comprehensive and detailed wiring diagram for each UPS system shall be designed and documented. The wiring diagram shall clearly indicate all UPS system wiring and connections, and shall clearly indicate all wiring and connections between the UPS system and the traffic signal controller cabinet and equipment.

4.2 Submission Requirements

Prior to the installation of the UPS system a comprehensive and detailed wiring diagram for each UPS system at each traffic control signal shall be submitted to the Contract Administrator. Three (3) copies of each wiring diagram shall be submitted.

5.0 MATERIALS

5.01 General

The UPS system shall provide uninterruptible power and conditioning of the utility power required for the operation of all electronic equipment used to operate the traffic control signals in the event of main utility power supply failure or voltage or frequency fluctuations.

The UPS system shall be supplied complete with UPS automatic switch.

The UPS control unit shall be a line interactive or double conversion type with automatic voltage regulation for 120V, 60Hz, single phase.

The UPS system shall include all wiring necessary to interconnect the UPS control unit to the power source and to the traffic signal control components.

The UPS control unit must latch from line to battery and from battery to line (transfer time) in less than 60 milliseconds.

When installed at a traffic signal using LED signal lamps, the UPS system shall be capable of maintaining full signal display operation for a minimum of 4 hours after which it shall be capable of maintaining a flashing signal display for a further 6 hours minimum.

Switching from full operation to a flashing operation may be determined by a timer circuit or based on battery capacity.

If the UPS control unit or the batteries fail, the system shall automatically switch back to utility line power.

If line power is restored during flashing operation, the traffic control signals shall commence the Start-up Sequence specified in the traffic control signals’ timing sheet.
The UPS cabinet shall be supplied complete with pedestal or pole mounting hardware as indicated in the Contract Documents.

The battery installation and wiring to the batteries shall be according to Ontario Electrical Safety Code.

The UPS system components shall operate properly for the time periods specified above under the following conditions:

i) Ambient temperature -37 °C to +74 °C

ii) Humidity: 5 percent to 95 percent

iii) The UPS system components shall withstand shock and vibration according to NEMA TS 2-2003

5.02 UPS Cabinet

The cabinet shall be approved according to the Ontario Electrical Safety Code.

The UPS cabinet shall be a CSA-Type 3 cabinet constructed of aluminium and shall be painted grey. The cabinet shall be fabricated using sheet aluminium 3.17 mm thick and adequately reinforced by welded aluminium members.

The dimensions and details of the UPS cabinet shall be according to the Contract Documents.

The cabinet shall have one door hinged on one side with a continuous stainless steel piano hinge.

The door shall use a latch and lock mechanism. The door handle shall be zinc coated and painted the same colour as the cabinet.

The opening in the UPS cabinet shall allow full access to UPS components housed in the cabinet.

The cabinet shall be vented according to the Ontario Electrical Safety Code.

The circuit providing power to the battery heating mats shall be thermostat controlled and the thermostat shall be located in the UPS cabinet.

5.03 Batteries

Batteries shall be AGM VRLA or Gel Cell technology.

Conductor connections between batteries and the UPS control unit, between batteries on the same shelf, and between batteries on separate shelves shall be of suitable length to allow the UPS control unit and the batteries to be pulled out completely from the shelves a minimum of 300 mm without disconnecting the conductors.

Each battery shall be placed on its own heater mat with all heater mats being supplied with AC power by the UPS control unit.

Battery mats shall become inoperable with loss of line voltage.
The batteries shall be protected by a circuit breaker or a fuse.

Each battery shall be labelled with the date of manufacture. The label shall be at a visible location on the top of the battery.

In addition to any other warranty, the Contractor shall provide a 3 year warranty on the batteries. The warranty period for each battery shall be 3 years, commencing from the date of “switch on” for operation of the UPS system in which the batteries are used. Any defective battery shall be replaced within 30 days. The warranty shall include all labour, equipment, and materials required to replace the batteries, including traffic control and all removal and disposal work. The Contractor shall be responsible for the removal and disposal of any defective batteries replaced under warranty. The Owner shall be the sole judge in determining if a battery is defective.

5.04 UPS Control Unit

The UPS control unit shall be rack mountable with the following maximum dimensions: Width of 483 mm (19-inch), depth of 254 mm (10 inches), and height of 153 mm (6 inches).

The front face of the control unit shall have indicators capable of displaying the following:

i) Number of times the system was on battery supply

ii) Total time on battery supply

iii) Battery charge status to indicate the battery capacity

Each of the battery supply indicators listed above shall have a manual reset switch.

The UPS control unit shall have a minimum of one standard 120V grounded socket located on either the back or the front panel.

The UPS control unit shall contain over-current protection located on the front panel to switch power On/Off from the batteries and to switch AC input and output power On/Off.

The UPS control unit shall have a self-test feature to test the UPS Automatic Switch and the control circuitry.

The UPS control unit shall have an open collector output or an AC or DC contact closure to indicate when the traffic signal is operating on battery supply.

The UPS control unit shall have an open collector output or an AC or DC contact closure to indicate low battery alarm.

The UPS control unit shall have a minimum of 1 switched AC output that will switch on when the traffic signal has been on battery supply continuously for 4 hours.

A 9 pin male serial port and/or Ethernet port shall be located on the front panel to allow for communication to a laptop computer for changing software settings. The Ethernet port shall support DHCP.

A set of battery voltage test points, or a readout indicating battery voltage condition shall be located on the front panel.
5.05 UPS Automatic Switch

The UPS automatic switch shall allow the UPS control unit to be removed for replacement or maintenance without turning off the traffic signal system.

The utility line power shall be connected to the input of the automatic switch. Under normal operating conditions, the automatic switch shall connect the utility line power to the UPS control unit. In the event that the UPS control unit is not present or does not function, the automatic switch shall automatically connect the utility line power directly to the traffic signal system, bypassing the UPS control unit.

5.06 Power Conditioning and the Use of Batteries by the UPS

Under normal operating conditions, the utility line power shall flow through the UPS control unit to the traffic signal system and any other connected loads.

When the utility line power is within the operating parameters specified by the UPS manufacturer and the Contract Documents, the UPS control unit shall condition and deliver the power to the loads without drawing power from the batteries.

When the utility line power is not within the operating parameters specified by the UPS manufacturer and the Contract Documents, the UPS control unit shall condition and deliver the power to the loads by drawing power from the batteries as required.

5.07 Electrical

The UPS system shall accept an AC voltage input range of 85 to 135 VAC, single phase, 2 wire plus ground without drawing on battery power.

The UPS system shall provide voltage regulation at 120 VAC ± 3 percent under any line, load or battery conditions other than “low battery”, and a frequency regulation of 60 Hz ± 3 Hz synchronized to the utility line power.

Power rating shall be a minimum of 1000 VA (700W). The UPS system shall provide pure sine wave output, computer grade power compatible with all equipment loads, with power factor correction.

The UPS system shall include full time protection from sudden voltage increase with inrush protection and AC line filtering.

The UPS system shall provide complete isolation from the line operating as a separately derived power source in accordance with section 10-Grounding and bonding, CSA C22.1.

The direct current (DC) system of the UPS system shall have a nominal DC system voltage of 60 VDC or less. The UPS DC system short circuit current shall not exceed 5000 A.

7.0 PRODUCTION

All wires and leads shall be tied and secured within the UPS cabinet prior to delivery.