



**CONSTRUCTION SPECIFICATION FOR
TRAFFIC SIGNAL EQUIPMENT AND
ELECTRICAL TRAFFIC CONTROL DEVICES**

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620.01 SCOPE

This specification covers the requirements for the installation of traffic signal equipment and electrical traffic control devices.

620.01.01 Specification Significance and Use

This specification has been developed for use in municipal oriented Contracts. The administration, testing, and payment policies, procedures, and practices reflected in this specification correspond to those used by many municipalities in Ontario.

Use of this specification or any other specification shall be according to the Contract Documents.

620.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

620.02 REFERENCES

When the Contract Documents indicate that municipal-oriented specifications are to be used and there is a municipal-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.MUNI, unless use of a provincial-oriented specification is specified in the Contract Documents. When there is not a corresponding municipal-oriented specification, the references below shall be considered to be the OPSS listed, unless use of a provincial-oriented specification is specified in the Contract Documents.

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

Ontario Provincial Standard Specifications, Construction

OPSS 603	Installation of Ducts
OPSS 604	Installation of Cable
OPSS 609	Grounding
OPSS 610	Removal of Electrical Equipment and Materials

Ontario Provincial Standard Specifications, Material

OPSS 2409	Traffic Signal Cable
OPSS 2410	Extra Low-Voltage Cable
OPSS 2460	Traffic Signal Arms, Brackets, Hangers, Fittings, and Hardware
OPSS 2461	Signal Heads
OPSS 2475	Uninterruptible Power Supply Systems for LED Traffic Signals

Ministry of Transportation Publications

Ontario Traffic Manual (OTM):
Book 12 - Traffic Signals

CSA Standards

C22.2 No. 41:22	Grounding and Bonding Equipment
C22.2 No. 45.2:08 (R2018)	Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel

C22.2 No. 65-18	Wire Connectors
C22.2 No. 85:14 (R2018)	Rigid PVC Boxes and Fittings
C22.2 No. 197:M83 (R2018)	PVC Insulating Tape
C22.2 No. 211.2:06 (R2021)	Rigid PVC (Unplasticized) Conduit
C57:16 (R2021)	Electric Power Connectors for Use in Overhead Line Conductors

Electrical Safety Authority (ESA)

Ontario Electrical Safety Code

Others

Ontario Highway Traffic Act, R.S.O. 1990, Chapter H.8

Transport Canada Guideline for Inspecting and Testing Pre-emption of Interconnected Traffic Control Signals and Railroad Crossing Warning Systems

620.03 DEFINITIONS

For the purpose of this specification, the definitions in the OTM Book 12 and the following definitions apply:

Auxiliary Signal Head means a traffic signal head installed as supplementary to the primary and secondary signal heads and that may be necessary due to local conditions.

Beaconing Actuation means the actuation of the audible signal when a pedestrian push button is pressed and held for a predefined period, typically 3 seconds.

Detection means the operation of a detector sensor unit in registering the presence or passage of a vehicle or pedestrian.

Highway Signal Head means a traffic signal head with a 300 mm diameter red lens and with 200 mm diameter amber and green lenses.

Interconnection means the system of cables and devices that operate traffic signal controllers at consecutive intersections in a fixed or pre-programmed timing sequence.

Oversize Highway Signal Head means a traffic signal head with 300 mm diameter red, amber, and green lenses.

Pedestrian Signal Head means a traffic signal head comprising of a walk and don't walk symbol mounted at a crosswalk.

Primary Signal Head means a traffic signal head mounted on the far right side of an intersection approach.

Secondary Signal Head means a traffic signal head mounted on the far left side or in the median of an intersection approach.

Signal Head means an assembly containing one or more signal displays.

Special Signal Head means a traffic signal head comprised of a combination of sections with red, amber, and green displays or sections with green and amber displays.

Standard Signal Head means a traffic signal head with 200 mm diameter red, amber, and green lenses.

Uninterruptible Power Supply means a backup power supply that supplies temporary power without an interruption in system operation in the event of a short-term loss of power from the local supply authority.

Vehicle Extension means the time, in seconds, added to the green interval to permit additional green time upon actuation by a vehicle approaching the intersection.

620.04 DESIGN AND SUBMISSION REQUIREMENTS

620.04.01 Submissions Requirements

620.04.01.01 Working Drawings and Service Manuals

Working Drawings and service manuals shall be submitted as specified in the Contract Documents.

620.05 MATERIALS

620.05.01 Traffic Signal Heads and Flasher Beacons

Traffic signal heads shall be according to OPSS 2461, OTM Book 12, and the Ontario Highway Traffic Act.

Flasher beacons shall be according to OPSS 2461.

620.05.02 Mast Arms, Brackets, and Signal Hangers

Mast arms, brackets, and signal hangers shall be according to OPSS 2460 and the Contract Documents.

620.05.03 Traffic Signal Cables

Traffic signal cables shall be according to OPSS 2409.

620.05.04 Electrical Insulating Tape

Electrical insulating tape shall be according to CSA C22.2 No. 197 and rated for 600 V and -10 to 90 °C working temperature.

620.05.05 Light Sources

620.05.05.01 Incandescent Lamps

Incandescent lamps shall be according to OPSS 2461.

620.05.05.02 LED Modules

LED modules shall be according to OPSS 2461.

620.05.06 Ducts and Fittings

Rigid PVC ducts and fittings shall be according to CSA C22.2 No. 211.2. Rigid aluminum ducts and fittings shall be according to CSA C22.2 No. 45.2.

620.05.07 Electrical Connectors

Wire connectors shall be of the insulated wing nut, vibration proof spring type, and shall be according to CAN/CSA C22.2 No. 65.

Cable connectors shall be according to CAN/CSA C22.2 No. 65 and CSA C57.

Mechanical connectors shall be according to CSA C22.2 No. 41.

620.05.08 Junction Boxes and Fittings

PVC junction boxes and fittings shall be according to CSA C22.2 No. 85.

620.05.09 Strapping

Stainless steel strapping and buckles shall have a minimum ultimate strength of 4.5 kN.

620.05.10 Traffic Signal Mounting Equipment

Fittings, accessories, and hardware shall be as specified in the Contract Documents.

620.05.11 Grommets

Grommets shall be rubber or neoprene sized to suit the aperture, metal thickness, and cable diameter.

620.05.12 Grounding Materials

Grounding materials shall be according to OPSS 609.

620.05.13 Controllers

Controllers shall be as specified in the Contract Documents.

A used traffic signal controller may be used for a temporary installation provided that it is in good condition and meets the Test Plans clause as specified in the Contract Documents.

620.05.14 Loop Detectors

Extra low-voltage cables for loop detectors shall be according to OPSS 2410.

620.05.15 Pedestrian Push Buttons

Pedestrian push buttons shall be as specified in the Contract Documents.

620.05.16 Accessible Pedestrian Signals

Accessible pedestrian signals shall be as specified in the Contract Documents.

620.05.17 Sealing Compound

Sealing compound shall be of the cold pumped type or hot poured type as specified in the Contract Documents.

620.05.18 Aerial Mounting Equipment

Fittings, accessories, and hardware shall be as specified in the Contract Documents.

620.05.19 Microloop Detectors

Microloop detectors shall be according to the manufacturer's specifications and as specified in the Contract Documents.

620.05.20 Microwave Detectors

Microwave detectors shall be according to the manufacturer's specifications and as specified in the Contract Documents.

620.05.21 Video Detectors

Video detectors shall be according to the manufacturer's specifications and as specified in the Contract Documents.

620.05.22 Variable Message Signs

Variable message signs shall be according to the manufacturer's specifications and as specified in the Contract Documents.

620.05.23 Advance Warning Signs

Advance warning signs shall be according to the manufacturer's specifications and as specified in the Contract Documents.

620.05.24 Traffic Signal Pre-Emption Equipment

Traffic signal pre-emption equipment shall be according to the manufacturer's specifications, as specified in the Contract Documents, and the specific requirements of the authority that is authorized to activate and use the pre-emption function.

620.05.25 Uninterruptible Power Supply Systems

Uninterruptible power supply systems shall be according to OPSS 2475.

620.07 CONSTRUCTION

620.07.01 General

General electrical work requirements shall be as specified in the Contract Documents.

The work shall include the supply, installation, modification, and testing of all materials and systems required to provide traffic signal systems, traffic control devices, and other devices that are fully functional and perform their intended function as specified in the Contract Documents.

620.07.02 Traffic Signals

620.07.02.01 Mast Arms

The attachment point of the mast arm on the pole shall be set to obtain the required clearance from finished grade to the bottom of the signal head. When two or more mast arms are mounted on the same pole, the clearance height of the primary signal head shall be set to obtain the required clearance height specified in the Contract Documents. Other mast arms with secondary or auxiliary signal heads shall be adjusted on the pole so that a minimum separation of one pole diameter is obtained between fittings or bolts touching the pole.

Holes for wooden pole mounting shall be drilled to accommodate the through bolts. Nuts shall be tightened to obtain a minimum wood compression of 3 mm under the washers.

Mast arm attachment to steel poles using U bolts or pole plates shall be tightened to a point when the pole just begins to deform.

Mast arms shall be installed perpendicular to the through lanes of traffic being served.

620.07.02.02 Traffic Signal Head Supports

Silicon based sealer shall be applied to the assembly as specified in the Contract Documents.

Traffic signal heads shall be supported as specified in the Contract Documents.

Traffic signal head supports shall be fastened onto the tenon of the mast arm or onto the traffic signal pole itself. Traffic signal head supports shall be adjusted and secured.

620.07.02.03 Double Arm Brackets

Double arm brackets shall be assembled on signal heads prior to pole mounting. The arm shall be installed in parallel alignment and all locknuts securely tightened.

Pole plates shall be mounted on the side of the pole so that the signal heads meet the required clearance height from finished grade. Pole plates shall be secured with stainless steel strapping that shall not overlap or secure any other equipment on the pole.

620.07.02.04 Signal Heads

Signal heads shall be installed facing the direction of approaching traffic. LED modules or incandescent lamps of the size and type specified in the Contract Documents shall be installed. Incandescent lamps shall be installed with positive electrical contact in the signal head lamp holders. Lamp holders for incandescent lamps shall be turned so that the gap in the lamp filament is facing upwards.

Signal heads shall be covered with opaque covers and remain securely in place until all tests have been completed and the signal heads are put into operation. Pedestrian signal heads shall be turned to face the pole prior to operation.

Signal heads shall be adjusted for maximum visibility and focusing prior to final tightening or sealing of hardware. Unused top and bottom hubs in signal heads shall be plugged with bird stops and the top hub shall have a gasket.

620.07.02.05 Wiring Apertures

Wiring apertures shall be drilled as required in metal poles. Apertures shall be located clear of the vertical seam and overlapping sections of sectional steel poles. Apertures shall be de-burred and painted with grey zinc rich paint. Grommets shall be installed after the paint is dry.

620.07.02.06 Pole Mounted Conduit Systems

Pole mounted conduit systems including rigid PVC junction boxes and all necessary fittings and hardware shall be installed when traffic signal equipment is to be installed on concrete or wooden poles. Conduit shall be installed in straight lengths to follow the taper of the pole using stainless steel strapping or galvanized steel two-hole clips secured by galvanized lag screws at 1.5 m maximum spacing. Offset bends shall be used when required to avoid pole attachments and other equipment. Conduits shall be kept free of kinks or scorch marks.

620.07.02.07 Wiring

Traffic signal cable shall be installed between the signal head and the pole handhole or the pole mounted PVC junction box. Wiring shall be run through the mast arms, signal hangers, and the upper arm of double arm brackets. A minimum length of 600 mm of riser cable shall be left in pole handholes.

Aerial cable from the PVC junction box to the signal head shall be installed according to OPSS 604.

Riser cables shall be connected to LED modules or incandescent lamp holder leads via terminal blocks or with insulated wing nut vibration proof spring connectors. Termination of spare conductors and handhole or junction box connections shall be made with insulated spring connectors. All insulated wire connectors shall be held in place with three half laps of electrical vinyl tape. Upon completion of connections, all conductors shall be neatly bundled together and secured with four laps of electrical vinyl tape.

Signal heads shall be bonded according to OPSS 609 and the Ontario Electrical Safety Code using the designated bonding conductor in the cable, and connected securely to the signal head and the pole ground stud or the system ground wire in PVC junction boxes.

Cables shall be identified at all access points and labelled as specified in the Contract Documents. Cables shall be identified using tags with permanent waterproof markings.

620.07.02.08 Optically Directed Signal Heads

Optically directed signal heads shall be installed according to the manufacturer's instructions. Signal heads shall be adjusted to focus along the designated roadways or traffic lanes.

620.07.02.09 Aerial Mounted Equipment

Aerial mounted equipment shall be installed using all fittings, hardware, PVC junction boxes, and accessories necessary for the mounting of equipment on aerial messenger cable systems. All compression nuts, lock nuts, and fitting hardware shall be securely tightened to prevent shifting of equipment by wind.

620.07.02.10 Equipment Modifications

Removal of existing equipment shall be according to OPSS 610 and as specified in the Contract Documents. Installation of new, refurbished, or modified equipment shall be done according to the requirements for installation of the particular items of equipment as described herein.

620.07.03 Traffic Control Devices

620.07.03.01 Flasher Beacons

Flasher beacons for post top mounting shall be aligned facing the direction of approaching traffic.

Flasher beacons for pole front or side mounting shall be aligned facing the direction of approaching traffic and mounted on double arm brackets or mast arms and signal hangers as specified in the Contract Documents.

Single or multiple cluster of flasher beacons for aerial mounting shall be arranged on the overhead support cable to provide the required visibility and clearances for each direction of approaching traffic to be controlled. Mounting hardware shall be securely tightened.

620.07.03.02 Flasher Mechanisms

Flasher mechanisms shall be mounted in enclosures with the accompanying conduit, conduit fittings, and wiring systems.

620.07.03.03 Sign Light Assemblies

Sign light assemblies shall be installed with rigid aluminum conduit and fittings, lamp holders, and lamps and shall be installed facing the direction of approaching traffic. Lengths of conduit shall be secured against fittings with lock nuts.

620.07.03.04 Internally Illuminated Signs

Internally illuminated signs shall be installed on double arm brackets, mast arms and signal hangers, or aerial support cables as specified in the Contract Documents.

620.07.03.05 Grounding

Traffic control devices shall be grounded according to OPSS 609.

620.07.03.06 Removals

Removals shall be according to OPSS 610.

620.07.04 Controllers

620.07.04.01 Controller Cabinets

620.07.04.01.01 Pole Mounted Controller Cabinets

Pole mounted controller cabinets shall be installed complete with mounting brackets, hardware, stainless steel strapping, and pole mounted conduits and fittings and shall be located and oriented as specified in the Contract Documents.

620.07.04.01.02 Pad Mounted Controller Cabinets

Pad mounted controller cabinets shall be installed complete with hardware and accessories and shall be located and oriented as specified in the Contract Documents.

A gasket shall be attached squarely and symmetrically on the bottom channel of the cabinet prior to installation with holes for mounting bolts drilled, when necessary.

A gasket with adhesive on one side shall be provided to install between the concrete pad and the bottom of the cabinet or base extension unit.

The cabinet enclosure shall include a main cabinet and a base extension unit. The top of the base extension unit shall match the bottom of the main cabinet. A gasket shall be installed between the main cabinet and the base extension unit. All stainless steel hardware to bolt the main cabinet together with the base extension unit shall be provided.

620.07.04.01.03 Pedestal Mounted Controller Cabinets

Pedestal mounted controller cabinets shall be installed complete with hardware and accessories and shall be located and oriented as specified in the Contract Documents.

620.07.04.01.04 Equipment Bonding

Equipment bonding shall be according to OPSS 609 and the Ontario Electrical Safety Code.

620.07.04.02 Controller Equipment

620.07.04.02.01 Shelf-Mounted and Rack-Mounted Equipment

Shelf-mounted and rack-mounted controller equipment shall be neatly and suitably arranged on the shelves or racks so that all preformed wiring harnesses are of adequate length to allow connections and may be trained to out-of-the-way locations. Similar items of equipment shall be grouped together. All equipment shall be installed with the front facing outward so that the main operational controls and switches are readily accessible.

620.07.04.02.02 Cabinet-Wall Mounted Equipment

Cabinet-wall mounted equipment shall be installed level and clear of nearby components. The equipment shall be bolted in place with minimum 5 mm diameter stainless steel machine bolts, nuts, and lock washers.

620.07.04.02.03 Identification of Equipment

All equipment shall be identified with permanent markings.

620.07.04.02.04 Security

Controller cabinets shall be kept locked at all times, except when work is being performed on the controller cabinet equipment. Upon completion of the work, all keys to the controller cabinet shall be given to the Contract Administrator.

620.07.04.02.05 Traffic Signal Control Programming and Timing

All controller and conflict monitor programming shall be installed and all timing controls, switches, and programming controls shall be set.

The Contract Administrator shall provide the traffic signal interval timing to the Contractor. The Contractor shall install the traffic signal timing into the traffic signal controller. The Contractor shall verify that the traffic signal timing is consistent and complete prior to installing it.

620.07.05 Activation Devices

620.07.05.01 Detector Loops

620.07.05.01.01 Loop Layout

Detector loops shall be accurately laid out on the pavement to the dimensions specified in the Contract Documents. Slot cutting lines shall be marked with non-permanent materials.

When the layout of a loop crosses a major pavement crack, butt or expansion joint, or irregularity, the treatment for the crossing shall be as specified in the Contract Documents.

620.07.05.01.02 Saw Cutting

The temperature shall be within the allowable limits prior to saw cutting and ensure that any dampness or precipitation can be successfully blown out of saw cut slots prior to and during installation.

Saw cutting of loop slots in pavement shall be in straight lines with slot depths and widths according to the dimensions specified in the Contract Documents. Corner cutting for slots shall be extended only far enough past each corner point to obtain the full depth of the slot. Slot crossing of pavement irregularities shall be constructed using additional widths and depths of slots as specified in the Contract Documents.

When specified in the Contract Documents, saw-cut marks shall be made on the curbs to indicate location of the loop.

620.07.05.01.03 Slot Preparation

Upon completion of saw cutting, the slot shall be cleaned with compressed air and dried by applying heat.

Corner of slot shall be rounded using hand tools. All slots and corners shall be examined for protrusions of sharp stone aggregates or debris that may damage the cable. Any such protrusions or debris shall be removed. Final slot preparation shall be done immediately prior to installation of the cable.

620.07.05.01.04 Flexible Duct Installation

A hole shall be drilled through the pavement to accommodate a flexible duct at the location specified in the Contract Documents.

All work for flexible duct installation, including earth excavation, backfill, removal, and restoration shall be according to OPSS 603.

620.07.05.01.05 Loop Cable

The loop shall be installed with the size, winding direction, configurations, number of turns, and type of cables as specified in the Contract Documents.

The loop cable end that progresses clockwise shall be marked at the splice point with two bands of colour contrasting electrical vinyl tape.

Each loop cable and extra low-voltage cable shall be identified with a vinyl sleeve wire marker in the splice point as specified in the Contract Documents.

Cable in slots shall be firmly and carefully tamped in place using a blunt instrument on each successive turn of cable. Cables shall be held in place to prevent floating using 25 mm lengths of foam backer rod at 600 mm intervals.

When cables are installed in slots crossing pavement irregularities, all cables shall be installed through split neoprene tubing.

Loop cables between the loop and the splice point, including those in the slot, shall be twisted together to form a consistent lay of 10 turns per metre. The entire loop and lead cable system shall be installed as a continuous and unspliced length of cable.

620.07.05.01.06 Sealing Compound

Sealing compound shall be installed in slots as specified in the Contract Documents.

Sealing compounds shall be installed in slots as protection for loop cables. Sealing compound shall be allowed to set according to the manufacturer's instructions prior to allowing vehicles to cross over the loop. Loop sealant shall be applied directly into the loop slot with no spillage. Spilled loop sealant or other excess loop sealant on the road surface that is not within the loop slot shall be removed from the road surface. Sealing compound shall be of the following types:

a) Cold Pumped Type

Cold pumped compounds shall be installed using a pressure pump or cartridge gun according to the manufacturer's instructions.

b) Hot Poured Type

Hot poured sealant shall be applied according to the manufacturer's recommendation. Hot poured sealant shall not be used when loops are to be installed in the binder course pavement prior to placement of the top course of pavement over the loops.

620.07.05.01.07 Splicing

Splices of cables shall be made only at the designated splice points. Cables shall be stripped of insulation by approximately 12 mm, butt spliced, soldered together, and covered with a resin or silicone material to produce a sealed connection.

620.07.05.02 Microloop Detectors

Microloop detectors shall be installed in underground ducts at the depths and locations specified in the Contract Documents. Microloops shall be connected to lead-in cable as specified in the Contract Documents.

Ducts for microloops and lead-in cables shall be installed by subsurface installation according to OPSS 603. Lead-in cables for microloops shall be installed according to OPSS 604.

620.07.05.03 Microwave Detectors

Microwave detectors shall be installed at locations and mounting heights specified in the Contract Documents. Microwave detectors shall be orientated and configured for operation according to the manufacturer's specifications and as specified in the Contract Documents.

All cabling and equipment required to transmit, receive, and process microwave detection signals shall be installed according to the manufacturer's specifications and as specified in the Contract Documents.

620.07.05.04 Video Detectors

Video detectors shall be installed at locations and mounting heights specified in the Contract Documents. Video detectors shall be orientated and configured for operation according to the manufacturer's specifications and as specified in the Contract Documents.

All cabling and equipment required to transmit, receive, and process video and video detection signals shall be installed according to the manufacturer's specifications and as specified in the Contract Documents.

620.07.05.05 Variable Message Signs

Variable message signs shall be installed at locations specified in the Contract Documents. Variable message signs shall be orientated and configured for operation according to the manufacturer's specifications and as specified in the Contract Documents.

All cabling and equipment required to transmit messages to the variable message signs shall be installed according to the manufacturer's specifications and as specified in the Contract Documents.

620.07.05.06 Advance Warning Signs

Advance warning signs shall be installed at locations specified in the Contract Documents. Advance warning signs shall be orientated and configured for operation according to the manufacturer's specifications and as specified in the Contract Documents.

All cabling and equipment required to transmit messages to the advance warning signs shall be installed according to the manufacturer's specifications and as specified in the Contract Documents.

620.07.05.07 Pedestrian Push Buttons

Pedestrian push buttons shall be installed at locations specified in the Contract Documents and include the installation of pedestrian push buttons and push button signs as specified in the Contract Documents.

Pedestrian push buttons and push button signs shall be mounted on the side of the pole so that the pedestrian signal push button sign arrow indicates the proper direction for which roadway crossing is required.

Pedestrian push buttons shall be installed with stainless steel self-tapping screws or stainless steel strappings. A wiring aperture shall be drilled in metal poles and fitted with a rubber grommet or a rigid conduit shall be installed on poles for wiring access.

Push buttons for metal poles shall be installed as specified in the Contract Documents with an integral sign frame or separately mounted with stainless steel strappings or screws.

620.07.05.08 Accessible Pedestrian Signals

Accessible pedestrian signals shall be installed according to all applicable laws and regulations.

620.07.06 Traffic Signal Pre-Emption Equipment

Traffic signal pre-emption equipment shall be installed according to the manufacturer's instructions and as specified in the Contract Documents. Pre-emption equipment shall be set up to operate according to the manufacturer's specifications, as specified in the Contract Documents, and the specific requirements of the authority that is authorized to activate and use the pre-emption function.

620.07.07 Traffic Signal Interconnection Equipment

Traffic signal interconnection equipment shall be installed as specified in the Contract Documents.

620.07.08 Traffic Signal Control Equipment Supplied by Owner

When the Owner supplies the traffic signal control equipment, the equipment shall be loaded and transported from the Owner's premises specified in the Contract Documents. The Contractor shall ensure that all components are safely connected, secured, and packaged prior to transporting the equipment.

620.07.09 Uninterruptible Power Supply Systems

Uninterruptible power supply equipment shall be installed and adjusted according to the manufacturer's instructions and as specified in the Contract Documents.

620.07.10 Quality Control

620.07.10.01 General

The Contract Administrator shall be notified of the time and location of all inspection and testing 3 Business Days prior to the start of the work and confirm that the work shall be performed as scheduled 24 hours prior to the start of the work.

The work shall be inspected and tested 3 Days prior to the actual turn on of the signals to ensure that it is according to the requirements as specified in the Contract Documents.

A minimum of 72 hours prior to the scheduled activation of each traffic signal, the Contractor shall coordinate and attend an on-site quality control meeting with the Contract Administrator.

Upon completion of installations and testing, a visual check shall be made of the controller cabinet to ensure proper operation of the equipment.

All test results shall be submitted to the Contract Administrator.

620.07.10.02 Test Plans

A test plan shall be submitted to the Contract Administrator documenting how the traffic signals and electrical traffic control devices will be tested. The test plan shall be submitted to the Contract Administrator prior to any installation work and a minimum of 30 Business Days prior to the start of any testing.

The Contractor shall make additions or modifications to the test plan as specified by the Contract Administrator. Testing shall not commence until the test plan has been accepted by the Contract Administrator. Once accepted, the traffic signals and traffic control devices shall be tested according to the accepted test plan and as specified in the Contract Documents.

As a minimum, the test plan shall include a pre-installation test plan and a proof of performance test plan.

Once accepted by the Contract Administrator, the accepted test plan shall form part of the Contract Documents.

620.07.10.03 Pre-Installation Testing and Inspection

Actuation devices and connection components shall be inspected prior to installation to ensure that they meet the requirements as specified in the Contract Documents.

Traffic signal controllers and components shall be inspected prior to installation to ensure that they meet the requirements as specified in the Contract Documents.

The Contractor shall be responsible for ensuring that all controller and conflict monitor programming are installed and that all timing controls, switches, and programming controls are properly set.

Signal heads, mast arms, traffic signal head supports, double arm brackets, and connection components shall be inspected prior to installation to ensure that they meet the requirements as specified in the Contract Documents.

620.07.10.03.01 Traffic Signal Control Equipment

Traffic signal control cabinets complete with traffic signal control equipment shall be tested and inspected. The functionality and performance of each component shall be tested and confirmed to operate according to the manufacturer's specifications and as specified in the Contract Documents.

The entire traffic signal control equipment shall be tested with the traffic signal control equipment installed within the cabinet and all programming, timing, switches, and controls installed and set. The functionality and performance of the traffic signal control equipment as a complete system shall be tested and confirmed to operate according to the traffic signal timing plan, the manufacturer's specifications, and as specified in the Contract Documents.

If the traffic signal control equipment or any part thereof fails to operate correctly, the deficiency shall be corrected and the testing and inspection repeated in full.

620.07.10.03.02 Traffic Signal Equipment

The functionality and performance of each piece of traffic signal equipment shall be tested and inspected and confirmed to operate according to the manufacturer's specifications and as specified in the Contract Documents.

If the traffic signal equipment or any part thereof fails to operate correctly, the deficiency shall be corrected and the testing and inspection repeated in full.

620.07.10.03.03 Electrical Traffic Control Devices

The functionality and performance of each electrical traffic control device shall be tested and inspected and confirmed to operate according to the manufacturer's specifications and as specified in the Contract Documents.

If the electrical traffic control device or any part thereof fails to operate correctly, the deficiency shall be corrected and the testing and inspection repeated in full.

620.07.10.03.04 Controllers

Pre-shipping shop tests are required prior to transporting the controller to the Working Area. When the Owner supplies the controller, the tests shall be carried out by the Owner.

The following pre-installation tests are required:

a) Cabinet Assembly and Components

A visual check shall be made to ensure that all components necessary to the complete controller are present and that all pre-assembled equipment is securely mounted and connected.

b) Circuit Output

The output terminal board voltage shall be tested for 108 V minimum output from load switches and for proper terminal assignment according to the manufacturer's wiring diagram.

c) Programming

With the actual phase timing for the intended intersection in operation, the controller programming shall be tested to ensure that the intended operation is accomplished. This test shall include all required combinations of actuation and recall settings together with any special features such as advance green, phase skip, pre-emption, or coordination.

d) Interval Sequence

With the proper programming for the intended intersection in operation, but with modified timing values suitable to test conditions, the controller unit shall be cycled through all phases for a minimum of 24 hours. Controller output shall be tested using a test board with indicator lights to ensure that the proper phases and phase intervals appear in the correct sequence. The testing shall be conducted using either a 120 V test board wired to the output side of the load switches or by a 24 V test board wired to the input side of the load switches. Test results shall be confirmed a minimum of 6 times.

e) Actuation

With an appropriate test board, the effect of detection devices and pedestrian push buttons in entering a call to the controller unit shall be tested. All modes of detector sensor unit program and vehicle extension calls shall be tested. Tests shall confirm that all calls are registered, activated, and are associated with the correct traffic phase.

f) Conflict Monitors

Conflict monitors shall be tested according to the manufacturer's recommendations. All flash and reset functions shall be tested.

g) Flashers

The output of flasher units and flash transfer relays shall be tested for proper functioning over a two hour period.

h) Recall

Recall switch functions for each phase shall be tested to ensure that the controller recalls to the phase selected and remains on hold in the absence of a call on an opposing phase.

i) Manual Override Controls

Manual override controls shall be tested for proper operation under all possible switching combinations.

j) Environmental Controls

The heater element and circuitry shall be tested for continuity and proper resistance. The ventilation fan shall be checked for proper operation in conjunction with the thermostat control system. If the average temperature during the installation period is below 5 °C, the cover plate shall be installed over the louvres and the heater circuit shall be prepared for operation.

620.07.10.04 Proof of Performance Testing and Inspection

The work shall be inspected and tested a minimum of 3 Business Days prior to the actual turn on of the signals to ensure that it is according to the requirements as specified in the Contract Documents. In particular, and without limiting the foregoing, ensure all components are installed, tested, and proven to perform as specified in the Contract Documents and that 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.

All proof of performance testing and inspection shall be performed on site with all signal heads covered with an opaque covering and all pedestrian signal heads turned to face the pole to which they are attached.

All traffic signal cable circuits shall be tested according to OPSS 604.

Each signal display shall be inspected and tested for correct phase connection and operation as specified in the Contract Documents.

Detection and actuation devices shall be tested and inspected for correct operation according to the manufacturer's specifications and as specified in the Contract Documents. This testing shall include observation of all calls generated to verify that they are registered and activated.

Traffic signal timing shall be verified to be consistent and complete. With the proper programming and signal timing in operation and with all system components and circuits connected, the traffic signal system shall be cycled through all of its phases and operations.

620.07.10.04.01 Detector Loops

Loop wiring shall be tested for continuity, for leakage to ground, and for inductance at the controller cabinet. Resistance to ground shall be 10 mega ohm or greater. Inductance shall be within 25% of the value specified in the Contract Documents using a 100 kHz signal at 5 V.

Any detector loop required to be replaced shall be removed from the original slot and a new detector loop shall be installed in the original slot or installed in a re-cut slot. The new detector loop shall be installed with new wiring and sealing compound and retested.

All test results shall be submitted to the Contract Administrator.

620.07.10.04.02 Microloop Detection Systems

Microloop detection systems shall be tested to confirm that the microloop detection equipment is accurately detecting vehicles and transmitting calls to the controller. Microloop detection systems shall be tested according to the manufacturer's specifications and as specified in the Contract Documents.

620.07.10.04.03 Microwave Detection Systems

Microwave detection systems shall be tested to confirm that the microwave detection equipment is accurately detecting vehicles and transmitting calls to the controller. Microwave detection systems shall be tested according to the manufacturer's specifications and as specified in the Contract Documents.

620.07.10.04.04 Video Detection Systems

Video detection systems shall be tested to confirm that the video detection equipment is accurately detecting vehicles and transmitting calls to the controller. Video detection systems shall be tested according to the manufacturer's specifications and as specified in the Contract Documents.

620.07.10.04.05 Variable Message Sign Systems

Variable message sign systems shall be tested to confirm that messages are accurately transmitted to the variable message signs and that the messages are displayed correctly. Variable message sign systems shall be tested according to the manufacturer's specifications and as specified in the Contract Documents.

620.07.10.04.06 Advance Warning Sign Systems

Advance warning sign systems shall be tested to confirm that the signs activate and deactivate at the correct points in the cycle of traffic control signal indications and that the advance warning signs activate and display correctly. Advance warning sign systems shall be tested according to the manufacturer's specifications and as specified in the Contract Documents.

620.07.10.04.07 Pedestrian Push Buttons

Upon completion of the installation of the pedestrian push buttons, the system shall be tested at the controller cabinet.

620.07.10.04.08 Accessible Pedestrian Signals

Upon completion of the installation of the accessible pedestrian signals, the system shall be tested for proper actuation and operation.

620.07.10.04.09 Traffic Signal Pre-Emption Equipment

Traffic signal pre-emption equipment shall be tested to confirm that each pre-emption system (i.e., railway, emergency vehicles, and transit) works correctly and performs its intended function. Pre-emption equipment shall be tested to confirm that pre-emption requests are served in the following order of priority:

- a) Railway
- b) Emergency Vehicles
- c) Transit

620.07.10.04.09.01 Railroad

Upon completion of the railroad pre-emption installation, the pre-emption system shall be tested according to Transport Canada Guideline for Inspecting and Testing Pre-emption of Interconnected Traffic Control Signals and Railroad Crossing Warning Systems.

620.07.10.04.09.02 Emergency Vehicles

Testing of pre-emption equipment for emergency vehicles shall be coordinated with the emergency services that will use this pre-emption function. Emergency services (e.g., fire and ambulance) shall be present for the testing of this pre-emption equipment.

620.07.10.04.09.03 Transit

Upon completion of the transit signal pre-emption installation, the pre-emption system shall be tested with the assistance of the transit authority to confirm the correct operation of the transit signal pre-emption devices and algorithm.

620.07.10.04.10 Controllers

620.07.10.04.10.01 General

Field tests are required upon completion of the installation of the controller. The controller shall be allowed to operate functionally only after all testing has been completed and all components are operational.

620.07.10.04.10.02 Signal Cable

All traffic signal cable circuits shall be tested according to OPSS 604.

620.07.10.04.10.03 Interval Sequence

With the proper programming and timing functions in operation, the controller shall be cycled through all phases with all signal circuits connected and with signal heads covered.

620.07.10.04.10.04 Actuation

All calls shall be observed to be registered and activated. Actuation equipment shall be tested.

620.07.10.04.11 Uninterruptible Power Supply Systems

Uninterruptible power supply systems shall be tested to confirm that the system operation continues without interruption when there is an interruption of power from the local supply authority. The duration of operation on the uninterruptible power supply system shall be confirmed to be according to the manufacturer's specifications and as specified in the Contract Documents.

620.07.10.04.12 System Proof of Performance Testing and Inspection

The work shall be inspected and tested to ensure that the work is according to the requirements as specified in the Contract Documents. In particular, and without limiting to the foregoing, all components are installed, tested, and proven as specified in the Contract Documents and that all cables are energized and in working order without activating the traffic signals for public display.

The complete traffic signal system, including the traffic signal control system, shall be inspected and tested to verify that the complete integrated system operates correctly, safely, and as specified in the Contract Documents.

620.07.11 Management of Excess Material

Management of excess material shall be according to the Contract Documents.

620.08 QUALITY ASSURANCE

Equipment and Materials, as supplied by the Contractor, are subject to inspection by the Contract Administrator prior to installation.

Equipment requiring the submission of Working Drawings and service manuals as specified in the Contract Documents may be inspected by the Contract Administrator prior to shipping from the manufacturer's factory or at the supplier's place of business. The Contractor shall inform the Contract Administrator when the equipment fabrication is complete and shall make suitable arrangements for any required inspection.

All electrical installation work is subject to random inspection by the Contract Administrator. The Contract Administrator may witness any testing performed by the Contractor during installation.

620.09 MEASUREMENT FOR PAYMENT

620.09.01 Actual Measurement

- 620.09.01.01 Loop Detectors**
- Microloop Detectors**
- Microwave Detectors**
- Video Detectors**
- Pedestrian Push Buttons**

**Traffic Actuation Equipment
Traffic Signal Controllers
Pedestal Mounted Traffic Signal Controllers
Traffic Signal Head Supports
Single Member Arms and Signal Hangers
Double Arm Brackets
Highway Signal Heads
Oversize Highway Signal Heads
Special Signal Heads
Standard Signal Heads
Pedestrian Signal Heads
Single Signal Head Sections
Optically Directed Signal Heads
Flasher Beacons
Flasher Mechanisms
Sign Light Assemblies
Internally Illuminated Signs
Variable Message Signs
Advance Warning Signs
Accessible Pedestrian Signals**

For measurement purposes, a count shall be made of the number of each of the above types of traffic signal equipment or traffic control device installed.

**620.09.01.02 Traffic Signal Controller Modifications (Intersection Locations)
Traffic Signal Equipment Modifications (Intersection Locations)**

For measurement purposes, a count shall be made of the number of each of the above types of traffic signal equipment modified.

620.09.01.03 Uninterruptible Power Supply Systems

For measurement purposes, a count shall be made of the number of uninterruptible power supply systems installed.

620.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

620.10 BASIS OF PAYMENT

**620.10.01 Loop Detectors - Item
Microloop Detectors - Item
Microwave Detectors - Item
Optically Directed Signal Heads - Item
Flasher Beacons - Item
Flasher Mechanisms - Item
Sign Light Assemblies - Item
Internally Illuminated Signs - Item
Variable Message Signs - Item
Advance Warning Signs - Item
Accessible Pedestrian Signals - Item
Uninterruptible Power Supply Systems - Item**

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

620.10.02 Traffic Signal Equipment - Item

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment, and Material to do the work of installing all traffic signal equipment.

620.10.03 Traffic Control Devices - Item

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment, and Material to do the work of installing all traffic control devices.

620.10.04 Rock Excavation

Payment for rock excavation shall be according to OPSS 603.

**Appendix 620-A, April 2023
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

The designer should specify the following in the Contract Documents:

- Traffic signal mounting equipment fittings, accessories, and hardware specifications. (620.05.10)
- Controller specifications. (620.05.13)
- Pedestrian push button specifications. (620.05.15)
- Aerial mounting equipment fittings, accessories, and hardware specifications. (620.05.18)
- Microloop detector specifications. (620.05.19)
- Microwave detector specifications. (620.05.20)
- Video detector specifications. (620.05.21)
- Variable message sign specifications. (620.05.22)
- Advance warning sign specifications. (620.05.23)
- Traffic signal pre-emption equipment specifications. (620.05.24)
- Uninterruptible power supply system specifications. (620.05.25)
- Primary traffic signal head clearance height. (620.07.02.01)
- Sealer requirement for traffic signal head assemblies. (620.07.02.02)
- Size and type of LED modules or incandescent lamps to be installed in the signal heads. (620.07.02.04)
- Labelling requirement for cables. (620.07.02.07)
- Existing equipment to be removed for existing equipment modification. (620.07.02.10)
- Internally illuminated sign installation specifications. (620.07.03.04)
- Location and orientation of pole mounted controller cabinets. (620.07.04.01.01)
- Location and orientation of pad mounted controller cabinets. (620.07.04.01.02)
- Location and orientation of pedestal mounted controller cabinets. (620.07.04.01.03)
- Location and size of detector loops. (620.07.05.01.01)

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- Treatment for loops crossing major cracks, butt or expansion joints, or irregularities. (620.07.05.01.01)
- Loop saw cut depths, width, and length dimensions. (620.07.05.01.02)
- Location of flexible ducts for detector loops. (620.07.05.01.04)
- Size, winding direction, configurations, number of turns, and type of cable for detector loops. (620.07.05.01.05)
- Identification markings for loop and extra low-voltage cables. (620.07.05.01.05)
- Location of sealing compound to be installed for loop cable slots. (620.07.05.01.06)
- Depth and location of microloop detectors. (620.07.05.02)
- Installation specifications for microloop detectors and type of lead-in cable. (620.07.05.02)
- Location and mounting height of microwave detectors. (620.07.05.03)
- Orientation, configuration, and installation specifications for microwave detectors. (620.07.05.03)
- Location and mounting height of video detectors. (620.07.05.04)
- Orientation, configuration, and installation specifications for video detectors. (620.07.05.04)
- Location of variable message signs. (620.07.05.05)
- Orientation, configuration, and installation specifications for variable message signs. (620.07.05.05)
- Location of advance warning signs. (620.07.05.06)
- Orientation, configuration, and installation specifications for advance warning signs. (620.07.05.06)
- Location of pedestrian push buttons and pedestrian push button sign specifications. (620.07.05.07)
- Installation specifications for push buttons on metal poles. (620.07.05.07)
- Installation and setup specifications for traffic signal pre-emption equipment. (620.07.06)
- Installation specifications for traffic signal interconnection equipment. (620.07.07)
- Installation and adjustment specifications for uninterruptible power supply systems. (620.07.09)
- Traffic signal control equipment operation details. (620.07.10.03.01)
- Traffic signal equipment operation details. (620.07.10.03.02)
- Electrical traffic control device operation details. (620.07.10.03.03)
- Signal display performance details. (620.07.10.04)
- Detection and actuation device testing requirements. (620.07.10.04)
- Inductance value for detector loop testing. (620.07.10.04.01)

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- Microloop detection system operation details. (620.07.10.04.02)
- Microwave detection system operation details. (620.07.10.04.03)
- Video detection system operation details. (620.07.10.04.04)
- Variable message sign system operation details. (620.07.10.04.05)
- Advance warning sign system operation details. (620.07.10.04.06)
- Uninterruptible power supply system operation details. (620.07.10.04.11)

The designer should determine if the following are required and, if so, specify them in the Contract Documents:

- Beaconing actuation for accessible pedestrian signals. (620.05.16)
- Additional orientation guides for accessible pedestrian signals. (620.05.16)
- Additional accessible pedestrian signal features. (620.05.16)
- Saw-cut marks on curb to indicate loop location. (620.07.05.01.02)
- Supply of traffic signal control equipment by owner and location of control for pickup. (620.07.08)

The designer should ensure that the General Conditions of Contract and the 100 Series General Specifications are included in the Contract Documents.

Related Ontario Provincial Standard Drawings

OPSD 2011.701 General Symbols, Traffic Actuation Devices
OPSD 2200.041 Concrete Footing for 1.5m Base Mounted Pedestrian Pushbutton Pole
OPSD 2232.010 Sectional Steel Pole with Brackets, Luminaire, and Traffic Signal Head
OPSD 2235.010 Pole Guying Details
OPSD 2236.010 Wooden Pole and Anchorage Settings in Solid Rock 1
OPSD 2236.020 Wooden Pole and Anchorage Settings in Solid Rock 2
OPSD 2238.010 Wooden Pole in Earth
OPSD 2240.010 Wooden Pole with Elliptical Bracket, Overhead and Underground Circuits
OPSD 2242.010 Wooden Pole with Neutral Supported Cable
OPSD 2242.020 Wooden Poles with Aerial Signal Cables Lashed on Messenger
OPSD 2245.010 Installation of Aerial Cable Systems
OPSD 2245.020 Minimum Vertical Clearances for Aerial Cable Systems
OPSD 2250.010 Aluminum Tapered Elliptical Brackets on Metal and Concrete Poles, Mounting Details
2500 Series Electrical Drawings