CONSTRUCTION SPECIFICATION FOR TRAFFIC SIGNAL EQUIPMENT

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620.01 SCOPE

This specification covers the requirements for the installation of traffic signal equipment, including traffic signal heads, mast arms, brackets, signal hangers, optically directed lens assemblies, LED modules, aerial mounting equipment and equipment modifications.

620.01.01 Specification Significance and Use

This specification is written as a provincial-oriented specification. Provincial-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of the Ontario Ministry of Transportation.

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

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

Ontario Provincial Standard Specifications, Construction

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 2460	Traffic Signal Arms, Brackets, Hangers, Fittings and Hardware
OPSS 2461	Signal Heads

CSA Standards

C22.2 No. 45.2-08 (R2013)	Electrical Rigid Metal Conduit - Aluminum, red brass, and stainless steel (Tri-national standard, with NMX-J-576-ANCE and UL 6A)
C22.2 No. 65-13	Wire connectors (Tri-national standard, with UL 486A-486B and NMX-J-543- ANCE)
C22.2 No. 85-14	Rigid PVC Boxes and Fittings
C22.2 No. 197-M1983 (R2013)	PVC Insulating Tape
C22.2 No. 211.2-06 (R2011)	Rigid PVC (Unplasticized) Conduit

620.03 DEFINITIONS

For the purpose of this specification the following definitions apply:

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

Backboard means a panel surrounding a signal head.

Conflict Monitor means a device used to prevent conflicting signal phases.

Controller unit means a traffic signal controller

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

Light Emitting Diode (LED) means a semiconductor device that emits incoherent monochromatic light when electrically biased in the forward direction. This effect is a form of electroluminescence. The colour depends on the semiconducting material used, and can be near-ultraviolet, visible or infrared. These LEDs are used to provide red, amber, green or green arrow, etc. indications in traffic signal heads.

Load Switch means a device used to switch 120-volt power to the traffic control signal heads. Load switches are normally semi-conductor devices, which are switched by low voltage signal from the controller unit.

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

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

Quality Verification Engineer (QVE) means an Engineer retained by the Contractor qualified to provide the services specified in the Contract Documents.

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 the signal face.

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

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

620.05 MATERIALS

620.05.01 Traffic Signal and Pedestrian Heads

Each traffic signal head shall be provided with LED modules unless otherwise specified in the Contract Documents.

Each traffic signal head shall be a highway signal head unless otherwise specified in the Contract Documents.

Traffic signal heads and pedestrian heads shall be according to OPSS 2461.

620.05.02 Mast Arms, Brackets, Signal Hangers

Mast arms, brackets and signal hangers shall be according to OPSS 2460. Signal hangers shall be adjustable mid-section hanger or dual-end hanger as specified in the Contract Documents.

620.05.03 Traffic Signal Cables

Traffic signal cables shall be according to OPSS 2409.

620.05.04 Tape

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

620.05.05 LED Modules

LED modules shall be according to OPSS 2461.

620.05.06 Conduits and Fittings

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

620.05.07 Wire Connectors

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

620.05.08 Junction Boxes and Fittings

PVC junction boxes and fittings shall be according to CAN/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 meet the requirements 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.

620.07 CONSTRUCTION

620.07.01 Mast Arms

The attachment point of the mast arm shall be set on the pole 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

primary head shall be set to obtain the required clearance height specified in the Contract Documents. Other mast arms, with secondary or auxiliary 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.

For wood pole mounting, holes shall be drilled to accommodate 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 where the pole just begins to deform.

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

620.07.02 Traffic Signal Hangers

Traffic signal hangers shall be slip-fitted on the tenon of the mast arm and secured in position with the signal heads adjusted to vertical.

Installation of the signal hanger shall be according to the manufacturer's instructions.

620.07.03 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 the bottom of the signal head meets the required clearance height from finished grade. Pole plates shall be secured with stainless steel strapping which shall not overlap or secure any other equipment on the pole.

620.07.04 Signal Heads

Signal heads shall be installed facing the direction of approaching traffic according to the legal drawing, Form PHM-125, approved for the intersection.

Signal heads shall be securely covered with an opaque covering and shall remain in place until all tests have been completed and the signal heads are put into operation. Pedestrian 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 hubs in signal heads shall be plugged with sealing caps, without a gasket.

620.07.05 Wiring Apertures

In metal poles, wiring apertures shall be drilled as required. 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. Rubber grommets shall be installed after paint is dry.

620.07.06 Pole Mounted Conduit Systems

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

620.07.07 Wiring

Traffic signal cable shall be installed between the signal head and either 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.

Drip loops shall be left on all external cable. Cable shall be protected with rigid PVC conduit where slack lengths of more than 450 mm are externally exposed. 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 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 spring 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 wraps of electrical vinyl tape.

Metal signal heads shall be grounded according to OPSS 609 by use of the designated spare conductor in the riser cable, connected securely to the ground terminal in the signal head and either the pole ground stud or the system ground wire in PVC junction boxes.

620.07.08 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.

620.07.09 Aerial Mounted Equipment

All equipment and fittings, hardware, PVC junction boxes, and accessories necessary for the mounting of equipment on aerial messenger cable systems shall be installed as specified in the Contract Documents. All compression nuts, locknuts and fitting hardware shall be securely tightened to prevent shifting of equipment by natural elements (i.e. wind, rain, ice or snow, etc.)

620.07.10 Equipment Modifications

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

620.07.11 Quality Control

Pre-installation Testing and Inspection (PIT):

Signal heads, mast arm, double arm brackets and connection components shall be inspected prior to installation to ensure that they are according to the Contract Documents.

Proof of Performance Testing and Inspection (POP):

The work shall be inspected and tested to ensure that it meets the requirements of the Contract Documents and without limiting the foregoing, to ensure the following:

a) All components are installed, tested and proven as specified in the Contract Documents

b) All cables are energized and in working order prior to activating the traffic signals for public display.

The inspection, testing, and test results shall be witnessed by the Quality Verification Engineer.

A Certificate of Conformance shall be submitted to the Contract Administrator upon completion of the work. The Quality Verification Engineer shall affix his or her seal and signature to the completed Certificate of Conformance confirming that the following are in general conformance with the requirements of the Contract Documents:

a) Work

b) Material and installations

c) Inspection, testing, and test results

620.08 QUALITY ASSURANCE

The Contract Administrator may provide direction for the aiming of signal heads, optically directed lens assemblies and LED modules. At any time, the Contract Administrator may test-drive the controlled traffic lanes and notify the Contractor of any adjustments required.

620.09 MEASUREMENT FOR PAYMENT

620.09.01 Actual Measurement

620.09.01.01 Single Member Arms and Signal Hangers
Single Member Arms and Signal Hangers (Temporary)
Overbrace Arms and Signal Hangers
Overbrace Arms and Signal Hangers (Temporary)
Double Arm Brackets
Double Arm Brackets (Temporary)
Highway Type Signal Heads
Highway Type Signal Heads (Temporary)
Special Type Signal Heads
Special Type Signal Heads (Temporary)
Standard Type Signal Heads
Standard Type Signal Heads (Temporary)
Pedestrian Type Signal Heads
Pedestrian Type Signal Heads (Temporary)
Single Signal Head Section
Single Signal Head Section (Temporary)
Optically Directed Signal Heads
Optically Directed Signal Heads (Temporary)

For measurement purposes, a count shall be made of the number of arms, hangers, brackets, and signal heads installed.

620.09.01.02 Traffic Signal Equipment Modifications

For measurement purposes, a count shall be made of the number of intersection locations where traffic signal equipment modification is carried out.

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

Single Member Arms and Signal Hangers – Item
Single Member Arms and Signal Hangers (Temporary) – Item
Overbrace Arms and Signal Hangers – Item
Overbrace Arms and Signal Hangers (Temporary) – Item
Double Arm Brackets – Item
Double Arm Brackets (Temporary) – Item
Highway Type Signal Heads – Item
Highway Type Signal Heads (Temporary) – Item
Special Type Signal Heads – Item
Special Type Signal Heads (Temporary) – Item
Standard Type Signal Heads – Item
Standard Type Signal Heads (Temporary) – Item
Pedestrian Type Signal Heads – Item
Pedestrian Type Signal Heads (Temporary) – Item
Single Signal Head Section – Item
Single Signal Head Section (Temporary) – Item
Optically Directed Signal Heads – Item
Optically Directed Signal Heads (Temporary) – Item
Traffic Signal Equipment Modifications - 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.