# MATERIAL SPECIFICATION FOR HEAVY CLASS STEEL AND SECTIONAL STEEL POLES, BASE MOUNTED

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## 2422.01 SCOPE

This specification covers the requirements for base mounted galvanized heavy class steel and sectional steel poles 6.0, 7.5, 9.0, and 10.50 metres in height.

### 2422.01.01 Specification Significance and Use

This specification is written as a municipal-oriented specification. Municipal-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of many municipalities in Ontario.

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

## 2422.01.02 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.

## 2422.02 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 906 Structural Steel for Bridges

**Ontario Ministry of Transportation Publications**

Designated Sources for Materials (DSM)
Structural Manual

**CSA Standards**

| | |
|---|---|
| G40.20-13/G40.21-13 (R2018) | General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel |
| G164-18 | Hot Dip Galvanizing of Irregularly Shaped Articles |
| S6-19 | Canadian Highway Bridge Design Code |
| W47.1-19 | Certification of Companies for Fusion Welding of Steel |
| W59-18 | Welded Steel Construction |

**American Association of State Highway and Transportation Officials (AASHTO)**

LTS-5-M Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 5th Edition, Interim Revisions (2010)

## 2422.03 DEFINITIONS

For the purpose of this specification, the following definition applies:

**Product Drawings** means drawings prepared by the manufacturer that have been approved by the Owner for use with the product.

## 2422.04 DESIGN AND SUBMISSION REQUIREMENTS

### 2422.04.01 Design Requirements

All poles shall be designed to support the required traffic signal and lighting system components and shall be according to CSA S6 and MTO Structural Manual. All poles shall be according to CSA S6 and AASHTO LTS-5-M for fatigue requirements, AASHTO Fatigue Importance Category 2.

#### 2422.04.01.01 Wind Loading

Wind loading shall be based on the maximum wind pressure for Ontario according to CSA S6.

#### 2422.04.01.02 Ice Loading

Ice loading shall be based on the maximum ice loading for Ontario according to CSA S6.

#### 2422.04.01.03 Geometric Parameters

Latitude of design and fabrication details is at the discretion of the supplier and is subject to approval of the design by the Owner.

#### 2422.04.01.04 Supported Load Parameters

Design calculations shall employ force and dimensions for various items of equipment to be mounted on the poles as shown in Table 1.

#### 2422.04.01.05 Heavy Class Steel and Sectional Steel Pole

Heavy class steel and sectional steel poles used for traffic signal or combination traffic signal and lighting system shall be capable of bearing the loads associated with configurations shown in Table 2.

#### 2422.04.01.06 Location of Equipment

Mast arms shall be to be solidly attached to the pole at a height above the pole base plate as given by:

$$H_A = 5{,}650 \text{ mm} - H$$

where: $H_A$ = mast arm height above the pole base plate
$H$ = mast arm height from Table 1

Where more than one mast arm is considered, the shorter arm shall be attached to the pole at a point 300 mm above that of the longer arm.

Pedestrian heads shall be mounted at a height of 2,750 mm above the pole base plate.

Luminaire brackets shall be mounted at a point 150 mm from the top of the pole.

**2422.04.02 Submission Requirements**

**2422.04.02.01 Product Drawings**

The heavy class steel and sectional steel pole manufacturer shall submit the product drawings and the design assumptions and calculations for the poles to the Owner for approval.

As a minimum, the product drawings shall include the following information:

a) Material properties and standards.

b) Dimensions.

c) Hardware requirements.

d) Plans, elevations, sections, and details to show pole structural details.

e) Anchor bolt locations.

f) Welds.

g) Joining method for heavy class steel poles sections.

The product drawings and calculations shall bear the seals and signatures of the design and checking Engineers.

**2422.04.02.02 Working Drawings**

Working Drawings shall be prepared for the fabrication of heavy class steel and sectional steel poles.

Three sets of Working Drawings shall be submitted to the Contract Administrator at least 14 Days prior to the commencement of fabrication of the heavy class steel and sectional steel poles for information purposes only. The seals and signatures of the design Engineer shall be affixed on the Working Drawings prior to submission.

Where multi-discipline engineering work is depicted on the same Working Drawing and the design or design-checking Engineer or both are unable to seal and sign the Working Drawing for all aspects of the work, the drawing shall be sealed and signed by as many additional design and design-checking Engineers as necessary.

As a minimum, the Working Drawings shall include the following information:

a) Detailed dimensions.

b) Plans, elevations, sections, and details to show pole structural details.

c) Equipment layout.

d) Anchor bolt locations.

e) Exact pole weight.

f) Detailed bill of materials.

g) Details of equipment nameplates.

A copy of the Working Drawings shall be retained at the fabricator's plant during and after the heavy class steel and sectional steel pole fabrication.

## 2422.05 MATERIALS

### 2422.05.01 General

All steel used in the production of poles shall be according to CSA G40.21, Grade 300WT, for pole shafts, base plates, and gussets.

All galvanized steel shall be according to CSA G164.

All welding shall be according to CSA W59.

## 2422.07 PRODUCTION

### 2422.07.01 General

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

All welds, except for fillet welds, shall be ground smooth.

The pole base plate for any height of pole shall be made with mounting holes suitable for the anchor rod or anchorage assembly. The pole base plate shall be reinforced with four welded gussets equally spaced around the pole or with a welded collar or combination of both welded collar and gussets.

The underside of the anchor base shall be true, distortion free, and perpendicular to the centreline of the pole shaft after fabrication.

A waterproof, removable galvanized steel top cap shall be furnished with the pole. The cap shall blend with the general pole design to present a neat overall appearance. The cap shall be rigidly secured to the top of the pole by a hexagonal head stainless steel set screw.

Wiring apertures at the bracket mounting level and at the handhole shall be accurately positioned on the pole. The wiring apertures shall provide a smooth cable entrance.

For lighting applications, a wiring aperture, complete with rubber grommet, shall be provided.

Handholes, complete with covers, shall be reinforced with a steel handhole frame of such strength and cross-section that the strength of the pole is not reduced.

### 2422.07.02 Fabrication Outside of Canada and USA

For steel poles fabricated in a production facility outside of Canada and USA, the manufacturer shall be listed in the MTO DSM or the following requirements shall apply:

a) Fabrication of steel poles shall not begin until the information on the mill test certificates is verified by testing at a Canadian laboratory according to OPSS 906. The mill test certificates by the Canadian laboratory shall be stamped with the name of the laboratory and state that the material is according to the specified Contract requirements. Two copies of these stamped mill test certificates shall be submitted to the Contract Administrator.

b) All steel poles fabricated outside of Canada and USA shall be shipped to a facility in Canada certified in accordance with CSA W47.1, Division 1 or 2 for quality verification.

c) Shipped steel poles shall be accompanied by reports containing the results of all inspection and testing performed in the production facility outside of Canada and USA demonstrating compliance with the Quality Control subsection of this specification.

d) Prior to galvanizing or coating, steel poles shall be in a condition that permits inspection and testing.

e) The manufacturer shall hire an independent welding inspection company to perform quality verification of shipped steel poles according to the Quality Control subsection of this specification. All costs incurred to perform inspection and testing at a Canadian facility shall be the responsibility of the Contractor.

f) Acceptance of steel poles shall be based on satisfactory inspection of one randomly selected complete pole from a lot. The size of a lot shall consist of a maximum five poles. All of the components of the pole shall be inspected and tested according to the Quality Control subsection of this specification. Reports accompanying the shipment shall also be reviewed by the welding inspector. Inspection, testing, and reporting shall be done on each shipment received.

g) The welding inspector shall ensure that traceability of all structural steel has been maintained by:

   i. Correlation of heat numbers on steel poles to the mill test certificates.
   ii. Review of mill test certificates, verifying that materials used conform to the contract requirements.

h) If the inspection or testing performed on the steel poles demonstrate that they do not meet the requirements of the Contract Documents, all poles in that lot shall be rejected.

**2422.07.03 Heavy Class Steel Poles**

The poles, as specified in the Contract Documents, shall be round or octagonal in cross-section and shall taper uniformly inwards from the base for the height of the pole.

Poles shall have one or two longitudinal automatically electrically welded joints from top to bottom.

The maximum permitted number of circumferential (transverse) welded joints shall be as shown in Table 3.

The pole sections shall be joined by an electrical weld before galvanizing.

Sweep shall not exceed 3.2 mm per 4.57 m, and the overall sweep shall not be greater than:

(Pole height (m)/4.57 m) x 3.2 mm

In all cases, the base shall telescope the butt end of the pole and be secured with one continuous weld on the inside of the base at the end of the pole and another continuous weld on the outside at the top of the base. All welding at base shall be made in such a manner as to ensure that the welded connection shall develop the same strength of the adjacent pole section to resist any bending action.

**2422.07.04 Heavy Class Sectional Steel Poles**

The pole sections shall be of round tapered construction so that a number of sections may be assembled by means of an overlapping press fit to form a tapered steel pole of the height specified in the Contract Documents.

Each section shall have one longitudinal automatically electrically welded joint from top to bottom.

Each section shall be stencilled with O-L (nominal overlap requirement) and graduations in one-inch increments.

**2422.07.05 Ground Bar**

A ground bar with a bronze ground connector suitable for No. 6 AWG wire shall be welded to the inside of each pole. The bronze ground connector shall be attached to the ground bar before shipment.

**2422.07.06 Marking**

Each pole shall have the following identification markings located approximately 300 mm above the top of the handhole:

a) Manufacturer's name or trademark.

b) Height of pole.

c) Gauge of steel.

d) Bolt circle diameter.

e) Designation OPSS 2422.

f) Date of manufacture (i.e., yyyy-mm-dd).

These markings shall be on a corrosion-resistant metal plate securely attached to the surface of the pole.

**2422.07.07 Packaging and Shipping**

Each pole shall be shipped complete with hardware suitably packaged to ensure that all parts are delivered as an entity.

The Owner shall be advised of the shipping date 3 Business Days prior to delivery.

**2422.07.08 Quality Control**

The Contract Administrator shall be notified of the fabrication, testing, and delivery dates.

**2422.08 QUALITY ASSURANCE**

**2422.08.01 Inspection**

All work is subject to an inspection by the Owner's representative prior to shipment.

The supplier shall notify the Owner a minimum of 1 Business Day in advance of the date that the fabrication of the poles is to commence.

The Owner's representative shall have free access to the place of fabrication for the purpose of inspecting and examining plant records; certificates; materials used; fabrication process, including welding and galvanizing; and to make any tests as may be considered necessary, while the poles are being fabricated.

## 2422.09 OWNER PURCHASE OF MATERIAL

### 2422.09.01 Working Drawings and Shipment

Within 30 Days of receipt of a purchasing order to supply heavy class steel and sectional steel poles, the supplier shall submit 4 copies of pole Working Drawings, as described in the Submission Requirements subsection, to the Owner, for approval.

Working Drawings shall be given final approval by the Owner, if found to be acceptable, or shall be marked with deficiencies, if unacceptable.

Unacceptable drawings shall be returned to the supplier for correction. The supplier shall resubmit 4 copies of corrected Working Drawings within 14 Days. When the resubmitted drawings are acceptable to the Owner, they shall be given final approval.

One copy of the final approved drawings shall be returned to the supplier along with written notification to commence fabrication. Within 14 Days of receipt of the notification to commence fabrication, the supplier shall submit 4 copies of all final approved Working Drawings to the Owner.

Fabrication of the equipment shall not commence until the supplier has received final approved Working Drawings and written notification to commence fabrication from the Owner. All fabrication shall conform to the dimensions indicated on the final approved Working Drawings.

The supplier shall advise the Owner of the shipping date 3 Business Days prior to delivery.

### 2422.09.02 Measurement and Payment

For measurement purposes, a count shall be made of the number of heavy class steel and sectional steel poles delivered and accepted.

Payment at the price specified in the purchasing order shall be for the supply of the heavy class steel and sectional steel poles delivered to the destination on the date and time specified.

The cost of all testing, except that performed in the Owner’s laboratory, shall be included in the price.

**TABLE 1**
**Supported Load Parameters**

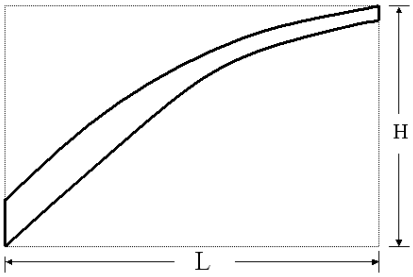
| Item of Equipment | Dimensions mm | Projected Area $m^2$ | Weight N |
|---|---|---|---|
| Roadway Lighting Luminaire (Ovuloid) | 990 L x 380 H | 0.22 | 107 |
| Roadway Lighting Bracket (Aluminum) | 2400 L x 1200 H (tapered) | 0.15 | 112 |
| Double Arm Brackets (Aluminum) | 400 L x 42 Dia. (2 per set) | 0.04 | 24 |
| Mast Arm (Aluminum)   | 610 L x 250 H (tapered) | 0.04 | 78 |
| | 1200 L x 530 H (tapered) | 0.10 | 91 |
| | 1800 L x 610 H (tapered) | 0.15 | 114 |
| | 2400 L x 840 H (tapered) | 0.19 | 65 |
| | 3000 L x 610 H (tapered) | 0.23 | 94 |
| | 3600 L x 840 H (tapered) | 0.38 | 113 |
| | 4600 L x 1070 H (tapered) | 0.47 | 216 |
| | 5500 L x 910 H (tapered) | 0.70 | 324 |
| | 6100 L x 1070 H (tapered) | 0.79 | 307 |
| | 6700 L x 1150 H (tapered) | 0.85 | 354 |
| | 7600 L x 1140 H (tapered) | 1.10 | 504 |
| Traffic Signal Heads (Aluminum: 4-Section) | 1650 H x 610 W | 1.01 | 123 |
| Pedestrian Heads (Aluminum: 2-Section) | 690 H x 345 W | 0.23 | 78 |
| Traffic Signs | Varies: see Table 2 | 1.50 | 23 |

**TABLE 2**
**Heavy Class Steel and Sectional Steel Pole Configurations**

| Pole Height m | Luminaire and Bracket set | Longest Mast Arm with Head m | Maximum Mast Arm Total Length (Note 1) m | Number of Pedestrian Heads (Note 2) | Traffic Signs (Note 3) $m^2$ |
|---|---|---|---|---|---|
| 10.5 | 1 | 7.6 | 13.1 | 2 | 0.75 |
| 9.0 | 1 | 7.6 | 13.1 | 2 | 0.75 |
| 7.5 | 1 | 7.6 | 13.1 | 2 | 0.75 |
| 6.0 | 0 | 7.6 | 13.1 | 2 | 0.75 |

Notes:

1. Mast arm total length applies to the sum of the lengths of two mast arms at 90-degree orientation.

2. Two pedestrian heads at 90-degree orientation include a set of double arm brackets for each.

3. Traffic signs shall be split to give 0.25 $m^2$ mounted on the mast arm beside the signal head and 0.5 $m^2$ mounted at 2.75 m height above the pole base plate.

**TABLE 3**
**Circumferential Welded Joints**

| Pole Height<br>m | Maximum Number<br>of Welds |
|---|---|
| 6.0 | 1 |
| 7.5 | 1 |
| 9.0 | 1 |
| 10.5 | 2 |

**Appendix 2422-A: November 2022**
**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

No information provided here.

## Related Ontario Provincial Standard Drawings

No information provided here.