MATERIAL SPECIFICATION FOR SECTIONAL STEEL HIGH MAST LIGHTING POLES

TABLE OF CONTENTS

2471.01 SCOPE

This specification covers the requirements for base mounted sectional steel high mast lighting poles 25, 30, 35, 40, and 45 metres in height with a multisided cross-section.

2471.02 REFERENCES

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

Ontario Provincial Standard Specifications, Construction

OPSS 906 Structural Steel
OPSS 911 Coating Structural Steel Systems

Ontario Ministry of Transportation Publications

Structural Manual
Designated Sources for Materials (DSM)

CSA Standards

B95-1962 (R2002)	Surface Texture (Roughness, Waviness and Lay)
G40.20-13/G40.21-13 (R2018)	General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel
S6:19	Canadian Highway Bridge Design Code

W47.1-09 (R2014)	Certification of Companies for Fusion Welding of Steel
W59-18	Welded Steel Construction (Metal Arc Welding)
W178.1-18	Certification of Welding Inspection Organizations
W178.2-18	Certification of Welding Inspectors

ASTM International

A500/A500M-18 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

Canadian General Standards Board (CGSB)

48.9712-2014 Non-Destructive Testing - Qualification and Certification of NDT Personnel

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)

International Organization for Standardization/International Electrotechnical Commission (ISO/IEC)

17025:2017 General Requirements for the Competence of the Testing and Calibration Laboratories

Others

Federal Standard 595C Color Standards

2471.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Multisided Cross-Section means a steel section having either eight or twelve sides as specified in the Contract Documents.

2471.04 DESIGN AND SUBMISSION REQUIREMENTS

2471.04.01 Design Requirements

Sectional steel high mast lighting poles shall be designed according to CSA S6, Structural Manual, AASHTO LTS-5M, DSM product drawings, and as specified in the Contract Documents. Each pole shall be capable of supporting a total load of 2,000 kg with a combined effective projected area of all the luminaires, shroud, and shields of 4.0 m^2.

2471.04.02 Submission Requirements

2471.04.02.01 Working Drawings

Working Drawings shall be prepared for the fabrication of the sectional steel high mast lighting poles.

Three sets of Working Drawings shall be submitted to the Contract Administrator 14 Days prior to commencement of fabrication of the sectional steel high mast lighting poles, for information purposes only. An Engineer shall review the drawings and affix a reviewed stamp with his or her signature to the Working Drawings verifying that the Working Drawings are consistent with the Contract Documents and sound engineering practices.

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

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

The Working Drawings shall contain all information necessary to fabricate the sectional steel high mast lighting poles including:

a) Dimensioned drawings, including lengths, sizes, cross-sections, and details of the sectional steel pole, and exact weights of pole sections.

b) Final forces for field assembly of pole sections.

c) Details for the mounting supports of the winch assembly, the head frame assembly, and the electrical panel assembly.

d) Details of access opening and of access door.

e) Welding details, including welding procedures to be used for each joint.

f) Detailed bill of materials.

g) Details of identification nameplates.

2471.04.02.02 Mill Test Certificates

Mill test certificates shall be submitted according to OPSS 906.

2471.04.02.03 Welding Procedures

Welding procedure data sheets for each joint configuration to be welded shall be prepared according to CSA W59, stamped with CWB's acceptance, and available for review during fabrication of the sectional steel high mast lighting poles. Three sets of welding procedures shall be submitted to the Contract Administrator 14 Days prior to commencement of fabrication of the sectional steel high mast lighting poles, for information purposes only.

2471.04.02.04 Welder's Qualification

Welders shall have valid CWB issued qualification cards indicating the welding processes and the positions for which they are qualified to weld. Prior to the commencement of fabrication, three copies of the Welders' and Welding Operators' current qualification cards shall be submitted to the Contract Administrator.

2471.05 MATERIALS

2471.05.01 Steel

All structural steel shall be CSA G40.20/G40.21, Grade 350WT, Category 3. Higher grades of steel shall not be accepted.

Steel for tenon pipe shall be CSA G40.20/G40.21, Grade 300W, or A 500M Grade C.

For pole masts, silicon content reported on the mill test certificate shall be less than or equal to 0.06%.

2471.05.02 Electrodes

Electrodes and flux used for welding shall have a low hydrogen content and shall be as specified in the fabricator's CWB approved welding procedures.

2471.05.03 Paint Coatings

Paint coatings shall be according to OPSS 911 and the Contract Documents.

The colour of the finish coat shall be equivalent to 16307 grey according to Federal Standard 595C.

2471.07 PRODUCTION

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

Production shall be done in fabrication facilities listed in the relevant DSM listing.

Structural steel fabrication shall be according to OPSS 906, CSA W59, Contract Documents, and the Working Drawings.

2471.07.01 Tolerances

Fabrication shall be according to the dimensions on the sealed and signed Working Drawings.

The dimensions of the assembled high mast lighting pole shall be within the following tolerances:

a) Overall height of pole mast: 5 mm for every 1 m in height.

b) Cross-sectional width of shaft across flats:

   i. 1.0%, for widths less than 500 mm,
   ii. 0.75% for widths greater than 500 mm.

c) Maximum sweep of the pole mast on its overall length measured from a chord joining the extremities and the centreline of the mast shall not exceed 0.2% of its overall length.

d) Maximum deviation from straight of the shaft wall on any 3 m length of pole mast shall not exceed 5 mm.

e) Offset between the centreline of the top section of the pole and the centreline of the bottom section of the pole shall not exceed 150 mm.

f) Offset between the centreline of the base plate and the centre of the pole mast at base shall not exceed 5 mm.

g) Wall thickness shall be within the tolerance permitted in CSA G40.20/G40.21 and ASTM A500M.

2471.07.02 Fabrication

2471.07.02.01 General

The pole mast shall be cold formed from steel plate and each section shall be fabricated with one or two continuous longitudinal welds. If two welds are used, they shall be on opposite sides of the pole shaft.

One circumferential shop splice per section shall be permitted. Where possible, the shop splice shall be completed prior to forming the pole cross-section.

In the area of the lap splice between pole segments, there shall be no protrusions preventing proper alignment of one section with the next. Any excess weld material shall be removed by grinding to form a smooth surface maintaining a uniformly tapered section.

Each pole shall be supplied with a reinforced handhole complete with a cover. The cover shall have provision for padlocking and shall be fitted with a silicone rubber gasket such that, upon locking, the cover shall be tightly fitted to the handhole.

Each pole shall be supplied with the appropriate mounting plate, brackets, and other attachments required for the installation of the raising and lowering equipment. The mounting plate, brackets, and other attachments shall be attached to the shaft wall by welds as specified in the Contract Documents. Nuts for securing the electrical panel shall be welded to the back of the mounting plate at each mounting hole as specified in the Working Drawings.

The head frame shall be assembled to the pole by means of a tenon mounting system. The tenon shall be compatible with the head frame and raising and lowering device.

In the tenon mounting system, a circular plate with nominal thickness of 12 mm shall be welded to the top of pole as specified in the Contract Documents. The plate shall have a circular opening through its centre, equal to the outside diameter of the tenon, through which the tenon shall be inserted.

The pole section joints shall be slip fitted connections as specified in the Contract Documents. Joint details shall not interfere with the raising or lowering of the luminaire assembly.

The maximum overlap shall be such that the height of the completed mast complies with the permitted overall tolerances. The minimum overlap length shall be as per the Working Drawings.

Shop trial-assembly shall be carried out to check the fit of the sections. The manufacturer shall determine the necessary compressive assembly forces and lap lengths to be achieved during the pre-assembly operation to ensure the final field assembly shall meet the requirements of the Contract Documents. Sections shall be match-marked to facilitate the field assembly. The markings shall be permanent and the location, size, and marking medium shall not interfere with the slip joint.

All cut edges of the base plate shall have a surface finish not greater than 1,000 (25µm) as defined in CSA B95. All corners shall be ground to a radius of 3 mm.

2471.07.02.02 Fabrication Outside of Canada and USA

For high mast lighting poles fabricated in a production facility outside of Canada and USA, the following additional requirements shall apply:

a) The fabrication facility must be listed on List #6.60.40 in the Electrical Division of the DSM.

b) Fabrication of high mast lighting 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.

c) All high mast lighting 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.

d) Shipped high mast lighting 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.

e) Shipped high mast lighting poles shall not be galvanized or coated and shall be in a condition that permits inspection and testing.

f) The Contractor shall hire an independent welding inspection company to perform quality verification of shipped high mast lighting 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.

g) Acceptance of high mast lighting 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 5 poles. All of the components of the pole shall be inspected and tested according to the Quality Control subsection of this Specification. The reports accompanying the shipment shall also be reviewed by the welding inspector. Inspection, testing, and reporting shall be done on each shipment received.

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

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

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

2471.07.03 Welding

All welding shall be according to CSA W59, including its provisions for cyclically loaded structures, and shall be undertaken by a manufacturer certified in accordance with CSA W47.1, Division 1 or 2.

During fabrication, upon request the Contractor shall make available to the Contract Administrator the CWB approved qualification cards for each Welder and Welding Operator employed on the work.

Welds for circumferential splices shall be full strength complete joint penetration.

The longitudinal seam welds shall be single V and shall be made from the outside of the structure. Throat thickness shall be according to CSA W59, to ensure a minimum of 60% joint penetration.

Longitudinal seam welds within 150 mm of a complete penetration circumferential weld or within the lap of the slip joints plus an additional 150 mm extending from the slip joint shall be full strength complete penetration groove welds and shall be ground smooth.

Any section of weld that does not meet the acceptance standards shall be removed, re-welded, and re-inspected.

2471.07.04 Coating

2471.07.04.01 Galvanizing

All steel components of sectional steel high mast lighting poles shall be hot dip galvanized according to OPSS 911.

2471.07.04.02 Paint Coating

After galvanizing and prior to paint coating, each component of the sectional steel high mast lighting pole shall be checked for continuity and smoothness of the galvanized coating. Any deficiencies in galvanized coating shall be corrected according to OPSS 911.

Components specified to be paint coated shall then be paint coated after surface preparation according to OPSS 911, using one of the approved paint systems for coating galvanized surfaces from the ministry's DSM. The dry film thickness of galvanized coating after surface preparation by sweep blasting shall be at least 87 µm.

During trial-assembly, care shall be taken not to damage the coatings of the pole. Any damage to the coatings that occur during the trial-assembly or any other operations shall be repaired according to OPSS 911.

2471.07.05 Identification Nameplate

Each sectional steel high mast lighting pole shall have an identification nameplate as specified in the Contract Documents.

The nameplate shall be made of stainless steel and shall be securely attached to the outside upper part of the handhole cover by rivets. A neoprene or rubber gasket shall be placed between the handhole cover and the nameplate to prevent corrosion effects.

2471.07.06 Quality Control

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

2471.07.06.01 Certification

2471.07.06.01.01 Welding Inspection Company

The company undertaking welding inspection shall be certified under the Bridges category in accordance with CSA W178.1. Certification shall include visual inspection as well as all non-destructive testing methods required to fulfill the inspection and testing requirements of this specification.

2471.07.06.01.02 Welding Inspectors for Visual Inspection and Non-Destructive Testing

Visual inspection of the sectional steel high mast lighting poles shall be performed by welding inspectors certified in accordance with CSA W178.2. Certification shall be to either CWB level 2 or CWB level 3.

Non-destructive testing of the sectional steel high mast lighting poles shall be performed by an ultrasonic or radiographic technician, or both, certified in accordance with CAN/CGSB 48.9712, to either CGSB level 2 or CGSB level 3 for the method used.

2471.07.06.01.03 Coating Inspectors

Coating inspectors shall have successfully completed National Association of Corrosion Engineers Coating Inspection Program (NACE CIP) Level 1 and Level 2 with a minimum of 3 years of proven coating inspection experience.

2471.07.06.02 Inspection, Testing, and Reporting

2471.07.06.02.01 Welding Inspection and Testing

The welding inspector shall inspect and test the sectional steel high mast lighting poles as follows:

a) Visual Inspection

   i. The fabrication of steel components shall be visually inspected to ensure material, dimensions, fit-up, and welding are according to specifications. Certification of conformance by the welding inspector for each phase of the fabrication shall be based on the applicable Working Drawings, codes, and specifications.

      The welding inspector shall witness the trial-assembly of the pole sections to ensure compliance with the Contract Documents.

      When the sectional steel high mast lighting poles have been delivered to the Working Area and prior to installation, the inspector with the required credentials shall inspect them to ensure that all the components of the high mast lighting poles are according to the Contract Documents.

b) Non-Destructive Testing

   i. All complete penetration groove welds, including shaft to base welds, circumferential splices in shaft and welds at slip joints, shall be 100% tested. Longitudinal welds at the bottom of the shaft shall be tested for a length of 2.0 m from the base plate. All testing of groove welds shall be by radiographic or ultrasonic test method and shall be according to CSA W59 for cyclically loaded structures. Any weld repairs shall be tested by appropriate methods as determined by an Engineer.

2471.07.06.02.02 Coating Inspection

The coating inspector shall inspect each phase of the cleaning and coating work for compliance with the Contract Documents prior to proceeding to the next phase. Acceptance of the surface preparation and coating thickness measurements shall be according to OPSS 911.

2471.07.06.02.03 Reporting

Prior to shipping the high mast lighting poles to site, the Contractor shall submit 2 copies of the inspection reports, containing the results of all the inspection and testing performed during fabrication, welding, and coating work, to the Contract Administrator. The inspection reports shall be completed and certified by the applicable inspector and signed and sealed by an Engineer.

2471.08 QUALITY ASSURANCE

Sectional steel high mast lighting poles are subject to inspection by the Owner at any time during the course of fabrication and installation.

Welding is subject to inspection by the Owner using both visual and non-destructive testing procedures and techniques according to CSA W59 for cyclically loaded structures.

The surface preparation and coating of sectional high mast steel lighting poles are subject to inspection by the Owner during the coating work. Acceptance of the work shall be based on the applicable OPS specification and SSPC Standards.