# ELECTRICAL AND SIGNING MATERIAL STANDARDS

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Engineering Branch
December 2003
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101 SCOPE

The Electrical and Signing Material Standards provides detailed material specifications for lighting, signal and signing equipment used by the Ministry of Transportation. This document covers only materials that have specialized Ministry requirements. Additional non-specialized materials are contained in the latest edition of the Standard Specification for Highway Construction.

The Electrical and Signing Material Standards for the Ministry of Transportation is divided into three Volumes as follows:

**Volume 1** - Material Standards for Traffic Signal, Lighting and Signing Installations (This volume).


Volume 1 defines the minimum standard for the supply of various specialized materials used by the Ministry of Transportation for traffic signal, lighting and signing installations.

Volume 2 defines the minimum standard for the supply of traffic signal controllers and related equipment. In future, this volume will also contain specifications for the advanced transportation system controller.

Volume 3 defines the minimum standard for the supply of equipment for advanced transportation systems such as fiber optic communication systems, closed circuit television systems and electronic changeable message sign systems. Volume 3 is currently under development.

Volume 1 is divided into the following sections:

- 100 Introduction
- 200 Underground Equipment
- 300 Poles and Structures
- 400 Service Equipment
- 500 Lighting Equipment
- 600 Traffic Signal Equipment
700  Self Luminous Displays
800  General Equipment

Volume 2 is divided into the following sections:

1000  Introduction
1100  Traffic Controller Cabinets
1200  Traffic Controller Assemblies
1300  General Equipment for Traffic Controllers

Volume 3 is divided into the following sections:

2000  Introduction
2100  Fiber Optic Equipment
2200  Closed Circuit Television Equipment
2300  Electronic Message Signs
2400  Specialized Equipment

As previously indicated, this document does not cover all materials used by the Ministry for electrical and signing installations. Additional material may be found in the latest edition of the Ministry Standard Specifications for Highway Construction. Materials contained within the Standard Specifications for Highway Construction, Section 635, are non-specialized and generally consist of, but are not limited to the following:

- Concrete bases for luminaires, signals, signs, flashers and controllers.
- Power conduit, conduit fittings, trench marker tape and pull strings.
- Miscellaneous stainless steel mounting hardware and conduit mounting straps.
- Fire signal indicating lights.
- Service masts, porcelain insulators, clevis assembly, grounding material and associated hardware.
- Wiring, connectors, small PVC junction boxes, fuses, electrical tape, heat shrink, labels and ty-raps.
- Wooden sign posts.
- Aluminum channel for overhead signs.
• Perforated square galvanized steel for sign structures.
• Delineator posts and reflectors.
• Barriers.
• Material related to all civil work (i.e. asphalt, concrete etc.).

In addition, specialized signing material such as extruded aluminum signs, ‘T’ sections, ‘J’ clips and plywood signs are not covered in this document. These materials are supplied by the Ministry Sign Shop in Kamloops.

Products listed under Section 800 - General Equipment are specialized materials that have no approved alternative and must be purchased from the designated manufacturer only (or distributor).
102 PRODUCT APPROVAL PROCESS

102.1 PRE-APPROVAL

.1 Suppliers of products contained in these specifications must be on the Recognized Products List in order for their product to be accepted for use on Ministry of Transportation projects. The term “Products” in these specifications includes original equipment manufacturers and equipment fabricators such as pole suppliers and cabinet manufacturers.

.2 Suppliers must apply for approval to the New Products Evaluation Standing Electrical Sub-Committee, Engineering Branch, and Ministry of Transportation. Information on the New Products Evaluation can be found on the Ministry's web site http://www.th.gov.bc.ca/publications/eng_publications/geotech/rpb. Suppliers shall ensure their products meet the requirements of the specification and shall submit a minimum of the following information with their application for approval:

.1 A letter requesting pre-approval.
.2 Sample of the product and technical specifications and instruction manuals if applicable.
.3 Where required, test results from an independent testing company together with an approval certificate verifying that the product meets the minimum requirements of the specification. All testing and report costs, including test samples and sample material for test specimens, shall be borne by the supplier.
.4 Evidence of compliance to the applicable CSA specifications.
.5 Proof of a suitable quality management system as required in Clause 102.3.
.6 Provide proof that the product can be produced in accordance the applicable specification.
.7 Provide proof that the product is interchangeable with all current pre-approved product (if applicable).
.8 Provide a minimum of three references.
.9 Provide the length of time that the product has been in use in the field together with testimonial from users.

.10 Submit any additional data as required within the applicable standard.

.3 The Ministry will review all pre-approval applications only if the information requested in the above paragraphs is submitted.

.4 When a supplier obtains product approval, the supplier will be added to the Ministry’s Recognized Products List. Ministry product approval provides acceptance of the product for use on Ministry projects and does not constitute approval of the product design.

.5 The Ministry will retain all documentation for use in the product auditing process. This documentation will be used to ensure the product meets the minimum quality benchmark as stated by the supplier.

.6 Where material standards are revised, Suppliers shall modify their products to conform to the revision. Suppliers shall demonstrate to the Ministry Representative that the modified product conforms to the revision.

.7 The Ministry may remove the product from the Recognized Products List for any just reason including the following:

.1 Repeated failure of the supplier to comply with the requirement of this specification and any special provisions issued with the contract.

.2 Failure of the supplier to participate in any audits.

.3 Failure of the supplier to allow product inspections.

.4 Failure of the supplier to repair or replace defective product.

.5 Repeated defects in product.

.6 Repeated failure of the supplier to deliver product within the agreed time limits.

.7 Failure to modify product to suit the most current material standard.

.8 Should the Ministry remove the product from the Recognized Products List. The supplier will not be eligible to reapply for product approval until all deficiencies have been corrected to the satisfaction of the Ministry.
102.2 WARRANTY

.1 The supplier shall warrant that all product is free from defects in material and workmanship. The warranty period shall be one year from the date of final acceptance by the Ministry (i.e. when equipment is installed in the field). During this warranty period, the supplier shall repair or replace any defective product free of cost to the Ministry. This shall include all shipping costs. All defective products shall be repaired or replaced immediately upon notification.

102.3 SUPPLIER QUALITY MANAGEMENT SYSTEM

.1 The supplier shall have and maintain an approved quality management system throughout the contract. The quality management system shall meet the requirements of one of the following:

.1 The latest issue of ISO 9002.

.2 The Q-Base Code. (The Q-Base Code contains the basic requirements of the ISO standard, but it is intended for small companies (i.e. less than 10 employees) who are not ready to advance to full ISO certification).

.2 Alternative quality management systems that fully meet the objectives of the above standards may be accepted by the Ministry. The supplier shall provide the Ministry with evidence of a documented quality management system.

.3 The purpose of the quality management system is to ensure that the product meets the quality requirements of the contract, is delivered on time, and is produced in a cost-effective manner. The supplier’s quality management system shall apply to all stages of the design, procurement, manufacturing, testing and delivery of the product.

102.4 MINISTRY AUDIT PROCESS

.1 The Ministry audit the suppliers products by performing one or more of the following activities:

.1 Perform an audit of the supplier’s Quality Management System.

.2 Perform product inspections at the factory.

.3 Perform random field audits to ensure that the product is performing in the field as specified.
.2 Failure of any Ministry Audit may result in removal from the Recognized Products List.
103 ALTERNATIVE PRODUCT SUBMISSIONS

.1 In some cases the specifications are prescriptive toward the production of one type of product. The Ministry will consider alternative product(s) for approval; however, as a minimum, the alternative product(s) must meet the functional requirements of the specification. The supplier shall describe where the product does not meet specification and provide proof of how the product meets the functional requirements of the specification and evidence of successful use under all field conditions. The supplier shall provide technical data and samples as required to support the submission.

.2 The Ministry will decide if the product is acceptable as an alternative based on quality of the product, acceptable field test data and overall value to the Ministry. If the product is acceptable, the Ministry will provide interim pre-approval and begin field testing to verify that the product performs as claimed by the supplier. The test period will be for a minimum of one year but may be longer depending on the product. The Ministry will provide full approval after the product has performed successfully in the field.
104 USING THIS MANUAL

.1 A structured number format is used to order the information in this manual. This format provides the ability to reference each point using a unique identifier, allowing the reader to refer to, or find a specific point quickly and easily.

.2 This manual is divided into sections, chapters, clauses, paragraphs, sub paragraphs and sub-sub-paragraphs. Each element is numbered sequentially, with sections beginning at the highest level. The numbering for all other elements begins with the section number. Table 1 describes each element and gives examples.

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Table 1. Description and examples of manual format.

.3 Using this format it is easy to identify any part of the manual. For example, if you wish to reference Chapter 302.1, Paragraph 3.2, you would refer to paragraph 302.1.3.2.
105 MANUAL REVISION AND ADDITIONS

.1 Users of this manual may submit suggestions or comments aimed at improving the manual, on the self addressed form in Appendix A.

.2 The Ministry of Transportation, Engineering Branch, Victoria, is responsible for making revisions. The Ministry reserves the right to modify the content of this document by special provisions when purchasing materials without notifying holders of the document. Should any modifications become permanent, the Ministry will post changes on the Ministry website.

.3 Manual revisions and additions will be posted as required on the Ministry website. Revisions and additions will include new pages to be substituted for those superseded.

.4 Manual revisions and additions are effective immediately for all Ministry projects that have not been issued for tender. Exceptions must be justified in writing and submitted for approval, to the Engineering Branch, Victoria.
106 RELATED MANUALS AND DOCUMENTS

.1 Related Ministry manuals:

.1 Ministry Electrical and Traffic Engineering Design Guidelines.
.2 Ministry Standard Specifications for Highway Construction.
.3 Ministry Pre-approved Suppliers & Products List.
.4 Technical Bulletins, Engineering Branch, Traffic Section (Electrical).
.6 Ministry List of Standard Traffic Signs.
.7 Specifications for Standard Highway Sign Materials, Fabrication and Supply.

.2 All of the above Documents are available on the Ministry website.

.3 Associations that may apply:

.1 Interim LED Purchase Specification of the Institute of Transportation Engineers (ITE) for LED Signal Modules
.3 ANSI - American National Standards Institute, 11 West 42nd Street, New York, New York, U.S.A. 10036 URL http://www.ansi.org
.4 ASTM - American Society for Testing and Materials, 100 Barr Harbor Drive West, Conshohocken, Pennsylvania 19428-2959 URL http://www.astm.org
.5 CSA - Canadian Standards Association International, 178 Rexdale Blvd., Toronto, Ontario M9W 1R3 URL http://www.csa-international.org
.6 EEMAC - Electrical and Electronic Manufacturers' Association of Canada, 5800 Explorer Drive, Suite 200, Mississauga, Ontario L4W 5K9 URL http://www.electrofed.ca
.7 IEEE - Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York U.S.A. 10017 URL http://www.ieee.org
.8 NEMA - National Electrical Manufacturers Association, 1300 N. 17th Street, Suite 1847, Rosslyn, Virginia 22209 URL http://www.nema.org

.9 ULC - Underwriters' Laboratories of Canada, 7 Crouse Road, Toronto, Ontario M1R 3A9 URL http://www.ulc.ca

.4 Reference standards that may apply:

.1 ACI - American Concrete Institute
.2 ACEC - Association of Consulting Engineers of Canada
.3 AISC - American Institute of Steel Construction
.4 ANSI - American National Standards Institute
.5 ASME - American Society of Mechanical Engineers
.6 ASTM - American Society for Testing and Materials
.7 AWPA - American Wire Producers Association
.8 AWS - American Welding Society
.9 CEC - Canadian Electrical Code (published by CSA)
.10 CEMA - Canadian Electrical Manufacturer's Association
.11 CGSB - Canadian General Standards Board
.12 CISC - Canadian Institute of Steel Construction
.13 CSA - Canadian Standards Association
.14 ICEA - Insulated Cable Engineers Association
.15 IEEE - Institute of Electrical and Electronic Engineers
.16 IPCEA - Insulated Power Cable Engineers Association
.17 NEMA - National Electrical Manufacturers Association
.18 SSPC - Steel Structures Painting Council
.19 ULC - Underwriters' Laboratories of Canada
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201 PLASTIC JUNCTION BOXES

201.1 SCOPE

.1 This specification shall apply to the supply of large round, small round and rectangular plastic junction boxes and large round to rectangular plastic junction box adapters. Junction box equipment shall consist of the following:

.1 Large round plastic junction box sections.
.2 Large round steel junction box lids.
.3 Large round plastic junction box lids.
.4 Large round plastics junction box drain plates.
.5 Rectangular plastic junction box sections.
.6 Rectangular steel junction box lids.
.7 Rectangular plastic junction box drain plates.
.8 Rectangular junction box mid-braces.
.9 Large round to rectangular plastic junction box adapters.
.10 Small round plastic junction box sections.
.11 Small round plastic junction box lids.
.12 Small round steel junction box lids.
.13 Small round plastic junction box drain plates.

.2 All items listed above and shown on the Material Standard drawings will be referred to as “product” in this specification.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

201.2 MATERIAL STANDARD DRAWINGS

.1 All products shall be supplied in accordance with the Material Standard drawings listed in Table 1, below.
The supplier shall verify all dimensions and sizes for proper fit prior to fabrication. The supplier shall report any drawing errors to the Ministry prior to fabrication.

The supplier shall verify that the product shown on the drawings is fully interchangeable with current approved product.

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</table>

Table 1. Material standard drawings for junction boxes.
201.3 PRODUCT OPERATING CONDITIONS

.1 Junction boxes will be buried in the ground. The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia.

.2 Junction boxes will often be placed in areas where they will be subjected to traffic loads.

201.4 PLASTIC JUNCTION BOXES

201.4.1 General Requirements

.1 Plastic junction box material shall be made from uniform non-porous material.

.2 All plastic junction box products shall be manufactured out of the same type of material.

201.4.2 Dimensions

.1 The dimensions shown with an asterix(*) on the Material Standard Drawings shall be within 0.5% of those specified. All other dimensions shall be within 3% of those specified.
201.4.3 Low Temperature Brittleness

.1 Plastic junction box sections (without bracing installed), lids, drain plates, and adapters shall be capable of withstanding a free fall drop of 2 meters onto a 25 mm thick steel plate at a test temperature of -20 degrees C without shattering. Cracks of less than 100 mm will be allowed, provided no material separates from the junction box equipment.

.2 Plastic material shall also comply with CAN/CSA C22.2 No. 40-M1989, Clause 6.2.6 - Resistance to Impact at Low Temperature.

201.4.4 Resistance to Moisture Damage

.1 The mechanical properties of the plastic material shall not be significantly affected by long-term exposure to moisture.

.2 When testing samples in accordance with Clause 201.5.10, Ultraviolet Protection, the deflection at failure should be noted. The deflection at failure for exposed samples should not vary by more than 15% from the values obtained for unexposed samples.

.3 Test samples exposed in accordance with ASTM G53 shall not experience a weight change of more than 2% nor shall the specimen warp or experience any dimensional change of more than 2%.

201.4.5 Resistance to Chemical Reagents

.1 Plastic Junction box sections, lids, drain plates, adapters and brackets shall be resistant to sodium chloride, diesel fuel, gasoline and antifreeze. They will be exposed to certain chemical reagents as follows:

.1 Samples of dimensions 140 mm (length) x 25 mm (width) x the nominal thickness of material shall be tested for resistance to: sodium chloride solution, diesel fuel, gasoline, and antifreeze in accordance with ASTM D543-87.

.2 The sodium chloride reagent shall be prepared in accordance with ASTM D543, Clause 5.3.40.

.3 The diesel fuel reagent shall conform to ASTM D543 Clause 5.3.28.

.4 The gasoline reagent shall be unleaded gasoline.

.5 The antifreeze reagent will be a 50% mixture of ethylene glycol based antifreeze in distilled water.
After exposure to the reagents, the specimens will be tested for flexural strength in accordance with ASTM D790-86. The deflection at failure and the secant modulus measurement at 5% deflection of the span for exposure to NaCl shall be within 15% of that for unexposed specimens. In the case of the gasoline, diesel fuel and antifreeze reagents, the properties shall be within 30% of that for the unexposed specimens.

201.4.6 Flammability

.1 Samples will be taken from the plastic junction box sections, and will be tested for rate of burning in accordance with ASTM D635.

.2 The plastic material shall have a burn rate not exceeding 20 mm per minute or shall self-extinguish before it reaches the 100 mm mark.

201.4.7 Lateral Stiffness

.1 The lateral stiffness of the plastic junction box sections shall be sufficient to support two 50 kg bags of fine sand placed on the rim of the box as shown in Material Standards Drawing MS204.1. After the 50 kg load is placed on the rim of the box, the deflection readings shall be taken after 10 minutes or when any creeping has stopped. The resulting deflection shall not reduce the openings at the larger end of the box by more than 10 mm and by 6 mm at the smaller end of the box. The lateral stiffness test shall be conducted at 20 degrees C ± 5 degrees C.

201.4.8 Axial Compression

.1 An axially symmetric compression load of 71 kN (16000 lbs) for a round plastic junction box section and a 36 kN (8000 lbs) for a rectangular junction box section will be gradually applied to the top of the box sections with a steel lid in place as shown on drawing MS204.1. The force shall be applied, using a 150 mm diameter plate, located at the centre of the lid.

.2 When subjected to full axial compression loads, a residual deflection in box height of more than 3% of the specified height and/or any cracking or deformation in the junction box section or steel lid will constitute failure.

.3 Round plastic lids shall withstand an axially symmetric compression load of 13.5 kN (3000 lbs) when the force is applied as described in the previous paragraph.
When subjected to the full axial compression load, a residual deflection in the lid of more than 4 mm and/or any cracking or deformation in the lid shall constitute failure. The axial compression tests shall be conducted at 20 degrees C ± 5 degrees C.

201.4.9 Resistance to Thermal Degradation from Hot Asphalt Exposure

.1 The supplier shall demonstrate that the plastic junction box is capable of withstanding the thermal stress when surrounded by hot asphalt. Junction box sections shall maintain their structural integrity and shall not deform.

.2 A sample of 140 mm (length) x 13 mm (width) x nominal thickness shall be taken from either the plastic junction box, lid, drain plate or adapter and placed on supports at each end. The supports shall be 13 mm wide thus providing an unsupported sample span of 114 mm. The sample and supports shall be placed within an oven at 150° degrees C for 5 minutes.

.3 Sag in the specimen of more than 3 mm shall constitute failure of the material to withstand thermal degradation.

201.4.10 Ultraviolet Protection

.1 After one year of outside storage, all plastic products shall continue to meet the requirements of Paragraphs 201.4.2, 201.4.3, 201.4.7 and 201.4.8 above. In order to assure that products will meet this requirement, samples from the plastic will be subjected to accelerated ageing tests as follows:

.1 Samples of dimensions 140 mm by 13 mm will be exposed in accordance with ASTM G53-88.

.2 After 240 hours exposure in accordance with ASTM G53-88, specimens will be prepared from the exposed samples and tested in three point bending in accordance with ASTM D790M-86. The specimens will be tested so that the exposed surface experiences tension during the bending test.

.3 Neither the Secant Modulus of Elasticity nor the deflection at failure of the exposed samples shall vary more than 15% from that of the unexposed material.

.4 The 15% moduli comparison shall be made at the point of 5% deflection of the 100 mm span length.
201.5 STEEL LIDS

.1 Steel lids for plastic junction boxes shall conform to the applicable Material Standard drawings.

.2 Steel shall be weldable checkerplate material.

.3 Steel lids shall have recessed, slotted holes for hold down bolts. Steel lids shall have 2 hold down brackets welded to the underside of the lid. All welds shall be in accordance with CAN/CSA W59.

.4 Steel lids shall be hot dip galvanized in accordance with CAN/CSA G164 after fabrication.

201.6 NUT/BONDING TABS

.1 Each junction box section shall be supplied with two stainless steel nut/bonding tab assemblies.

.2 Each bonding tab shall be tack welded to a Hex head stainless steel nut as shown on the applicable Material Standard drawings.

.3 The nut and bonding tab shall be cast into the junction box. The nut and bonding tab shall not twist or dislodge from the box when the lid is torqued down with the hold down bolts under normal service conditions. The nuts shall be coated with anti-seize and lubricating compound.

201.7 HOLD DOWN BOLTS

.1 Junction box lid hold down bolts shall be Hex head stainless steel, type 18-8 or 316, (size as noted on applicable Material Standard drawings). Bolts shall be threaded full length.

.2 Junction box sections shall be supplied with hold down bolts in place.

201.8 MID BRACES

.1 Mid braces shall be supplied in rectangular junction boxes as detailed on Material Standard Drawing MS201.7.

.2 Braces shall be painted with a rust inhibiting paint after fabrication.
201.9 IDENTIFICATION

.1 All products shall be stamped with the supplier’s trademark and year/month they are made. The identification for junction box sections and adapters shall be located as detailed on the Material Standard drawings. Lids and drain plates shall be stamped on the smooth side. Identification shall be permanent and easy to read.

201.10 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 Products shall be packaged as follows:

.1 Junction box sections shall be stacked in bundles not more than 10 high. Junction box sections shall be securely strapped in an upright position on a wood pallet.

.2 Lids, drain plates, mid braces and adapters shall be packaged in bundles and securely strapped to wood pallets.

.3 Wood pallets shall be 1.0m x 1.2m.

.3 Prior to shipping, the supplier must provide the Ministry Representative with a listing of how they plan to bundle, package, and ship the product. The list shall contain the maximum quantity in each bundle or on each pallet and the weight of the bundle or pallet.

.4 Any products damaged in shipping shall be replaced at no extra cost to the Ministry.
202 COMMUNICATION CONDUIT

202.1 SCOPE

.1 This specification shall apply to the supply of communication conduit and related equipment and shall include the following:

  .1 4” Schedule 40 type conduit with factory installed innerducts.
  .2 4” FRE conduit with factory installed innerducts.
  .3 2” Schedule 40 PVC conduit.
  .4 Innerduct pass-through termination kit.
  .5 Polyethylene innerduct (for pulling in existing installed duct)
  .6 Innerduct and outerduct plugs.
  .7 Polyester pull rope.
  .8 Tracer wire.
  .9 Marker tape.

.2 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions

202.2 MATERIAL STANDARD DRAWINGS

.1 The Material Standard drawings listed in Table 2, below are intended to illustrate the nominal dimensions and general appearance of multicell communication conduit.
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<td>4” Multicell Communication Conduit - General Arrangement</td>
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<tr>
<td>MS210.2</td>
<td>4” Multicell Communication Conduit - Pass-Through Termination Kit</td>
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Table 2. Material standard drawings for communication conduit

### 202.3 PRODUCT OPERATING CONDITIONS

.1 Conduit, plugs, and fittings shall be designed to function normally at temperatures between -40°C and +40°C.

### 202.4 MULTICELL CONDUIT

#### 202.4.1 General

.1 Complete conduit sections including outer conduit and innerducts shall be manufactured in 20’ sections (20' installed, 20’ 6” before installation). The installation instructions shall carry a warning that the installer shall not use any unauthorized solvents on the conduit. Each coupling section shall seal the inner wall of the bell (female) end and the outer wall of the spigot (male) end.

.2 Complete conduit sections including outer conduits, innerducts, and all spacers and connection parts shall be certified by the manufacturer as complete and free of defects including non-circularity and foreign inclusions. Conduit shall be nominally uniform (as commercially practical) in colour, density, and physical properties. Conduit shall be straight and the ends shall be cut flush and square to the inside diameter.

.3 The conduit shall be designed to provide for connecting (coupling) one complete section of conduit assembly to the next section by use of a bell joint on one end of the outer conduit and multiple seals on each of the four innerducts. The conduit sections shall be designed to assemble spigot into the bell end.

.4 Internal spacers shall be factory installed to hold the innerducts in a square configuration. Spacers shall be moulded from high impact PVC plastic, and be factory certified to withstand all handling pressures and stresses.

.5 Each innerduct shall be one continuous unit within a 20’6” conduit section.
.6 Innerduct seals and gaskets shall withstand a pressure of 100 PSI and be suitable for the blowing of cable as an installation method.

.7 The coupling system shall have self aligning holes for innerduct entry.

202.4.2 4” Outerduct - RPVC

.1 RPVC outer conduits shall be orange rigid polyvinyl chloride (RPVC) with an outside diameter of 4.500” ± 0.009” and a minimum wall thickness of 0.237”. All 4” RPVC multicell conduit shall meet the NEMA TC-2 specifications for schedule 40 with the following exceptions:

.1 A 6” integral bell shall be used in place of the standard (3 3/8”) bell.

.2 The assembled length of a conduit section shall be 20’ (unassembled 20’ 6”).

202.4.3 4” Outerduct - FRE

.1 FRE outer conduits shall be orange coloured, 4.500” outside diameter filament wound fibreglass reinforced epoxy (FRE) with minimum 0.250” wall thickness. All 4” FRE multicell conduit shall meet the NEMA TC-14 specifications for bullet resistant FRE with the following exceptions:

.1 A 5” integral bell shall be used.

.2 The assembled length of a conduit section shall be 20’ (unassembled 20’ 6”).

.2 FRE conduit shall be free from defects including delamination, non-circularity and foreign inclusions.

202.4.4 Innerduct - HDPE

.1 HDPE innerducts shall be 1.375” ± 0.005” outside diameter high density polyethylene (HDPE) with minimum 0.100” wall thickness. All HDPE innerduct shall be extruded from a high density polyethylene compound and shall have the following characteristics:

.1 The stiffness shall be 120 lbs/in/in or greater.

.2 The coefficient of thermal expansion shall be equal to or less than 1.06 x 10^-4 /in/in/°C to minimize the difference between the expansion and contraction rates of PVC and HPDE.

.3 The impact resistance shall be 10 ft lb. or greater.
The innerduct shall be one continuous run within a 20’ 6” section of multicell conduit.

Innerducts shall be prelubricated to meet a dynamic coefficient of friction of less than 0.2 according to Bellcore TA-NWT-000356 Standard using MDPE jacketed fibre optic cable.

The coupling body shall be designed so that polyethylene innerducts may move freely to accommodate for expansion.

**202.4.5 Innerduct - PVC**

PVC innerducts shall be 1.315” ± 0.005” outside diameter polyvinyl chloride (PVC) with a minimum of 0.060” wall thickness and a maximum of 0.080” wall thickness. All PVC innerduct shall meet the NEMA TC-8 specifications for type DB PVC with the following exceptions:

1. No bell end shall be required on pre-installed innerducts.
2. Innerducts shall be the required length to fit into a 20’ 6” length section of multicell conduit which has a 6” integral bell end allowing insertion of a male (spigot) end of a similar section of multicell conduit.
3. The joint tightness test requirement (section 3.2 of NEMA TC-8) applies to the innerducts when joined as part of the multicell conduit system.
4. No markings are required on innerducts (section 3.6 of NEMA TC-8).

PVC innerducts shall be pre-lubricated as follows:

1. PVC innerduct shall be prelubricated so that a co-efficient of friction of less than 0.030 is achieved using Bellcore TA-NWT-000356 test procedures for a HDPE jacketed fibre.
2. Evaporation of pre-lubricant shall be no more than 0.05% at 500 °F.
3. Innerduct flushed with water for one hour at a rate of five (5) gallons per minute shall result in no increase in the co-efficient of friction as measured above.
202.4.6 **Innerduct Burn Resistance**

1. HPDE and PVC innerducts shall be tested for their resistance to burn through during fiber cable installation. Standard HPDE or PVC innerduct shall pass the following test procedure for testing burn through resistance of innerduct (The testing shall be completed using a duct cut tester developed by NEPTCO Incorporated).

   1. A length of innerduct shall be curved and rigidly constrained to a radius of 600mm. A length of NEPTCO WP1800 prelubricated tape shall be threaded through the innerduct and wrapped around a capstan. The ends of the tape shall be sewn together to form a continuous loop. The tape shall advance through the innerduct at a rate of 30 metres per minute with a tension of 2000 N. The tape shall not burn through within 150 minutes.

202.4.7 **Bends**

1. Complete conduit rigid bend sections, including outer conduit and innerduct, shall be manufactured at 90°, 45°, 22.5° and 11.25° angles, and shall be complete with bell and spigot. The radius of rigid bend sections shall be 9’.

2. Complete conduit flexible bend sections, including flexible corrugated PVC outer conduit and flexible burn resistant innerducts shall be manufactured, and shall be complete with bell and spigot.

3. Burn resistant innerduct used in bends shall meet the test requirements in clause 202.4.6.

202.4.8 **Couplings**

1. Couplings shall be factory assembled in the bell end of the outer conduit, and shall be supplied with lead-ins to facilitate assembly. The couplings shall be designed and factory certified to handle normal expansion and contractions.

202.4.9 **4” Multicell Pass-Through Termination Kits**

1. All PVC termination kits and fittings shall meet the NEMA TC-8 specifications for cell classification, stiffness and crush resistance of type DB PVC.
.2 Kits for termination in a pull box or vault shall have one bell end (for regular spigot insertion) and one spigot end. The spigot end shall allow innerduct to be inserted so that the innerduct may ‘pass-through’ the vault as a continuous duct.

.3 The innerduct pass-through mechanism shall have seals between the outer 4” conduit and the innerducts.

.4 The innerducts used to pass through a vault shall be flexible enough that 6” of innerduct may be inserted into the spigot end at each end of a 2000 mm long vault.

202.4.10 Ultraviolet Protection

.1 Conduit and fittings shall contain an ultraviolet inhibitor.

202.4.11 Colours, Markings and Identification

.1 Colours of inner conduits shall be as described in Table 3 and shall be read from the spigot end of a length of conduit in a clockwise direction.

<table>
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<th>CONDUIT</th>
<th>INNERDUCT SIZE</th>
<th>COLOUR</th>
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<tr>
<td>4” RPVC Outer Conduit (Orange)</td>
<td>1.25” (nominal)</td>
<td>Blue</td>
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<tr>
<td></td>
<td>1.25” (nominal)</td>
<td>Orange</td>
</tr>
<tr>
<td></td>
<td>1.25” (nominal)</td>
<td>Green</td>
</tr>
<tr>
<td></td>
<td>1.25” (nominal)</td>
<td>Brown</td>
</tr>
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Table 3. Multicell conduit colour scheme.

.2 Colours are specified in terms of the Munsell Colour System (ASTM D 1535) and shall comply with the requirement of ANSI/EIA-359-A “EIA Standard Colors for Color Identification and Coding”.

.3 The outer conduit shall have a longitudinal print line that denotes “install this side up”, to allow for the proper alignment of the innerducts. The print line shall be marked with data traceable to plant location, date, shift, and machine of manufacturer.
.4 The bell (female) end of a conduit section shall have some method of indicating the first (top) innerduct.

.5 The spigot end of the 4” communications conduit shall have a line marked to indicated the proper insertion depth into the bell end.

202.5 CONDUIT PLUGS

.1 All installed multicell conduit innerducts and 2” conduit shall have their ends sealed with commercial pre-formed plugs. These plugs shall be designed to prevent the passage of gas, dust and water into the innerducts. Sealing plugs shall be removable and reusable.

.2 The plugs sealing cables in an innerduct or conduit shall be the split type to permit installation or removal without removing conductor or cables.

.3 At places where multicell conduit with pre-installed innerduct enters or exits pull boxes or service vaults, the outerduct shall be sealed with respect to the innerduct by gaskets in the termination kit. The innerducts shall be sealed with a plug until a pass-through innerduct or fibre optic cable is installed. When a cable is installed in an innerduct, the innerduct plug shall be replaced with a split type plug which allows the cable to pass through a central hole sized to the fibre optic cable. Bushing sleeves shall be used to size the fibre to the hole in the split plug.

.4 Sealing plugs shall be made of polypropylene and be equipped with a neoprene or polyurethane gasket. All nuts, bolts, fasteners, and washers shall be fabricated out of stainless steel.

.5 Sealing plugs used to seal conduit and innerducts shall be capable of withstanding a pressure of 152 KPa (22 psi).

.6 A sealing plug that seals an empty conduit or innerduct shall have an eye or other type of capturing device (on the side of the plug that enters the conduit) to attach onto the pull rope, so that the pull rope will be easily accessible when the plug is removed.
202.6 **WARNING TAPE**

.1 The warning tape shall be 100 mm wide with bold printed black letters of approximately 75 mm on bright orange colour background, and contain the printed warning “CAUTION BURIED FIBRE OPTIC CABLE” repeated at approximately 1 metre intervals.

.2 The printed warning shall be non-erasable and shall be rated to last with the tape for a minimum of 40 years.

.3 The construction of the warning tape shall be such that it will not delaminate when it is wet. It shall be resistant to insects, acid, alkaline and other corrosive elements in the soil.

.4 Warning tape shall have a minimum of 73 kg (160 lbs) tensile strength per 100 mm wide strip and shall have a minimum of 700 percent elongation before breakage.

.5 Warning tape shall also be available with a copper conductor to facilitate tracing.

202.7 **PACKAGING**

.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 All conduit shall come from the factory supplied with end caps sealing both ends of the conduit to prevent the entry of foreign material.

.3 Any product damaged in shipping shall be replaced at no extra cost to the Ministry.
203 CONCRETE VAULTS, JUNCTION BOXES AND MANHOLES

203.1 SCOPE

.1 This specification details the minimum requirements for the supply of concrete vaults, junction boxes and manholes.

.2 All items listed above will be referred to as “product” in this specification.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

203.2 GENERAL MATERIAL AND FABRICATION REQUIREMENTS

.1 Materials shall be new.

.2 All hardware shall be stainless steel or galvanized unless otherwise noted.

.3 Precast concrete junction boxes, vaults and manholes and auxiliary sections shall be fabricated in steel forms.

203.3 STANDARDS

.1 The concrete for precast products shall meet the requirements of CAN/CSA A23.1-M90, Concrete Materials and Methods of Concrete Construction. The supplier shall fabricate product in accordance with the requirements of CAN/CSA A23.4-M94, Precast Concrete Materials and Construction. The supplier is responsible for the design of a structurally sound product meeting the load requirements defined in this specification. The Ministry drawings are provided only to establish the functional requirements of the product.

.2 Pulling inserts and bolts for racks integrally cast in concrete shall be in accordance with ANSI/ACI-347-78.
203.4 MATERIALS

.1 Concrete shall have a minimum compressive strength of 35 Mpa at 28 days.

203.5 LIDS

.1 Lids for concrete junction boxes and vaults shall be hot-dip galvanized after fabrication to the requirements of CAN/CSA G164M, Hot Dip Galvanizing of Irregularly Shaped Articles. Lids and frame for manholes shall be cast iron.

.2 Lids shall have a checkerplate or some other skid resistance finish.

.3 The steel for lids shall be of sufficient thickness and strength to withstand the applied forces without permanent deformation.

203.6 CONCRETE JUNCTION BOXES

.1 Concrete junction boxes shall conform to the size and shape shown on drawings SP635.1.3.1 and 1.3.2 of the Standard Specifications for Highway Construction. The supplier shall submit shop drawings for approval as required in Paragraph 203.9.

.2 Junction boxes shall be designed to support an axially symmetric load of 510kN (5,000 kg). The load shall be gradually applied to the lid. The force shall be applied using a 600mm x 250 mm rectangular plate located at the centre of the lid. Cracking (i.e. cracks greater than .5 mm) or failure of the concrete (i.e. collapse) or permanent deformation of the lid will constitute failure.

203.7 CONCRETE VAULTS

.1 Concrete vaults shall conform to the size and shape shown on drawing SP635.1.3.3 of the Standard Specifications for Highway Construction. The supplier shall submit shop drawings for approval as required in Clause 203.9.

.2 Vaults shall be designed to support CS600 static loading plus 30% impact loading as defined in the latest version of CAN/CSA S6.
203.8 CONCRETE MANHOLES

.1 Functional drawings of the concrete manhole will be provided with the special provisions. The supplier shall submit shop drawings for approval as required in Clause 203.9.

.2 Manholes shall be supplied in two sections to facilitate transport.

.3 Manholes shall be designed to support CS600 static loading plus 30% impact loading as defined in the latest version of CAN/CSA S6.

.4 The outside surface of the manhole shall be sealed to prevent the entry of water.

.5 A product to seal the joints (mastic seal) shall be supplied with the manhole. The sealant shall meet the requirements of ASTM C-990-91.

203.9 SHOP DRAWINGS

203.9.1 Submission

.1 The supplier shall submit to the Ministry Representative a complete set of shop drawings, prepared and sealed by a professional engineer registered by the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC). The shop drawings shall meet the requirements of CAN/CSA A23.4-M94, Precast Concrete Materials and Construction.

203.9.2 Drawing Format

.1 The drawing format shall be as follows:

.1 In Autocad format (most current release). Other CAD programs that produce DXF file format are acceptable.

.2 Produced on ISO A1 size paper (other sizes shall meet the approval of the Ministry Representative).

.3 In metric units only.

.4 Legible when reduced to 1/2 size.

203.9.3 Ministry Review

.1 The Ministry Review of drawings will be as follows:
.1 Drawings will be reviewed by the Ministry Representative solely to ascertain conformance with the general design concept. Responsibility for approval of detail design inherent in the drawings rests solely with the supplier. The review by the Ministry Representative shall not constitute approval.

.2 Review by the Ministry Representative shall not relieve the supplier of its responsibility for errors or omissions in the drawings or for proper completion of the work in accordance with the contract documents. The Ministry Representative may review all design drawings and return any comments to the supplier seven days after receipt.

.3 The supplier is responsible for verification and correlation of dimensions, fabrication processes, techniques of construction, installation and co-ordination of all parts of the work.

.4 After the Ministry Review, the drawings will be returned to the supplier. The supplier shall revise the drawings to the satisfaction of the Ministry Representative prior to fabrication.

203.10 IDENTIFICATION

.1 Steel lids shall be labelled as shown on the drawings or as specifically noted in the contract special provisions. Product shall also be labelled with the Manufacturer’s trademark, product identification, and the year and date of manufacture. This label shall be visible after being installed.

.2 The weight shall also be marked on the product.

203.11 PACKAGING

.1 Shipping documentation shall consist of an itemized bill of materials, purchase order number and Ministry release number.

.2 All products damaged in shipping shall be replaced at no extra cost to the Ministry.
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301 TRAFFIC SIGNAL, LUMINAIRE AND SIGN POLE STRUCTURES

301.1 SCOPE

.1 This specification shall apply to the supply of traffic signal, luminaire, sign pole structures and anchor bolts. Traffic signal, luminaire and sign pole structures shall generally consist of the following:

.1 Anchor Bolts and Cages.
.2 Pole Shafts.
.3 Arms.
.4 Adapters.
.5 Extensions.
.6 Sign Mounting Hardware.
.7 Bolt Kits.
.8 Flange Cover Plates.

.2 All items listed above and shown on the Material Standard drawings will be referred to as “product” in this specification.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

301.2 PRODUCT APPROVAL

.1 In addition to the requirements of Chapter 102, the supplier shall provide the following information:

.1 Proof of Canadian Welding Bureau (CWB) qualification as required under Clause 301.8.

.2 Provide proof that the product can be produced in accordance with this specification.
.3 Provide proof that the product is interchangeable with all current approved product.

301.3 MATERIAL STANDARD DRAWINGS

.1 All products shall be supplied in accordance with the Material Standard drawings listed in Table 1.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware sizes and quantities. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.

.3 The supplier shall verify that the product shown on the drawings is fully interchangeable with current pre-approved product.
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Table 1. Material standard drawings for traffic signal, luminaire and sign pole structures, continued.

301.4 PRODUCT OPERATING CONDITIONS

.1 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia.
301.5 Qualifications

.1 The supplier shall produce suitable evidence that the plant is currently fully approved by the CWB to the requirements of CAN/CSA W47.1 Division 2.1 or better.

.2 The supplier shall also produce evidence of satisfactory experience in the fabrication of heavy structural steelwork. Acceptance of the suppliers plant will be at the discretion of the Ministry’s assessment of the supplier’s organization, personnel, equipment and past performance.

.3 The supplier shall employ or retain a Registered Professional Engineer experienced in structural steel fabrication, to provide guidance throughout the work.

.4 The following general conditions shall apply:

.1 A qualified welding supervisor shall be employed where and when welding is performed.

.2 All equipment being used shall be in good working order and shall be subject to inspection by the Ministry.

.5 Upon request, the supplier shall submit to the Ministry the name of the engineer(s) experienced in steel fabrication and the name of the welding supervisor(s). The supplier shall also submit, upon request, the names of all welding operators who are qualified by the CWB for the process in which they are employed.

301.6 Materials

301.6.1 General Material Requirements.

.1 All materials shall be new.

.2 Upon request, the supplier shall provide mill test certificates for all sheet steel and bolts to the testing agency. The mill test certificates shall contain all chemical and physical properties of the steel to be used in fabrication.

301.6.2 Steel Sheets and Plates.

.1 Steel Sheets and Plates shall conform to the following:

.1 All steel shall be weldable.
.2 Steel shall be free of surface defects and internal discontinuities.

.2 Steel over 3 mm thick shall have a minimum grade of 300 W (G45) and shall meet the requirements of CAN/CSA G40.20 and G40.21M.

.3 Steel 3 mm thick shall have a minimum grade of 350W (G50) and shall meet the requirements of CAN/CSA G40.20 and G40.21M or ASTM A570M.

.4 Silicon content of steel shall be as follows:
   .1 A570 Material - Si ≤ 0.03%.
   .2 300W Material - Si ≤ 0.03%.

301.6.3 Pipe.
   .1 Steel pipe shall conform to ASTM A53 GRADE B.

301.6.4 Connecting Hardware.
   .1 Connecting hardware shall consist of steel nuts, threaded rod, bolts and washers and shall conform to the following:
      .1 All nuts and bolts shall bear suitable markings to identify their grade and origin of manufacture. All nuts and bolts shall have UNC (Unified National Course) threads and hexagon heads.
      .2 Bolts, threaded rod, nuts, and washers larger than 3/8” diameter shall conform to the following:
         .1 Bolts and threaded rod shall be SAE Grade 5.
         .2 Nuts shall be SAE Grade 2 Heavy Hex.
         .3 Flat washers shall be hardened steel circular type in accordance with ASTM F436.
         .4 All spring lock washers shall be manufactured from mild steel.
         .5 All nuts, bolts and washers shall be galvanized after fabrication. All galvanizing shall meet the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as noted in CAN/CSA G164M, Appendix A.
         .6 All nut threads shall be sized to accept galvanized bolts without removing the protective coating.
After fabrication and galvanizing, all bolts shall be capable of withstanding an elongation of no less than 13% prior to fracture failure.

Bolts, nuts, and washers 3/8” diameter or smaller shall conform to the following:

1. Bolts shall be type 18-8 or 316 stainless steel.
2. Nuts shall be type 18-8 or 316 stainless steel finish hex.
3. Washers shall be type 18-8 or 316 stainless steel flat and spring types.

301.6.5 Anchor Bolts.

1. Anchor Bolts shall be supplied individually or in cages as shown on the Material Standard drawings and shall conform to the following:

   All 1”, 1¼” and 1½” diameter steel anchor bolts shall be AISI/SAE 4140 heat treated with a minimum yield strength (Fy) of 560 MPa, a minimum tensile strength (Fu) of 725 MPa, and a maximum tensile strength of 1000 MPa. Where the maximum tensile strength exceeds 1000 MPa, the chemical composition of the steel shall be verified by the Ministry Representative (i.e., to verify steel ductility).

   All 1” diameter steel ‘DYWIDAG’ anchor bolts shall be CSA G279 - M82 Grade 835/1030 (Fy/Fu) in MPa with a yield load of 460 kN and an ultimate load of 568 kN.

   After fabrication and galvanizing, all anchor bolts shall meet the following elongation requirement:

   1. All AISI/SAE 4140 anchor bolts shall be capable of withstanding an elongation of no less than 13% prior to fracture failure.

   2. All ‘DYWIDAG’ anchor bolts shall be capable of withstanding an elongation of no less than 4% prior to fracture failure.

   All anchor bolts and nuts shall be galvanized after fabrication. All galvanizing shall meet the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as noted in CAN/CSA G164M, Appendix A.

   Anchor bolt threads shall be sized to accept galvanized nuts without damaging the protective coating.
301.7 FABRICATION

.1 The supplier shall confirm all drawing dimensions and that all parts fit together prior to fabrication.

.2 All fabrication shall conform to the following:

   .1 Comply with most current edition of CAN/CSA S16.1-M, unless otherwise noted.

   .2 Each shaft, arm, extension, clamp and bracket shall be fabricated from one piece of sheet steel.

   .3 Shafts, arms, extensions and clamps shall be brake press formed or roll formed. The brake press knife shall have a radius suitable for the thickness of the material and nature of the bend.

   .4 All plate edges shall be free of notches and gouges.

   .5 The depth or projection of any imperfections on the inner or outer surfaces shall not exceed 15% of wall thickness. Any depth or projection up to 33% of wall thickness may be repaired by welding. Any excessive projecting weld metal shall be removed.

   .6 All holes shall have a smooth surface.

301.8 WELDING

.1 All welding shall conform to the following:

   .1 All welds shall be in accordance with CAN/CSA W59.

   .2 Supplier shall have CWB Plant approval as noted under Clause 301.5.

   .3 All welding electrodes shall conform to CAN/CSA W48. The deposited weld metal shall provide strength, ductility, impact toughness and corrosion resistance equivalent to the base metal.

   .4 All welds shall be continuous.

   .5 All welds shall have no cracks, inadequate penetration or lack of fusion.

   .6 All welds shall have no other defects exceeding the limits in size and frequency of occurrence specified in CAN/CSA W59, Clause 12.

   .7 All welds shall be free of slag and spatter.

   .8 All longitudinal seams shall be welded with a continuous semi-automatic process with a minimum of 60% penetration.
.9 Field welding will not be allowed without specific advance written approval by the Ministry.

301.9 TOLERANCES

.1 All fabrication shall meet the following tolerances:

.1 Straightness. The straightness of any item shall not exceed the overall length divided by 300 from the surface at any point. This shall be measured with a straight line joining the surface at both ends. The difference between the straight line and the surface shall then be measured to determine the straightness.

.2 Twisting. The twist in the overall length of any shaft, arm, or extension shall not exceed 7°.

.3 Length. The specified length of any item shall be within -0 to +60 mm or -0 to +5% (which ever is less).

.4 Across the flats Dimensions. The average of all across the flats dimensions from a given cross section shall be within 1% of the specified dimension. In addition, the ratio of the maximum to minimum across the flats dimensions shall be less than or equal to 1.05.

.5 Gap at Flange Connections. The gap at flange connections shall not exceed 2 mm.

.6 Arm Rise. The arm rise on type 1, 3, 6 and 7 shafts and type 2A and 2C luminaire arms shall be within 1° of the specified rise. The arm rise on type S, L, M and H shafts shall be within 0.5° of the specified rise. Arm rises shall apply to an unloaded structure in the standing position.

301.10 GALVANIZING

.1 All steel products shall be hot-dip galvanized after fabrication to the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as required in CAN/CSA G164M, Appendix A. Galvanized members shall be subject, at the discretion of the Ministry, to the tests for embrittlement outlined in CAN/CSA G164M, Section 5.5. The following galvanizing requirements shall also apply:

.1 All bolts, nuts and washers over 3/8” diameter shall be galvanized in accordance with Clause 301.6.4.1.2.5.
.2 All steel surfaces shall be free of oil, grease, welding slag, paint, varnish, rust, or anti-spatter compounds prior to galvanizing.

.3 The galvanizing shall be continuous and uniform in appearance, colour and texture.

.4 Any sharp edges caused by galvanizing drippings shall be filed smooth and coated with an approved cold galvanizing compound.

.5 All threaded holes shall be re-tapped after galvanizing and painted with an approved cold galvanizing compound.

.6 All loose galvanizing slag and spatter shall be removed from all components after galvanizing.

301.11 POWDER COATING

301.11.1 General

.1 Power coating of poles shall only be done when specified in the contract Special Provisions in accordance with the following requirements.

301.11.2 Surface Preparation

.1 Surface shall be cleaned to SSPC SP 7 Brush Off Blast Standard with a profile not exceeding 75 µm (3 mils).

301.11.3 Prebaking of Steel

.1 The steel shall be prebaked at 220 degrees Celsius (425 degrees Fahrenheit) for a minimum 25 minutes at temperature.

301.11.4 Coating

.1 Prime coat shall be E-2024-2Z Grey zinc epoxy Primer applied at 75 to 175 µm (3-7 mils) applied to the hot substrate electrostatically.

.2 Topcoat shall be HD Polyester applied at 75 to 125 µm (3-5 mils) electrostatically, then baked at 220 degrees Celsius (425 degrees Fahrenheit) for 25 minutes. The topcoat colour will be provided by the Ministry Representative.
In addition to Clause 301.15 Packaging, fully wrap all product in 3mm thick foam packing material followed by a layer of cellophane to protect product during shipping. Separate each component using suitable dunage (e.g. Two by four wood spacers).

301.11.5 Testing of Powder Coating

.1 Perform adhesion testing of the powder coated surface in accordance with the latest version of ASTM D4541, Pull-Off Strength of Coatings Using Portable Adhesion Testers. Pull-off test force shall be equal to that provided by the coating manufacturer or 1500 psi whichever is greater.

.2 Perform tests using an independent NACE qualified testing agency ("Testing Agency"). Submit testing company name, tester and proposed testing procedure to the Ministry Representative for acceptance prior to the start of testing. The Testing Agency shall perform the following:

.1 Visually inspect all poles and perform random measurements of coating thickness on at least 10% of all product from each production run.

.2 Perform adhesion testing on the first pole after the first powder coating application (i.e. heat run) to ensure that the coating process is correct.

.3 Perform adhesion testing on at least two other poles randomly selected by the testing agency from other production runs (i.e. heat runs).

.4 Perform adhesion test not sooner than 24 hours after powder coat application and not later than 72 hours after powder coat application.

.3 The Contractor shall submit a repair procedure for all tested poles that pass testing (i.e. repair of small damaged area as a result of the test).

.4 Should the pole fail testing, the Contractor shall remove all coating and re-coat all product in the production run to the satisfaction of the Ministry Representative and Testing Agency. To ensure that all product is acceptable for field use, the Ministry Representative reserves the right to require the Contractor to perform more testing at its sole cost should any product fail thickness testing and/or adhesion testing.

.5 The Contractor shall submit all coating test results to the Ministry Representative for review no later than one week following testing and shall include the results of the coating tests, test frequency and corrective measures in the Quality Management Report.
301.12 WET PAINT COATING OF GALVANIZED STEEL

301.13 INSPECTION AND REPORTING

301.13.1 General Requirements

.1 The supplier shall submit a Quality Control Report to the Ministry for a percentage of product produced as specified in the contract special provisions.

.2 The Quality Control Report shall be produced under the direction of the Suppliers Quality Assurance Manager. The Supplier shall submit sections of the Quality Control Report to the Ministry Representative at various stages of production. Each section of the report shall contain a minimum of the following information:

.1 SECTION A
   .1 Operator qualifications.
   .2 Welding procedures.
   .3 Mill certificates from the steel manufacturer.
   .4 Resolution of any non-conformance’s.

.2 SECTION B
   .1 Test certificates from bolt manufacturer verifying bolt strength after galvanizing.
   .2 Resolution of any non-conformances.

.3 SECTION C
   .1 NDT report(s) (by a certified testing agency).
   .2 Latest copy of seam weld test report (see below).
   .3 Dimensional checking and verification.
   .4 Resolution of any non-conformances.

.4 SECTION D
   .1 Testing of galvanizing.
   .2 Resolution of any non-conformances.
Each section of the report shall be submitted, reviewed and all non-conformances shall be resolved to the satisfaction of the Ministry prior to proceeding with the next stage.

After completion of the product, each section shall be bound into a Quality Control Report and submitted to the Ministry Representative. A copy of all Quality Control Reports shall be retained in a project file by the supplier’s Quality Assurance Manager.

NDT testing shall be performed by an agency certified to CAN/CSA-W178.1. The testing agency’s documentation must indicate all deficiencies found and corrective action taken.

The Ministry does not require destruction of product for testing of seam welds; however, the supplier shall provide evidence that seam welds meet the requirements of the approved CWB weld procedure by performing periodic random testing of test samples. Sample seam welds for each CWB approved seam weld procedure required by this specification shall be cut, etched and checked for penetration. Testing for all approved seam weld procedures shall be done by a company certified to CAN/CSA-W178.1. The testing company shall provide evidence that the samples were taken randomly from the production run. The frequency of seam weld testing shall be defined in the contract special provisions or as determined by the Ministry Representative.

All product tested shall be identified using a permanent marker pen. The identification shall contain the production run number which shall also be referenced in the testing report.

The cost for NDT testing of product shall be borne by the supplier including re-testing as determined by the Ministry and the testing agency. Should the supplier fail NTD testing, the supplier shall repair or replace all defective product to the satisfaction of the Ministry. The cost for preparation of the Quality Control Report including non-destructive testing shall be borne by the supplier.

**301.13.2 Specific Requirements**

**Welding.** Welds shall be tested for conformance with Clause 301.8. Testing of welds shall be performed as follows:

1. The testing of welds shall be performed in accordance with CAN/CSA-W59.
2. All welds shall be visually inspected.
.3 Full-penetration welds shall be ultrasonically tested.

.4 Fillet welds to base plates and flange plates shall be tested by the dry powder magnetic particle method.

.5 Seam welds shall be cut, etched and checked for penetration (random sample from seam welder).

.2 **Galvanizing.** Galvanizing shall be inspected for conformance with Clause 301.11.

.3 **Materials.** Confirm all materials meet the requirements of Clause 301.6 and perform testing as follows:

.1 Verify mil test certificates for conformance with Clause 301.6.2.

.2 Verify test certificates from the bolt manufacturer confirming that the galvanized anchor bolts and connecting bolts larger than 3/8” meet the requirements of Clause 301.7.4 and .5. Bolts shall be tested for yield strength, ultimate strength and elongation in accordance with ASTM A325 and tested for embrittlement in accordance with CAN/CSA G164M, Clause 6.5. If evidence of bolt strength cannot be produced from the bolt manufacturer, the Ministry may request that the supplier test (by a certified testing company) a percentage of bolts supplied. The quantity for testing shall be determined by the Ministry.

.4 **Tolerances.** Confirm all tolerances meet the requirements of Clause 301.9.

.5 **Fabrication.** Confirm all fabrication meets the requirements of Clause 301.8 and 301.9.

**301.14 IDENTIFICATION**

.1 All arms, shafts, extensions and miscellaneous hardware shall be labelled with identification labels as noted on Material Standard Drawings MS325.1, MS325.2 and MS325.3.

.2 Identification labels shall indicate the part and Ministry stock number. Identification labels shall be manufactured out of pressure sensitive vinyl (3 mil thick) and shall be screen printed with gloss vinyl ink. Labels shall be waterproof and must permanently adhere to the surface. Alternative label designs shall be approved by the Ministry Representative in writing prior to use.

.3 The supplier’s initials and year of manufacture shall be stamped on all flange plates in the location shown on the Material Standard drawings.
301.15 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials (using the stock number and part description shown on Material Standard Drawings MS325.1 and MS325.2), purchase order number and Ministry release number.

.2 Products shall be packaged as follows:

.1 Shafts, arms, and extensions shall be securely packaged in bundles not weighing more than 2500 kg. Bundles shall be organized to allow for easy loading and offloading with a forklift. Each bundle shall contain only one type of equipment. Suitable spacers shall be used to prevent the steel strapping from damaging the galvanizing on the poles.

.2 Bolt kits shall be packaged in cardboard boxes with their ID and Ministry stock number clearly marked on the box. All bolt kits shall be secured to wood pallets.

.3 Sign and sign luminaire mounting brackets, vertical and horizontal supports and sign luminaire bracket for each plywood sign shall be packaged on a wood pallet complete with all mounting hardware and assembly sketches. This shall only apply where plywood signs are specified.

.4 Individual anchor bolts shall be bundled in sets of four and packaged on wood pallets.

.5 Extensions (under 600 mm long), flange adapters, bolt kits, and flange cover plates shall be packaged on wood pallets.

.6 Each wood pallet shall contain only one type of equipment.

.7 Any miscellaneous hardware not supplied in a bolt kit must be attached to its parent item as shown on the drawings.

.3 Prior to shipping, the supplier must provide the Ministry Representative with a listing of how they plan to bundle, package, and ship the product. The list shall contain the maximum quantity in each bundle or on each pallet and the weight of the bundle or pallet.

.4 Any product damaged in shipping shall be replaced at no extra cost to the Ministry. The supplier and their shipper will assume all responsibility for getting the product to the Ministry in proper working order.
302 BREAKAWAY SIGN STRUCTURES

302.1 SCOPE

.1 This specification shall apply to the supply of breakaway sign structures. Breakaway sign structures shall generally consist of the following:

.1 Anchor Bolts.
.2 Stub Post Kits.
.3 Fuse Joint Kits.
.4 Connection Joint Kits.
.5 Legs.
.6 Columns.
.7 ‘C’ Channel Sign Supports.
.8 Flat Bar Sign Supports.
.9 Breakaway Sign Luminaire Mounting Brackets.

.2 All items listed above and shown on the Material Standard drawings will be referred to as “product” in this specification.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

302.2 PRODUCT APPROVAL

.1 In addition to the requirements of Chapter 102, the supplier shall provide the following information:

.1 Proof of Canadian Welding Bureau (CWB) qualification as required under Clause 301.8.
.2 Provide proof that the product can be produced in accordance with this specification.
.3 Provide proof that the product is interchangeable with all current approved product.
302.3 MATERIAL STANDARD DRAWINGS

.1 All products shall be supplied in accordance with the Material Standard drawings listed in Table 2.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware sizes and quantities. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.

.3 The supplier shall verify that the product shown on the drawings is fully interchangeable with current pre-approved product.

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Table 2. Material standard drawings for breakaway sign structures.

302.4 PRODUCT OPERATING CONDITIONS

.1 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia.
302.5 QUALIFICATIONS

.1 The supplier shall produce suitable evidence of current CWB plant approval, to the requirements of CAN/CSA W47.1 Division 2.1 or better.

.2 The following general conditions shall apply:

.1 A qualified welding supervisor shall be employed where and when welding is performed.

.2 All equipment being used shall be in good working order.

.3 Upon request, the supplier shall produce suitable evidence that all welding operators are qualified by the CWB for the process in which they are employed.

302.6 MATERIALS

302.6.1 General Material Requirements

.1 All materials shall be new.

.2 Upon request, the supplier shall provide mill test certificates for all sheet steel and bolts to the Ministry Representative prior to fabrication. The mill test certificates shall contain all chemical and physical properties of the steel to be used in fabrication.

302.6.2 Steel Sheet, Plate, W and C Shapes

.1 All steel shall be weldable.

.2 All steel shall be minimum grade 300 W (G45) and shall meet the requirements of CAN/CSA G40.20 and G40.21.

.3 ‘W’ and ‘C’ shapes shall be roll formed.

.4 Silicon content of steel shall be: $\text{Si} \leq 0.03\%$ or $0.15\% \leq \text{Si} \leq 0.25\%$.

302.6.3 Pipe

.1 Steel pipe shall conform to ASTM A53 GRADE B.
302.6.4 Connecting Hardware

.1 Connecting hardware shall consist of steel nuts, threaded rod, bolts and washers and shall conform to the following:

.1 All nuts and bolts shall bear suitable markings to identify their grade and origin of manufacture. All nuts and bolts shall have UNC (Unified National Course) threads and hexagon heads.

.2 Bolts, threaded rod, nuts, and washers larger than 3/8” diameter shall conform to the following:

.1 Bolts and threaded rod shall be SAE Grade 5 except where noted they shall be ASTM A325.

.2 Nuts shall be SAE Grade 2 Heavy Hex except where noted they shall be ASTM A325.

.3 Flat washers shall be hardened steel circular type in accordance with ASTM F436.

.4 All spring washers shall be manufactured from mild steel.

.5 All nuts, bolts and washers shall be galvanized after fabrication. All galvanizing shall meet requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as noted in CAN/CSA G164, Appendix A.

.6 All bolt threads shall be sized to accept galvanized nuts without removing the protective coating.

.7 After fabrication and galvanizing all bolts shall be capable of withstanding an elongation of no less than 13% prior to fracture failure.

302.6.5 Anchor Bolts

.1 Anchor Bolts shall be supplied as shown on the Material Standard drawings and shall conform to the following:

.1 All 1½” diameter anchor bolts shall be AISI/SAE 4140 heat treated with a minimum yield strength (Fy) of 560 MPa, a minimum tensile strength (Fu) of 725 MPa, and a maximum tensile strength of 1000 MPa. Where the maximum tensile strength exceeds 1000 MPa, the chemical composition of the steel shall be verified by the Ministry Representative (i.e. to verify steel ductility).

.2 After fabrication and galvanizing, all AISI/SAE 4140 anchor bolts shall be capable of withstanding an elongation of 13% prior to fracture failure.
.3 All anchor bolts and nuts shall be galvanized after fabrication. All galvanizing shall meet the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as noted in CAN/CSA G164M, Appendix A.

.4 Anchor bolt threads shall be sized to accept galvanized nuts without damaging the protective coating.

302.7 FABRICATION

.1 The supplier shall confirm all drawing dimensions and that all parts fit together prior to fabrication.

.2 All fabrication shall conform to the following:

.1 Comply with most current edition of CAN/CSA S16.1-M, unless otherwise noted.

.2 Each leg, column, C channel and flat bar shall be fabricated from one piece of steel.

.3 All plate edges shall be free of notches and gouges.

.4 The depth or projection of any imperfections on the inner or outer surfaces shall not exceed 15% of wall thickness. Any depth or projection up to 33% of wall thickness may be repaired by welding. Any excessive projecting weld metal shall be removed.

.5 All holes shall have a smooth surface.

302.8 WELDING

.1 All welding shall conform to the following:

.1 All welds shall be in accordance with CAN/CSA W59.

.2 Supplier shall have CWB plant approval as noted under Clause 302.8.

.3 All welding electrodes shall conform to CAN/CSA W48. The deposited weld metal shall provide strength, ductility, impact toughness and corrosion resistance equivalent to the base metal.

.4 All welds shall be continuous.

.5 All welds shall have no cracks, inadequate penetration or lack of fusion.

.6 All welds shall have no other defects exceeding the limits in size and frequency of occurrence specified in CAN/CSA W59, Clause 12.
.7 All welds shall be free of slag and spatter.
.8 Field welding will not be allowed without specific advance written approval by the Ministry.

302.9 TOLERANCES

.1 The fabrication shall meet the following tolerances:

.1 **Straightness.** The straightness of any item shall not exceed the overall length in millimeters divided by 1000 from the surface at any point or shall not exceed 10 mm from the surface at any one point (whichever is less). This shall be measured with a straight line joining the surface at both ends. The difference between the straight line and surface shall then be measured to determine the straightness.

.2 **Length.** The length of any item shall be within 0 to 6 mm or 0 to 5% (which ever is less).

.3 **Gap at Flange Connections.** The gap at flange connections shall not exceed 2 mm.

302.10 GALVANIZING

.1 All steel products shall be hot-dip galvanized after fabrication to the requirements of **CAN/CSA G164M.** The galvanizer shall safeguard against embrittlement as required in **CAN/CSA G164M, Appendix A.** Galvanized members shall be subject, at the discretion of the Ministry, to the tests for embrittlement outlined in **CAN/CSA G164M, Section 5.5.** The following galvanizing requirements shall also apply:

.1 All bolts, nuts and washers over 3/8” diameter shall be galvanized in accordance with **Clause 302.6.4.** Bolt threads shall be sized to accept galvanized nuts without damaging the protective coating.

.2 All steel surfaces shall be free of oil, grease, welding slag, paint, varnish, rust, or anti-spatter compounds prior to galvanizing.

.3 The galvanizing shall be continuous and uniform in appearance, colour and texture.

.4 Any sharp edges caused by galvanizing drippings shall be filed smooth and coated with an approved cold galvanizing compound.

.5 All threaded holes shall be retapped after galvanizing and painted with an approved cold galvanizing compound.
.6 All loose galvanizing slag and spatter shall be removed from all components after galvanizing.

### 302.11 IDENTIFICATION

.1 Breakaway sign stub posts, legs, columns, C channels, flat bars, sign luminaire brackets, and barrier stands shall be labelled with permanent identification labels as noted on Material Standard Drawing MS332.1 and MS332.2.

.2 Identification labels shall indicate the part and Ministry stock number. Identification labels shall be manufactured out of pressure sensitive vinyl (3 mil thick) and shall be screen printed with gloss vinyl ink. Labels shall be waterproof and must permanently adhere to the surface. Alternative label designs shall be approved by the Ministry Representative in writing prior to use.

.3 The supplier’s initials and year of manufacture shall be stamped on all flange plates in the location shown on the Material Standard drawings.

### 302.12 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials (using the stock number and part description shown on Material Standard Drawing MS332.1), purchase order number and Ministry release number.

.2 Products shall be packaged as follows:

.1 Breakaway sign stub post kits shall be supplied with the nuts, bolts and hardware in a heavy duty clear plastic bag. This bag shall be attached to the stub post. Each type of product shall be packaged on wood pallets.

.2 Fuse joint and connection joint kits shall be supplied fully assembled in a heavy duty clear plastic bag. A waterproof tag attached to the bag shall indicate the item and Ministry stock number.

.3 Breakaway sign legs, columns, C Channel and flat bar shall be packaged in bundles not weighing more than 1500 kg. Bundles shall be organized to allow easy offloading with a forklift. Each bundle shall contain only one type of equipment.

.4 Individual anchor bolts shall be bundled in sets of four and packaged on wood pallets.
.5 Each wood pallet shall contain only one type of equipment.

.3 Prior to shipping, the supplier must provide the Ministry Representative with a listing of how they plan to bundle, package, and ship the product. The list shall contain in the maximum quantity in each bundle or on each pallet and the weight of the bundle or pallet.

.4 Any product damaged in shipping shall be replaced at no extra cost to the Ministry. The supplier and their shipper will assume all responsibility for getting the product to the Ministry in proper working order.
303 BARRIER SIGN STANDS

303.1 SCOPE

.1 This specification shall apply to the supply of concrete roadside barrier and concrete median barrier sign stands.

.2 Barrier sign stands and related material as shown on the Material Standard drawings will be referred to as “product” in this specification.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

303.2 PRODUCT APPROVAL

.1 In addition to the requirements of Chapter 102, the supplier shall provide the following information:

   .1 Proof of Canadian Welding Bureau (CWB) qualification as required under Clause 301.8.

   .2 Provide proof that the product can be produced in accordance with this specification.

   .3 Provide proof that the product is interchangeable with all current approved product.

303.3 SUPPLIER QUALITY MANAGEMENT SYSTEM

.1 In addition the requirements of Clause 102.3, the Ministry will accept the following quality control program:

   .1 Ministry of Transportation Quality Control Program as documented in the latest edition of Section 421, Structural Steelwork of the Standard Specifications for Highway Construction.
303.4 MATERIAL STANDARD DRAWINGS

.1 All products shall be supplied in accordance with the Material Standard drawings listed in Table 3.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware sizes and quantities. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.

.3 The supplier shall verify that the product shown on the drawings is fully interchangeable with current pre-approved product.

<table>
<thead>
<tr>
<th>DRAWING NO.</th>
<th>DRAWING TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS333.1</td>
<td>Concrete Median Barrier (CMB) - Sign Stand Details</td>
</tr>
<tr>
<td>MS333.2</td>
<td>Concrete Roadside Barrier (CRB) - Sign Stand Details</td>
</tr>
<tr>
<td>MS333.3</td>
<td>Parts List - ID Label Details</td>
</tr>
</tbody>
</table>

Table 3. Material standard drawings for barrier sign stands.

303.5 QUALIFICATIONS

.1 The supplier shall provide the Ministry with welding procedures for the fillet weld shown on the Material standard drawings.

303.6 MATERIALS

303.6.1 General Material Requirements

.1 All materials shall be new.

303.6.2 Steel Sheet, Plate, W and C Shapes

.1 All steel shall be weldable.

.2 All steel shall be minimum grade 250 W (36 ksi) and shall meet the requirements of ASTM A36.
.3 ‘W’ and ‘C’ shapes shall be roll formed.

.4 Silicon content of steel shall be: Si ≤ 0.03% or 0.15% ≤ Si ≤ 0.25%.

303.6.3 Pipe

.1 Steel pipe shall conform to ASTM A53 GRADE B.

303.6.4 Connecting Hardware

.1 Connecting hardware shall consist of steel nuts, threaded rod, bolts and washers and shall conform to the following:

.1 All nuts and bolts shall bear suitable markings to identify their grade and origin of manufacture. All nuts and bolts shall have UNC (Unified National Course) threads and hexagon heads.

.2 The ¾” threaded rod shall be SAE Grade 5.

.3 Nuts shall be SAE Grade 2 Heavy Hex.

.4 Flat washers shall be hardened steel circular type in accordance with ASTM F436.

.5 All nuts, bolts and washers shall be galvanized after fabrication. All galvanizing shall meet requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as noted in CAN/CSA G164, Appendix A.

.6 All bolt threads shall be sized to accept galvanized nuts without removing the protective coating.

.7 The ½” bolt shall be type 18-8 or 316 stainless steel.

303.7 Fabrication

.1 The supplier shall confirm all drawing dimensions and that all parts fit together prior to fabrication.

.2 All fabrication shall conform to the following:

.1 All plate edges shall be free of notches and gouges.
.2 The depth or projection of any imperfections on the inner or outer surfaces shall not exceed 15% of wall thickness. Any depth or projection up to 33% of wall thickness may be repaired by welding. Any excessive projecting weld metal shall be removed.

.3 All holes shall have a smooth surface.

303.8 WELDING

.1 All welding shall conform to the following:

.1 All welds shall be in accordance with CAN/CSA W59.

.2 All welding electrodes shall conform to CAN/CSA W48. The deposited weld metal shall provide strength, ductility, impact toughness and corrosion resistance equivalent to the base metal.

.3 All welds shall be continuous.

.4 All welds shall have no cracks, inadequate penetration or lack of fusion.

.5 All welds shall have no other defects exceeding the limits in size and frequency of occurrence specified in CAN/CSA W59, Clause 12.

.6 All welds shall be free of slag and spatter.

.7 Field welding will not be allowed without specific advance written approval by the Ministry.

303.9 TOLERANCES

.1 The length of any item shall be within 0 to 6 mm or 0 to 5% (which ever is less).

303.10 GALVANIZING

.1 All steel products shall be hot-dip galvanized after fabrication to the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as required in CAN/CSA G164M, Appendix A. Galvanized members shall be subject, at the discretion of the Ministry, to the tests for embrittlement outlined in CAN/CSA G164M, Section 5.5. The following galvanizing requirements shall also apply:
.1 All bolts, nuts and washers over 3/8” diameter shall be galvanized in accordance with Clause 303.6.4.1.5. Bolt threads shall be sized to accept galvanized nuts without damaging the protective coating.

.2 All steel surfaces shall be free of oil, grease, welding slag, paint, varnish, rust, or anti-spatter compounds prior to galvanizing.

.3 The galvanizing shall be continuous and uniform in appearance, colour and texture.

.4 Any sharp edges caused by galvanizing drippings shall be filed smooth and coated with an approved cold galvanizing compound.

.5 All threaded holes shall be retapped after galvanizing and painted with an approved cold galvanizing compound.

.6 All loose galvanizing slag and spatter shall be removed from all components after galvanizing.

303.11 IDENTIFICATION

.1 Barrier stands shall be labelled with permanent identification labels as noted on Material Standard Drawing MS333.1 and MS333.2.

.2 Identification labels shall indicate the part and Ministry stock number. Identification labels shall be manufactured out of pressure sensitive vinyl (3 mil thick) and shall be screen printed with gloss vinyl ink. Labels shall be waterproof and must permanently adhere to the surface. Alternative label designs shall be approved by the Ministry Representative in writing prior to use.

.3 The supplier’s initials and year of manufacture shall be stamped beneath the ID label location shown on the Material Standard drawings.

303.12 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials (using the stock number and part description shown on Material Standard Drawing MS333.3), purchase order number and Ministry release number.

.2 Barrier sign stand kits shall be supplied with the nuts, bolts and hardware in a heavy duty clear plastic bag. This bag shall be attached to the barrier stand. All product shall be packaged on wood pallets.
.3 Any product damaged in shipping shall be replaced at no extra cost to the Ministry. The supplier and their shipper will assume all responsibility for getting the product to the Ministry in proper working order.
304 ALUMINUM FRANGIBLE BASES

304.1 SCOPE

.1 This specification shall apply to the supply of aluminum frangible bases for poles.

.2 A frangible base is a safety device installed between the pole base plate and the concrete base. The frangible base allows the pole to yield when impacted by a vehicle.

.3 Aluminum frangible bases will be referred to as “product” in this specification.

.4 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

304.2 MATERIAL STANDARD DRAWINGS

.1 All products shall be supplied in accordance with the Material Standard drawings listed in Table 4.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware sizes and quantities. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.

<table>
<thead>
<tr>
<th>DRAWING NO.</th>
<th>DRAWING TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS340.1</td>
<td>Aluminum Frangible Base Details</td>
</tr>
<tr>
<td>MS340.2</td>
<td>Aluminum Frangible Base Details</td>
</tr>
</tbody>
</table>

Table 4. Material standard drawings for frangible bases.
304.3 PRODUCT OPERATING CONDITIONS

.1 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia.

304.4 MATERIALS AND FABRICATION

304.4.1 Aluminum Frangible Bases

.1 Frangible bases shall be cast using aluminum alloy No. 356.2 heat treated to T6.

.2 The mass of the frangible base less hardware shall be 120 N (27 lbs).

304.4.2 Connecting Hardware

.1 The connecting hardware shall consist of steel nuts, bolts, and washers and shall conform to the following:

   .1 All nuts and bolts shall bear suitable markings to identify their grade and origin of manufacture. All nuts and bolts shall have UNC (Unified National Course) threads and hexagon heads.

   .2 Bolts, nuts, and washers larger than 3/8” diameter shall conform to the following:

      .1 Bolts shall be SAE Grade 5.

      .2 Nuts shall be SAE Grade 2 Heavy Hex.

      .3 Flat washers shall be hardened steel circular type in accordance with ASTM F436.

      .4 All spring washers shall be manufactured from mild steel.

      .5 All nuts, bolts and washers shall be galvanized after fabrication. All galvanizing shall meet the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as noted in CAN/CSA G164, Appendix A.

      .6 All bolt threads shall be sized to accept galvanized nuts without removing the protective coating.

      .7 After fabrication and galvanizing all bolts shall be capable of withstanding an elongation of no less than 13% prior to fracture failure.
.3 Bolts, nuts, and washers 3/8” diameter or smaller shall conform to the following:
   .1 Bolts shall be type 18-8 or 316 stainless steel.
   .2 Nuts shall be type 18-8 or 316 stainless steel finish hex.
   .3 Washers shall be type 18-8 or 316 stainless steel flat and spring types.
.4 Triangular washers shall conform to the following:
   .1 Shall be minimum grade 300 W steel and shall meet the requirements of CAN/CSA G40.20 and G40.21.
   .2 Shall be galvanized after fabrication. Galvanizing shall meet the requirements of CAN/CSA G164M.

304.5 IDENTIFICATION
   .1 Aluminum frangible bases shall be stamped with the supplier’s trademark and product identification in an easily identifiable location.

304.6 PACKAGING
   .1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.
   .2 All product shall be individually packaged in a cardboard box with all nuts, bolts and hardware. The exterior of the boxes shall be identified with the material name and Ministry stock number.
   .3 Cardboard boxes shall be shipped on wood pallets for easy offloading.
   .4 Any product damaged in shipping shall be replaced at no extra cost to the Ministry. The supplier and their shipper will assume all responsibility for getting the product to the Ministry in proper working order.
305  BREAKAWAY BASES

305.1  SCOPE

.1  This specification shall apply to the design and supply of breakaway bases for the following ministry standard poles:

.1  Type 1 and type 3 davit pole with the loading defined the following sections.

.2  13.5 meter luminaire pole with the loading defined in the following sections.

.2  Breakaway bases and associated hardware will be referred to as “product” in this specification.

.3  Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

305.2  MATERIAL STANDARD DRAWINGS

.1  The breakaway base shall be designed to accommodate the poles designs and base reaction forces shown on the Material Standard drawings listed in Table 5.

<table>
<thead>
<tr>
<th>DRAWING NO.</th>
<th>DRAWING TITLE</th>
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</thead>
<tbody>
<tr>
<td>MS341.1</td>
<td>Breakaway Base for Type 3 Shaft (Sign Pole)</td>
</tr>
<tr>
<td>MS341.2</td>
<td>Breakaway Base for Type 1 Shaft (Sign Pole)</td>
</tr>
<tr>
<td>MS341.3</td>
<td>Breakaway Base for 13.5 Meter Luminaire Pole</td>
</tr>
</tbody>
</table>

Table 5. Material standard drawings for breakaway bases.
305.3 DESIGN GUIDELINES

.1 The supplier shall design the breakaway bases in accordance with the following:

.1 Breakaway bases shall be designed to withstand the base reaction forces shown on drawings MS341.1, .2 and .3. The breakaway base design for the type 1 and type 3 poles shall be the same.


.3 The breakaway bases shall be designed to connect to the standard pole base plate and standard footing.

305.4 PRODUCT TESTING

.1 The breakaway bases shall be tested in accordance with the guidelines set forth in NCRHP Report 350 “Recommended Procedures for the Safety Performance Evaluation of Highway Features”. The test facility shall be designed to test specimens for compliance with the evaluation criteria set forth in Section 7 of the 2001 AASHTO Specifications.

.2 The tests shall be performed by a testing agency that is recognized as capable of conducting full scale impact testing of highway hardware. The tests results shall be approved by the Federal Highway Administration (FHWA).

305.5 DESIGN CALCULATIONS AND DRAWING SUBMISSIONS

305.5.1 General

.1 The supplier shall submit to the Ministry Representative a complete set of design calculations and drawings, prepared and sealed by a professional engineer.

305.5.2 Calculations

.1 The design calculations shall be detailed enough to allow for a technical review of the design. The calculations shall include a list of all assumptions made as part of the design.
305.5.3 **Drawing Content**

.1 The content of the design drawings shall be as follows:

.1 Drawings shall clearly indicate a list of materials and components, connections, bolt torques and explanatory notes.

.2 Drawings shall be detailed enough to allow for technical review of the design.

.2 The supplier shall submit detailed assembly drawings similar to MoTH standard drawing SP635-2.1.16 and SP635-3.1.5.

305.5.4 **Drawing Format**

.1 The drawing format shall be as follows:

.1 In the most current release of Autocad and submitted electronically.

.2 Produced on D size paper.

.3 In metric units only.

.4 Legible when reduced to 1/2 size or microfilmed.

.5 In accordance with *CSA Standard CAN/CSA-B78.2-86 - Dimensioning and Tolerancing of Technical Drawings*.

305.6 **MATERIALS**

305.6.1 **General Material Requirements**

.1 All materials shall be new.

305.6.2 **Connecting Hardware**

.1 Connecting hardware shall consist of steel nuts, threaded rod, bolts and washers and shall conform to the following:

.1 All nuts and bolts shall bear suitable markings to identify their grade and origin of manufacture. All nuts and bolts shall have UNC (Unified National Course) threads and hexagon heads.

.2 Bolts, nuts, and washers larger than 3/8” diameter shall conform to the following:

.1 Bolts and threaded rod shall be SAE Grade 5.
.2 Nuts shall be SAE Grade 2 Heavy Hex.

.3 Flat washers shall be hardened steel circular type in accordance with ASTM F436.

.4 All spring lock washers shall be manufactured from mild steel.

.5 All nuts, bolts and washers shall be galvanized after fabrication. All galvanizing shall meet the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as noted in CAN/CSA G164, Appendix A.

.6 All bolt threads shall be sized to accept galvanized nuts without removing the protective coating.

.7 After fabrication and galvanizing, all bolts shall be capable of withstanding an elongation of no less than 13% prior to fracture failure.

305.7 GALVANIZING

.1 All steel products shall be hot-dip galvanized after fabrication to the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as required in CAN/CSA G164M, Appendix A. Galvanized members shall be subject, at the discretion of the Ministry, to the tests for embrittlement outlined in CAN/CSA G164M, Section 5.5. The following galvanizing requirements shall also apply:

.1 All bolts, nuts and washers over 3/8” diameter shall be galvanized in accordance with Clause 305.6.2.1.5.

.2 All steel surfaces shall be free of oil, grease, welding slag, paint, varnish, rust, or anti-spatter compounds prior to galvanizing.

.3 The galvanizing shall be continuous and uniform in appearance, colour and texture.

.4 Any sharp edges caused by galvanizing drippings shall be filed smooth and coated with an approved cold galvanizing compound.

.5 All threaded holes or threaded couplings shall be retapped after galvanizing and painted with an approved cold galvanizing compound.

.6 All loose galvanizing slag and spatter shall be removed from all components after galvanizing.
305.8  PACKAGING

.1 Shipping documentation shall include an itemized bill of materials and Ministry purchase order number.

.2 Each breakaway base complete with connecting hardware and installation instructions shall be packaged individually in a cardboard box. The box shall be sealed and labelled with the Suppliers address, date of manufacture and Ministry stock number.

.3 Any product damaged in shipping shall be replaced at no extra cost to the Ministry. The supplier and their shipper will assume all responsibility for getting the product to the Ministry in proper working order.
306 CANTILEVER AND SIGN BRIDGE STRUCTURES

306.1 SCOPE

.1 This specification shall apply to the design and supply of cantilever and sign bridge structures complete with anchor bolt cages, connection hardware, mounting hardware for aluminum extruded signs and mounting hardware for sign luminaires. Specific information on each structure such as span width, sign size(s), number of sign brackets, number of sign luminaire brackets and any other special hardware requirement will be provided with the contract special provisions.

.2 Cantilever and sign bridge structures and their associated hardware shown on the Material Standard drawings will be referred to as “product” in this specification.

.3 The generic cantilever and sign bridge drawings contained in this specification are intended to establish design concept. The Ministry supports the use of innovative designs that are functional, aesthetically pleasing and cost effective. The supplier shall submit alternative designs to the Ministry for approval. The Ministry reserves the right to reject designs that are, in its opinion, not suitable or cost effective (i.e. cost effective for purchase, installation and/or maintenance).

.4 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

306.2 PRODUCT APPROVAL

.1 In addition to the requirements of Chapter 102, the supplier shall provide the following information:

.1 Proof of Canadian Welding Bureau (CWB) qualification as required under Clause 301.10.

.2 Provide proof that the product can be produced in accordance with this specification.
.3 Provide proof that the product is interchangeable with all current approved product.

306.3 SUPPLIER QUALITY MANAGEMENT SYSTEM

.1 In addition the requirements of Clause 102.3, the Ministry will accept the following quality control program:

.1 Ministry of Transportation Quality Control Program as documented in the latest edition of Section 421, Structural Steelwork of the Standard Specifications for Highway Construction.

306.4 MATERIAL STANDARD DRAWINGS

.1 All products shall meet the minimum requirements noted on the Material Standard drawings listed in Table 6.

.2 The generic drawings listed in Table 6 shall be used as a general guideline for the production of detailed working drawings as required in Clause 306.8.

<table>
<thead>
<tr>
<th>DRAWING NO.</th>
<th>DRAWING TITLE</th>
</tr>
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<tbody>
<tr>
<td>MS350.1</td>
<td>Sample Format for Design Criteria and Parts List – Details</td>
</tr>
<tr>
<td>MS350.2</td>
<td>Generic Single Truss Cantilever Sign Structure – Elevation</td>
</tr>
<tr>
<td>MS350.3</td>
<td>Generic Monotube Sign Bridge Structure – Elevation</td>
</tr>
<tr>
<td>MS350.4</td>
<td>Generic Single Truss Sign Bridge Structure – Elevation</td>
</tr>
<tr>
<td>MS350.5</td>
<td>Generic Cantilever and Sign Bridge Structures - Base Plate and Anchor Bolt Cage Details</td>
</tr>
<tr>
<td>MS350.6</td>
<td>Generic Cantilever and Sign Bridge Structures - Flange and Pin Joints</td>
</tr>
<tr>
<td>MS351.1</td>
<td>Generic Extruded Aluminum Sign Mounting for Generic Cantilever and Sign Bridge Structures - Sign and Luminaire Mounting Details</td>
</tr>
<tr>
<td>MS351.2</td>
<td>Generic Extruded Aluminum Sign Mounting for Monotube Structures - Sign and Sign Luminaire Mounting Details</td>
</tr>
<tr>
<td>MS351.3</td>
<td>Generic Extruded Aluminum Sign Mounting for Dual Truss Structures - Sign and Sign Luminaire Mounting Details</td>
</tr>
</tbody>
</table>

Table 6. Material standard drawings for cantilever and sign bridge structures.
306.5 PRODUCT OPERATING CONDITIONS
.1 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia. The structures shall be capable of withstanding the wind loads as specified by the Ministry.

306.6 DESIGN STANDARDS
.1 The supplier shall design the structures in accordance with the following:
   .1 Special provisions. (The special provisions will detail the items specific to each contract.)
   .2 Structure Elevation Drawings issued with special provisions.
   .3 These Material Standards.
   .4 Generic Material Standard Drawings (Alternative designs must be pre-approved by the Ministry).
   .5 The latest version of the Canadian Highway Bridge Design Code CAN/CSA-S6-00 (Calculations shall be supplied in metric units.).

306.7 DESIGN CRITERIA
.1 The final design shall include the following features:
   .1 The design shall be such that the final structure has an expected minimum life span of 50 years.
   .2 All shop connections shall be welded and all field connections shall be made with high strength bolts. All main members shall be as continuous as possible. Galvanizing length limitations may require long spans to be divided into a series of shorter, more manageable lengths. These lengths shall be bolted together with flange joints.
306.8 DESIGN CALCULATIONS AND WORKING DRAWING SUBMISSIONS

306.8.1 General
.1 The supplier shall submit to the Ministry Representative a complete set of design calculations and drawings, prepared and sealed by a professional engineer registered by the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC). As Built Calculations and Shop Drawings will be required at the completion of the contract.

306.8.2 Calculation Content
.1 The design calculations shall:
  .1 Be detailed enough to allow for a technical review of the design to ensure it meets the requirements of the contract.
  .2 Include a list of all assumptions made as part of the design.
  .3 Include, as a minimum, calculations for the following structural components:
    .1 Shaft.
    .2 Arm or truss.
    .3 Shaft flange connections.
    .4 Base plate.
    .5 All welded connections.
    .6 Anchor bolts.

306.8.3 Calculation Format
.1 The calculations shall be presented in an orderly manner logically progressing through the structure.

306.8.4 Drawing Content
.1 Drawing content shall be as follows:
.1 Drawings shall clearly indicate a list of materials and components, methods of construction, erection diagrams, connections, bolt torques, explanatory notes and all other information necessary for completion of work.

.2 The first drawing sheet for each structure shall contain the design criteria, list of material and components, and the structure elevation. The supplier shall use MS350.1 as a guide for what is required on the first drawing sheet for each structure.

.3 Drawings shall:
   .1 Be detailed enough to allow for technical review of the design to ensure that it meets the requirements of the contract.
   .2 Include all details required for the fabrication of the final product.
   .3 Show Anchor Bolt Orientations.
   .4 Show maximum sign area that the structure is capable of supporting for the specified wind pressure.

306.8.5 Drawing Format
.1 The drawing format shall be as follows:
   .1 In AutoCAD format. (Most current release.)
   .2 Produced on ISO A1 size paper (other sizes shall meet the approval of the Ministry Representative).
   .3 In metric units only.
   .4 Legible when reduced to 1/2 size or microfilmed.
   .5 In accordance with CSA Standard CAN/CSA-B78.2-86 - Dimensioning and Tolerancing of Technical Drawings.

306.8.6 Ministry Review
.1 The Ministry Review of design calculations and working drawings will be as follows:
   .1 Design calculations and working drawings will be reviewed by the Ministry Representative solely to ascertain conformance with the general design concept. Responsibility for approval of detail design inherent in the calculations and drawings rests solely with the supplier. The review by the Ministry Representative shall not constitute approval.
.2 Review by the Ministry Representative shall not relieve the supplier of responsibility for errors or omissions in the calculations and drawings or for proper completion of the work in accordance with the contract documents. The Ministry may review all design calculations and drawings and return any comments to the supplier seven days after receipt.

.3 The supplier is responsible for verification and correlation of field dimensions, fabrication processes, techniques of construction, installation and co-ordination of all parts of the work.

.4 After the Ministry Review, the calculations and drawings will be returned to the supplier. The supplier shall revise the drawings and calculations to the satisfaction of the Ministry Representative prior to fabrication.

306.8.7 Revisions

.1 The Ministry may require adjustments to the design calculations and drawings. If it is deemed that such revisions affect the contract price, this must be presented in writing to the Ministry Representative for consideration and written approval to proceed must be granted the supplier prior to proceeding with fabrication and installation of work.

306.9 PRODUCT PRODUCTION GUIDELINES

.1 Table 7 outlines the key dates and stages for submission, inspections and review of product. Shorter time frames may be required to suit the delivery dates defined in the Special Provisions for each contract.
<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>*DATE REQUIRED</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Design Calculation and Shop Drawings Submission</td>
<td>3 sets</td>
<td>No later than 3 weeks after the award of contract.</td>
<td>The supplier shall submit design calculations and shop drawings for review by the Ministry Representative.</td>
</tr>
<tr>
<td>2. Production Schedule</td>
<td>1 copy</td>
<td>No later than 3 weeks after the award of contract.</td>
<td>The supplier shall provide the Ministry Representative a type written production schedule outlining the key dates for all stages of fabrication.</td>
</tr>
<tr>
<td>3. Quality Assurance Manager and Independent NDT Agency</td>
<td>1 copy</td>
<td>No later than 3 weeks after the award of contract.</td>
<td>The supplier shall provide the Ministry Representative, in writing, with the name of the supplier’s Quality Assurance Manager and the NDT Agency.</td>
</tr>
<tr>
<td>4. Section A of the Quality Control Report</td>
<td>1 copy</td>
<td>Prior to fabrication.</td>
<td>The supplier shall submit a copy of Section A of the Quality Control Report for review by the Ministry Representative (refer to 306.18.1)</td>
</tr>
<tr>
<td>5. Section B of the Quality Control Report</td>
<td>1 copy</td>
<td>Prior to delivery of the anchor bolts.</td>
<td>The supplier shall submit a copy of Section B of the Quality Control Report for review by the Ministry Representative (refer to 306.18.1)</td>
</tr>
<tr>
<td>6. Notification of Fabrication Start</td>
<td>1 copy</td>
<td>No later that 3 days prior to fabrication.</td>
<td>The supplier shall notify the Ministry Representative, in writing, prior to starting fabrication.</td>
</tr>
</tbody>
</table>

Table 7. Product production guidelines.
<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>*DATE REQUIRED</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Pre-Assembly of the Structure</td>
<td>n/a</td>
<td>No later than 3 days prior to pre-assembly.</td>
<td>The supplier shall pre-assemble the structure prior to galvanizing. Pre-assembled structure shall be reviewed by the Ministry Representative.</td>
</tr>
<tr>
<td>8. Section C of the Quality Control Report</td>
<td>1 copy</td>
<td>Prior to Galvanizing.</td>
<td>The supplier shall submit a copy of Section C of the Quality Control Report for review by the Ministry Representative (refer to 306.18.1)</td>
</tr>
<tr>
<td>9. Section D of the Quality Control Report</td>
<td>1 copy</td>
<td>Prior to packaging.</td>
<td>The supplier shall submit a copy of Section D of the Quality Control Report for review by the Ministry Representative (refer to 306.18.1)</td>
</tr>
<tr>
<td>10. Notification of Shipping</td>
<td>n/a</td>
<td>No later than 3 days prior to shipping.</td>
<td>The supplier shall contact the Ministry Representative when the product is complete and ready for shipment. The supplier shall provide the Ministry Representative with the estimated shipment date and estimated arrival date at its final destination. The Ministry Representative may chose to inspect the product prior to shipping.</td>
</tr>
<tr>
<td>11. As Built Shop Drawings and Calculations and Quality Control Report</td>
<td>1 sets</td>
<td>Upon receipt of product.</td>
<td>The supplier’s Quality Assurance Manager shall submit a reproducible of sealed as built shop drawings, a sealed copy of the as built calculations and a final Quality Control Report (i.e. Compilation of sections A, B, C and D).</td>
</tr>
</tbody>
</table>

Table 7. Product production guidelines, continued.

*Shorter time frames may be required to meet the specified product delivery date.*
306.10 QUALIFICATIONS

.1 The supplier shall produce suitable evidence that the plant is currently fully approved by the CWB to the requirements of CAN/CSA W47.1 Division 2.1 or better.

.2 The supplier shall also produce evidence of satisfactory experience in the fabrication of heavy structural steelwork. Acceptance of the suppliers plant will be at the discretion of the Ministry’s assessment of the supplier’s organization, personnel, equipment and past performance.

.3 The supplier shall employ or retain a registered professional engineer experienced in structural steel fabrication, to provide guidance throughout the work.

.4 The following general conditions shall apply:

  .1 A qualified welding supervisor shall be employed where and when welding is performed.

  .2 All equipment being used shall be in good working order and shall be subject to inspection by the Ministry.

.5 Upon request, the supplier shall submit to the Ministry the name of the engineer(s) experienced in steel fabrication and the name of the welding supervisor(s). The supplier shall also submit, upon request, the names of all welding operators who are qualified by the CWB for the process in which they are employed.

306.11 MATERIALS

306.11.1 General Material Requirements

.1 General material requirements are as follows:

  .1 All materials shall be new.

  .2 The supplier shall provide mill test certificates for all sheet steel and bolts to the Ministry Representative prior to fabrication. The mill test certificates shall contain all chemical and physical properties of the steel to be used in fabrication.
306.11.2 Steel Sheets and Plates

.1 Steel Sheets and Plates shall conform to the following:
   .1 All steel shall be weldable.
   .2 Steel shall be free of surface defects and internal discontinuities.

.2 Steel over 3 mm thick shall have a minimum grade of 300 W (G45) and shall meet the requirements of CAN/CSA G40.20 and G40.21M.

.3 Steel 3 mm thick shall have a minimum grade of 350W (G50) and shall meet the requirements of CAN/CSA G40.20 and G40.21M or ASTM A570M.

.4 Silicon content of steel shall be as follows:
   .1 A570 Material - Si ≤ 0.03%.
   .2 300W Material - Si ≤ 0.03%.

306.11.3 Pipe

.1 Steel pipe for luminaire brackets shall conform to ASTM A53 GRADE B.

.2 Steel pipe used for structural members shall be manufactured from material meeting the requirements of CAN/CSA G40.20 and G40.21M or ASTM A570M.

306.11.4 Connecting Hardware

.1 Connecting hardware shall consist of steel nuts, threaded rod, bolts and washers and shall conform to the following:
   .1 All nuts and bolts shall bear suitable markings to identify their grade and origin of manufacture. All nuts and bolts shall have UNC (Unified National Course) threads and hexagon heads.

.2 Bolts, threaded rod, nuts, and washers larger than 3/8” diameter shall conform to the following:
   .1 Bolts and threaded rod shall be SAE Grade 5.
   .2 Nuts shall be SAE Grade 2 Heavy Hex.
   .3 Flat washers shall be hardened steel circular type in accordance with ASTM F436.
   .4 All spring lock washers shall be manufactured from mild steel.
.5 All nuts, bolts and washers shall be galvanized after fabrication. All galvanizing shall meet the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as noted in CAN/CSA G164, Appendix A.

.6 All bolt threads shall be sized to accept galvanized nuts without removing the protective coating.

.7 After fabrication and galvanizing, all bolts shall be capable of withstanding an elongation of no less than 13% prior to fracture failure.

.3 Bolts, nuts, and washers 3/8” diameter or smaller shall conform to the following:

.1 Bolts shall be type 18-8 or 316 stainless steel.

.2 Nuts shall be type 18-8 or 316 stainless steel finish hex.

.3 Washers shall be type 18-8 or 316 stainless steel flat and spring types.

### 306.11.5 Anchor Bolts

.1 Anchor bolts shall be supplied unassembled in an anchor bolt cage as shown on the Material Standard drawings and shall conform to the following:

.1 Anchor bolt top and bottom cage plates shall be labeled to ensure they are matched with the appropriate leg.

.2 Anchor bolts shall be 1 1/2” diameter AISI/SAE 4140 with a minimum yield strength (Fy) of 560 MPa, a minimum tensile strength (Fu) of 725 MPa, and a maximum tensile strength of 1000 MPa. Where the maximum tensile strength exceeds 1000 MPa, the chemical composition of the steel shall be verified by the Ministry Representative (i.e. to verify steel ductility).

.3 After fabrication and galvanizing, all AISI/SAE 4140 anchor bolts shall be capable of withstanding an elongation of no less that 13% prior to fracture failure.

.4 All anchor bolts and nuts shall be galvanized after fabrication. All galvanizing shall meet the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as noted in CAN/CSA G164M, Appendix A.

.5 Anchor bolt threads shall be sized to accept galvanized nuts without damaging the protective coating.
306.12 FABRICATION

.1 The supplier shall notify the Ministry Representative prior to fabrication as noted in Table 7.

.2 The supplier shall confirm all drawing dimensions and that all parts fit together prior to fabrication.

.3 Fabrication shall conform to the following:

.1 Comply with most current edition of CAN/CSA S16.1-M, unless otherwise noted.

.2 Each shaft, arm, extension, clamp and bracket shall be fabricated from one piece of sheet steel.

.3 Shafts, arms, extensions and clamps shall be brake press formed or roll formed. The brake press knife shall have a radius suitable for the thickness of the material and nature of the bend.

.4 All plate edges shall be free of notches and gouges.

.5 The depth or projection of any imperfections on the inner or outer surfaces shall not exceed 15% of wall thickness. Any depth or projection up to 33% of wall thickness may be repaired by welding. Any excessive projecting weld metal shall be removed.

.6 The diameter of bolt holes shall be 2 mm larger than the bolt diameter for all bolt holes except for bolt holes in base plates which shall be 4 mm larger than the bolt diameter. Holes shall be clean cut, without torn or ragged edges.

306.13 WELDING

.1 All welding shall conform to the following:

.1 All welds shall be in accordance with CAN/CSA W59.

.2 Supplier shall have CWB Plant approval as noted under Clause 306.10.

.3 All welding electrodes shall conform to CAN/CSA W48. The deposited weld metal shall provide strength, ductility, impact toughness and corrosion resistance equivalent to the base metal.

.4 All welds shall be continuous.

.5 All welds shall have no cracks, inadequate penetration or lack of fusion.

.6 All welds shall have no other defects exceeding the limits in size and frequency of occurrence specified in CAN/CSA W59, Clause 12.
.7 All welds shall be free of slag and spatter.
.8 All longitudinal seams shall be welded with a continuous semi-automatic process with a minimum of 60% penetration.
.9 All field welding will not be allowed without specific advance written approval by the Ministry.

306.14 TOLERANCES
.1 All fabrication shall meet the following tolerances:

.1 Straightness. The straightness of any item shall not exceed the overall length divided by 300 from the surface at any point. This shall be measured with a straight line joining the surface at both ends. The difference between the straight line and the surface shall then be measured to determine the straightness.

.2 Twisting. The twist in the overall length of any shaft, arm, or extension shall not exceed 7°.

.3 Length. The specified length of any item shall be within 0 to 60 mm or -0 to +5% (whichever is less) with the exception of sign bridge spans and heights which shall be within 5 mm of the specified dimensions.

.4 Across the Flat Dimensions. The average of all across the flats dimensions from a given cross section shall be within 1% of the specified dimension. In addition, the ratio of the maximum to minimum across the flats dimensions shall be less than or equal to 1.05.

.5 Gap at Flange Connections. The gap at flange connections shall not exceed 2 mm.

.6 Arm Rise. Arm rises apply to unloaded fully loaded structure in the standing position.

306.15 GALVANIZING
.1 All steel products shall be hot-dip galvanized after fabrication to the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as required in CAN/CSA G164M, Appendix A. Galvanized members shall be subject, at the discretion of the Ministry, to the tests for embrittlement outlined in CAN/CSA G164M, Section 5.5. The following galvanizing requirements shall also apply:
.1 All bolts, nuts and washers over 3/8” diameter shall be galvanized in accordance with Clause 306.11.4.2.5 and 306.11.5.4.
.2 All steel surfaces shall be free of oil, grease, welding slag, paint, varnish, rust, or anti-spatter compounds prior to galvanizing.
.3 The galvanizing shall be continuous and uniform in appearance, colour and texture.
.4 Any sharp edges caused by galvanizing drippings shall be filed smooth and coated with an approved cold galvanizing compound.
.5 All threaded holes or threaded couplings shall be retapped after galvanizing and painted with an approved cold galvanizing compound.
.6 All loose galvanizing slag and spatter shall be removed from all components after galvanizing.

306.16 POWDER COATING

306.16.1 General
.1 Power coating of poles shall only be done when specified in the contract Special Provisions in accordance with the following requirements.

306.16.2 Surface Preparation:
.1 Surface shall be cleaned to SSPC SP 7 Brush Off Blast Standard with a profile not exceeding 75 µm (3 mils).

306.16.3 Prebaking of Steel:
.1 The steel shall be prebaked at 220 degrees Celsius (425 degrees Fahrenheit) for a minimum 25 minutes at temperature.

306.16.4 Coating:
.1 Prime coat shall be E-2024-2Z Grey zinc epoxy Primer applied at 75 to 175 µm (3-7 mils) applied to the hot substrate electrostatically.
Topcoat shall be HD Polyester applied at 75 to 125 µm (3-5 mils) electrostatically, then baked at 220 degrees Celsius (425 degrees Fahrenheit) for 25 minutes. The topcoat colour will be provided by the Ministry Representative.

306.16.5 Testing of Powder Coating

.1 Perform adhesion testing of the powder-coated surface in accordance with the latest version of ASTM D4541, Pull-Off Strength of Coatings Using Portable Adhesion Testers. Pull-off test force shall be equal to that provided by the coating manufacturer or 1500 psi whichever is greater.

.2 Perform tests using an independent NACE qualified testing agency ("Testing Agency"). Submit testing company name, tester and proposed testing procedure to the Ministry Representative for acceptance prior to the start of testing. The Testing Agency shall perform the following:

.1 Visually inspect all poles and perform random measurements of coating thickness on at least 10% of all product from each production run.

.2 Perform adhesion testing on the first pole after the first powder coating application (i.e. heat run) to ensure that the coating process is correct.

.3 Perform adhesion testing on at least two other poles randomly selected by the testing agency from other production runs (i.e. heat runs).

.4 Perform adhesion test not sooner than 24 hours after powder coat application and not later than 72 hours after powder coat application.

.3 The Contractor shall submit a repair procedure for all tested poles that pass testing (i.e. repair of small damaged area as a result of the test).

.4 Should the pole fail testing, the Contractor shall remove all coating and re-coat all product in the production run to the satisfaction of the Ministry Representative and Testing Agency. To ensure that all product is acceptable for field use, the Ministry Representative reserves the right to require the Contractor to perform more testing at its sole cost should any product fail thickness testing and/or adhesion testing.

.5 The Contractor shall submit all coating test results to the Ministry Representative for review no later than one week following testing and shall include the results of the coating tests, test frequency and corrective measures in the Quality Management Report.
306.17 PRE-ASSEMBLY

.1 Prior to galvanizing, the supplier shall pre-assemble all structures complete with sign clamps and luminaire clamps to check the fit and geometry. Pre-assembled structures shall be inspected by the Ministry Representative.

.2 Following inspection by the Ministry Representative, the structures shall be disassembled for galvanizing.

306.18 INSPECTION AND REPORTING

306.18.1 General Requirements

.1 The supplier shall submit a Quality Control Report for review by the Ministry Representative. The Quality Control Report shall be produced under the direction of the Suppliers Quality Assurance Manager. The Supplier shall submit sections of the Quality Control Report to the Ministry Representative at various stages of production as outlined Table 7. Each section of the report shall contain a minimum of the following information:

.1 SECTION A

.1 Operator qualifications.

.2 Welding procedures.

.3 Mill certificates from the steel manufacturer.

.4 Resolution of any non-conformances.

.2 SECTION B

.1 Test certificates from bolt manufacturer verifying bolt strength after galvanizing.

.2 Resolution of any non-conformances.

.3 SECTION C

.1 NDT report(s) (by a certified testing agency).

.2 Latest copy of seam weld test report (see below).

.3 Dimensional checking and verification.

.4 Resolution of any non-conformance’s.

.4 SECTION D

.1 Testing of galvanizing.
.2 Resolution of any non-conformances.

.2 Each section of the report shall be submitted, reviewed and all non-conformances shall be resolved to the satisfaction of the Ministry prior to proceeding with the next stage.

.3 After completion of the product, each section shall be bound into a Quality Control Report and submitted to the Ministry Representative. A copy of all Quality Control Reports shall be retained in a project file by the supplier’s Quality Assurance Manager.

.4 NDT testing shall be performed by an agency certified to CAN/CSA-W178.1. The testing agency’s documentation must indicate all deficiencies found and corrective action taken.

.5 The Ministry does not require destruction of product for testing penetration of seam welds; however, the supplier shall provide evidence that seam welds meet the requirements of the approved CWB weld procedure by performing periodic random testing of test samples. Sample seam welds for each CWB approved seam weld procedure required by this specification shall be cut, etched and checked for penetration. Testing for all approved seam weld procedures shall be done by a company certified to CAN/CSA-W178.1. The testing company shall provide evidence that the samples were taken randomly from the production run. The frequency of seam weld testing shall be defined in the contract special provisions or as determined by the Ministry Representative.

.6 The cost for NDT testing of product shall be borne by the supplier including re-testing as determined by the Ministry and the testing agency. Should the supplier fail NTD testing, the supplier shall repair or replace all defective product to the satisfaction of the Ministry. The cost for preparation of the Quality Control Report including non-destructive testing shall be borne by the supplier.

306.18.2 Specific Requirements

.1 Welding. Welds shall be tested for conformance with Clause 306.13. Testing of welds shall be performed as follows:

.1 The testing of welds shall be performed in accordance with CAN/CSA-W59.

.2 All welds shall be visually inspected.

.3 Full-penetration welds shall be ultrasonically tested.
.4 Fillet welds to base plates and flange plates shall be tested by the dry powder magnetic particle method.

.5 Seam welds shall be cut, etched and checked for penetration.

.2 **Galvanizing.** Galvanizing shall be inspected for conformance with Clause 306.15.

.3 **Materials.** Confirm all materials meet the requirements of Clause 306.11 and perform testing as follows:

.1 Verify mil test certificates for conformance with Clause 306.11.2.

.2 Verify test certificates from the bolt manufacturer confirming that the galvanized anchor bolts and connecting bolts larger than 3/8” meet the requirements of Clause 306.11.5.4 and .5. Bolts shall be tested for yield strength, ultimate strength and elongation in accordance with ASTM A325 and tested for embrittlement in accordance with CAN/CSA G164M, Clause 6.5. If evidence of bolt strength cannot be produced from the bolt manufacturer, the Ministry may request that the supplier test (by a certified testing company) a percentage of bolts supplied. The quantity for testing shall be determined by the Ministry.

.4 **Tolerances.** Confirm all tolerances meet the requirements of Clause 306.14.

.5 **Fabrication.** Confirm all fabrication meets the requirements of Clause 306.12.

.6 **Pre-Assembly.** Check all pre-assembly for proper fit and conformance with shop drawings.

### 306.19 IDENTIFICATION

.1 The supplier shall label the structure complete with all associated hardware as shown on the Material Standard drawings.

### 306.20 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials and Ministry purchase order number.
.2 Products shall be pre-assembled (with exception of arms and shafts) and packaged as shown on the Material Standard drawings. (Pre-assembly serves two purposes: to ensure proper fit of components and to prevent loss of components). Hardware at flange connections shall be attached to their parent member.

.3 Any product damaged in shipping shall be replaced at no extra cost to the Ministry. The supplier and their shipper will assume all responsibility for getting the product to the Ministry in proper working order.
307 HIGHMAST POLE STRUCTURES

307.1 SCOPE

.1 This specification shall apply to the supply of highmast pole structures and anchor bolt cages.

.2 All items covered in this specification will be referred to as “product”.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

307.2 PRODUCT APPROVAL

.1 In addition to the requirements of Chapter 102, the supplier shall provide the following information:

   .1 Proof of Canadian Welding Bureau (CWB) qualification as required under Clause 301.6.

   .2 Provide proof that the product can be produced in accordance with this specification.

   .3 Provide proof that the product is interchangeable with all current approved product.

307.3 SUPPLIER QUALITY MANAGEMENT SYSTEM

.1 In addition the requirements of Clause 102.3, the Ministry will accept the following quality control program:

   .1 Ministry of Transportation Quality Control Program as documented in the latest edition of Section 421, Structural Steelwork of the Standard Specifications for Highway Construction.
307.4 MATERIAL STANDARD DRAWINGS

.1 All products shall be supplied in accordance with the Material Standard drawings listed in Table 8.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware sizes and quantities. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.

.3 Pole heights are defined in the Special Provisions.

.4 The supplier shall verify that the product shown on the drawings is fully interchangeable with current pre-approved product.

<table>
<thead>
<tr>
<th>DRAWING NO.</th>
<th>DRAWING TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS360.1</td>
<td>Highmast Pole General Arrangement - Elevation</td>
</tr>
<tr>
<td>MS361.1</td>
<td>Type L and Type H 30 m Highmast Poles - Elevations and Details</td>
</tr>
<tr>
<td>MS361.2</td>
<td>Type L and Type H 38 m Highmast Poles - Elevations and Details</td>
</tr>
<tr>
<td>MS361.3</td>
<td>Type L and Type H 45 m Highmast Poles - Elevations and Details</td>
</tr>
<tr>
<td>MS362.1</td>
<td>Highmast Pole Base – Details</td>
</tr>
<tr>
<td>MS362.2</td>
<td>Highmast Pole Handhole – Details</td>
</tr>
<tr>
<td>MS362.3</td>
<td>Highmast Pole Handhole - Door Details</td>
</tr>
<tr>
<td>MS364.1</td>
<td>Anchor Bolt Cage for Type L and H 30 m Highmast Poles - Details</td>
</tr>
<tr>
<td>MS364.2</td>
<td>Anchor Bolt Cage for Type L and H 38 m Highmast Poles - Details</td>
</tr>
<tr>
<td>MS364.3</td>
<td>Anchor Bolt Cage for Type L and H 45 m Highmast Poles - Details</td>
</tr>
</tbody>
</table>

Table 8. Material standard drawings for highmast pole structures.

307.5 PRODUCT OPERATING CONDITIONS

.1 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia. The equipment shall be capable of withstanding the wind loads as specified by the Ministry.
307.6 QUALIFICATIONS

.1 The supplier shall produce suitable evidence that the plant is currently fully approved by the CWB to the requirements of CAN/CSA W47.1 Division 2.1 or better.

.2 The supplier shall also produce evidence of satisfactory experience in the fabrication of heavy structural steelwork. Acceptance of the supplier’s plant will be at the discretion of the Ministry’s assessment of the supplier’s organization, personnel, equipment and past performance.

.3 The supplier shall employ or retain a registered professional engineer experienced in structural steel fabrication, to provide guidance throughout the work.

.4 The following general conditions shall apply:

.1 A qualified welding supervisor shall be employed where and when welding is performed.

.2 All equipment being used shall be in good working order and shall be subject to inspection by the Ministry.

.5 Upon request, the supplier shall submit to the Ministry the name of the engineer(s) experienced in steel fabrication and the name of the welding supervisor(s). The supplier shall also submit, upon request, the names of all welding operators who are qualified by the CWB for the process in which they are employed.

307.7 MATERIALS

307.7.1 General Material Requirements.

.1 All materials shall be new.

.2 The supplier shall provide mill test certificates for all sheet steel and bolts to the Ministry Representative prior to fabrication. The mill test certificates shall contain all chemical and physical properties of the steel to be used in fabrication.
307.7.2  Steel Sheets and Plates.
   .1 All steel shall be weldable and shall be free of surface defects and internal discontinuities.
   .2 Steel over 3 mm thick shall have a minimum grade of 300 W (G45) and shall meet the requirements of CAN/CSA G40.20 and G40.21M.
   .3 Silicon content of steel shall be - Si ≤ 0.03%.

307.7.3  Anchor Bolts.
   .1 Anchor Bolts shall be supplied in cages as shown on the Material Standard drawings and shall conform to the following:
      .1 Anchor bolts shall be 1 1/2” diameter AISI/SAE 4140 with a minimum yield strength (Fy) of 560 MPa, a minimum tensile strength (Fu) of 725 MPa, and a maximum tensile strength of 1000 MPa. Where the maximum tensile strength exceeds 1000 MPa, the chemical composition of the steel shall be verified by the Ministry Representative (i.e. to verify steel ductility).
      .2 After fabrication and galvanizing, all AISI/SAE 4140 anchor bolts shall be capable of withstanding an elongation of no less than 13% prior to fracture failure.
      .3 All anchor bolts and nuts shall be galvanized after fabrication. All galvanizing shall meet the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as noted in CAN/CSA G164M, Appendix A.
      .4 Anchor bolt threads shall be sized to accept galvanized nuts without damaging the protective coating.

307.8  WELDING
   .1 All steel welding shall conform to the following:
      .1 All welds shall be in accordance with CAN/CSA W59.
      .2 Supplier shall have CWB Plant approval as noted under Clause 307.6.
      .3 All welding electrodes shall conform to CAN/CSA W48. The deposited weld metal shall provide strength, ductility, impact toughness and corrosion resistance equivalent to the base metal.
      .4 All welds shall be continuous.
.5 All welds shall have no cracks, inadequate penetration or lack of fusion.

.6 All welds shall have no other defects exceeding the limits in size and frequency of occurrence specified in CAN/CSA W59, Clause 12.

.7 All welds shall be free of slag and spatter.

.8 Except where noted on the drawings, all longitudinal seams shall be welded with a continuous semi-automatic process with a minimum of 60% penetration. Seam welds at the pole joints shall have 100% penetration.

.9 Field welding will not be allowed without specific advance written approval by the Ministry.

307.9 GALVANIZING

.1 All steel products shall be hot-dip galvanized after fabrication to the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as required in CAN/CSA G164M, Appendix A. Galvanized members shall be subject, at the discretion of the Ministry, to the tests for embrittlement outlined in CAN/CSA G164M, Section 5.5. The following galvanizing requirements shall also apply:

.1 All bolts, nuts and washers shall be galvanized in accordance with Clause 307.7.3.

.2 All steel surfaces shall be free of oil, grease, welding slag, paint, varnish, rust, or anti-spatter compounds prior to galvanizing.

.3 The galvanizing shall be continuous and uniform in appearance, colour and texture.

.4 All surfaces shall be power washed to remove galvanizing residues.

.5 Any sharp edges caused by galvanizing drippings shall be filed smooth and coated with an approved cold galvanizing compound.

.6 All threaded holes shall be re-tapped after galvanizing and painted with an approved cold galvanizing compound.

.7 All loose galvanizing slag and spatter shall be removed from all components after galvanizing.
307.10  FABRICATION

.1 The supplier shall notify the Ministry Representative a minimum of 48 hours prior to fabrication.

.2 The supplier shall confirm all drawing dimensions and that all parts fit together prior to fabrication.

.3 All fabrication shall conform to the following:

.1 Comply with most current edition of CAN/CSA S16.1-M, unless otherwise noted.

.2 Pole sections shall be fabricated from one piece of sheet steel except on sections that are greater than 550 mm in diameter. In this case two longitudinal seam welds will be permitted. But welds are not permitted.

.3 Shafts shall be brake press formed or roll formed. The brake press knife shall have a radius suitable for the thickness of the material and nature of the bend.

.4 All plate edges shall be free of notches and gouges.

.5 The depth or projection of any imperfections on the inner or outer surfaces shall not exceed 15% of wall thickness. Any depth or projection up to 33% of wall thickness may be repaired by welding. Any excessive projecting weld metal shall be removed.

.6 All holes shall have a smooth surface.

307.11  TOLERANCES

.1 The fabrication of the masts shall meet the following tolerances:

.1 **Straightness.** The straightness of the pole sections shall not exceed the overall length divided by 300 from the surface at any point. This shall be measured with a straight line joining the surface at both ends. The difference between the straight line and the surface shall then be measured to determine the straightness.

.2 **Twisting.** The twist in the overall length of any shaft, arm, or extension shall not exceed 7°.

.3 **Length.** The specified length of pole sections shall be within -0 to +60 mm.
.4 Across the flats Dimensions. The average of all across the flats dimensions from a given cross section shall be within 1% of the specified dimension. In addition, the ratio of the maximum to minimum across the flats dimensions shall be less than or equal to 1.05.

307.12 IDENTIFICATION
.1 The supplier shall label the each section of each shaft using a weld on tab as shown on the Material Standard drawings.

307.13 LABELLING
.1 The supplier shall provide a lamicoid style nameplate on the outside of the door for each pole as shown on drawing MS362.3.

.2 The supplier shall provide a lamicoid style instruction guide on the inside of the large handhole as shown on drawing MS362.3.

307.14 PLAN POUCH
.1 The supplier shall supply and mount a waterproof plan pouch (400 high x 300 wide) on the inside of the door (Sigma Technologies type or approved alternative). The pouch shall be secured to the inside of the door as shown on drawing MS362.3.

307.15 PRODUCT PRODUCTION GUIDELINES
.1 Table 9 outlines the key dates and stages for inspections and review of product. Shorter time frames may be required to suite the delivery dates defined in the Special Provisions for each contract.
<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>*DATE REQUIRED</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Design Calculation and Shop Drawings Submission</td>
<td>3 sets</td>
<td>No later than 3 weeks after the award of contract.</td>
<td>The supplier shall submit design calculations and shop drawings for review by the Ministry Representative.</td>
</tr>
<tr>
<td>2. Production Schedule</td>
<td>1 copy</td>
<td>No later than 3 weeks after the award of contract.</td>
<td>The supplier shall provide the Ministry Representative a typed production schedule outlining the key dates for all stages of fabrication.</td>
</tr>
<tr>
<td>3. Quality Assurance Manager and Independent NDT Agency</td>
<td>1 copy</td>
<td>No later than 3 weeks after the award of contract.</td>
<td>The supplier shall provide the Ministry Representative, in writing, with the name of the supplier’s Quality Assurance Manager and the NDT Agency.</td>
</tr>
<tr>
<td>4. Section A of the Quality Control Report</td>
<td>1 copy</td>
<td>Prior to fabrication.</td>
<td>The supplier shall submit a copy of Section A of the Quality Control Report for review by the Ministry Representative (refer to 307.16.1)</td>
</tr>
<tr>
<td>5. Section B of the Quality Control Report</td>
<td>1 copy</td>
<td>Prior to delivery of the anchor bolts.</td>
<td>The supplier shall submit a copy of Section B of the Quality Control Report for review by the Ministry Representative (refer to 307.16.1)</td>
</tr>
<tr>
<td>6. Notification of Fabrication Start</td>
<td>1 copy</td>
<td>No later than 3 days prior to fabrication.</td>
<td>The supplier shall notify the Ministry Representative, in writing, prior to starting fabrication.</td>
</tr>
</tbody>
</table>

Table 9. Product production guidelines.
<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>*DATE REQUIRED</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Pre-Assembly of the Structure</td>
<td>n/a</td>
<td>No later than 3 days prior to pre-assembly.</td>
<td>The supplier shall pre-assemble the structure prior to galvanizing. Pre-assembled structure shall be reviewed by the Ministry Representative.</td>
</tr>
<tr>
<td>8. Section C of the Quality Control Report</td>
<td>1 copy</td>
<td>Prior to Galvanizing.</td>
<td>The supplier shall submit a copy of Section C of the Quality Control Report for review by the Ministry Representative (refer to 307.16.1)</td>
</tr>
<tr>
<td>9. Section D of the Quality Control Report</td>
<td>1 copy</td>
<td>Prior to packaging.</td>
<td>The supplier shall submit a copy of Section D of the Quality Control Report for review by the Ministry Representative (refer to 307.16.1)</td>
</tr>
<tr>
<td>10. Notification of Shipping</td>
<td>n/a</td>
<td>No later than 3 days prior to shipping.</td>
<td>The supplier shall contact the Ministry Representative when the product is complete and ready for shipment. The supplier shall provide the Ministry Representative with the estimated shipment date and estimated arrival date at its final destination. The Ministry Representative may chose to inspect the product prior to shipping.</td>
</tr>
<tr>
<td>11. As Built Shop Drawings and Calculations and Quality Control Report</td>
<td>1 sets</td>
<td>Upon receipt of product.</td>
<td>The supplier’s Quality Assurance Manager shall submit a reproducible of sealed as built shop drawings, a sealed copy of the as built calculations and a final Quality Control Report (i.e. Compilation of sections A, B, C and D).</td>
</tr>
</tbody>
</table>

Table 9. Product production guidelines, continued.

* Shorter time frames may be required to meet the specified product delivery date.
307.16 INSPECTION AND REPORTING

307.16.1 General Requirements

.1 The supplier shall submit a Quality Control Report for review by the Ministry Representative. The Quality Control Report shall be produced under the direction of the Supplier’s Quality Assurance Manager. The Supplier shall submit sections of the Quality Control Report to the Ministry Representative at various stages of production as outlined Table 9. Each section of the report shall contain a minimum of the following information:

.1 SECTION A

.1 Operator qualifications.
.2 Welding procedures.
.3 Mill certificates from the steel manufacturer.
.4 Resolution of any non-conformances.

.2 SECTION B

.1 Test certificates from bolt manufacturer verifying bolt strength after galvanizing.
.2 Resolution of any non-conformances.

.3 SECTION C

.1 NDT report(s) (by a certified testing agency).
.2 Latest copy of seam weld test report (see below).
.3 Dimensional checking and verification.
.4 Resolution of any non-conformances.

.4 SECTION D

.1 Testing of galvanizing.
.2 Resolution of any non-conformances.

.2 Each section of the report shall be submitted, reviewed and all non-conformances shall be resolved to the satisfaction of the Ministry prior to proceeding with the next stage.

.3 After completion of the product, each section shall be bound into a Quality Control Report and submitted to the Ministry Representative. A copy of all Quality Control Reports shall be retained in a project file by the supplier’s Quality Assurance Manager.
.4 NDT testing shall be performed by an agency certified to CAN/CSA-W178.1. The testing agency’s documentation must indicate all deficiencies found and corrective action taken. NDT testing shall be performed on the following percentage of product:

.1 All base plate welds.
.2 25% of all other welds.

.5 The Ministry does not require destruction of product for testing penetration of seam welds; however, the supplier shall provide evidence that seam welds meet the requirements of the approved CWB weld procedure by performing periodic random testing of test samples. Sample seam welds for each CWB approved seam weld procedure required by this specification shall be cut, etched and checked for penetration. Testing for all approved seam weld procedures shall be done by a company certified to CAN/CSA-W178.1. The testing company shall provide evidence that the samples were taken randomly from the production run. The frequency of seam weld testing shall be defined in the contract special provisions or as determined by the Ministry Representative.

.6 The cost for NDT testing of product shall be borne by the supplier including re-testing as determined by the Ministry and the testing agency. Should the supplier fail NTD testing, the supplier shall repair or replace all defective product to the satisfaction of the Ministry. The cost for preparation of the Quality Control Report including non-destructive testing shall be borne by the supplier.

307.16.2 Specific Requirements

.1 Welding. Welds shall be tested for conformance with Clause 307.8. Testing of welds shall be performed as follows:

.1 The testing of welds shall be performed in accordance with CAN/CSA-W59.
.2 All welds shall be visually inspected.
.3 Full-penetration welds shall be ultrasonically tested.
.4 Fillet welds to base plates and flange plates shall be tested by the dry powder magnetic particle method.
.5 Seam welds shall be cut, etched and checked for penetration (random sample from seam welder).

.2 Galvanizing. Galvanizing shall be inspected for conformance with Clause 307.9.
.3 **Materials.** Confirm all materials meet the requirements of *Clause 307.7* and perform testing as follows:

.1 Verify mil test certificates for conformance with *Clause 307.7.1*.

.2 Verify test certificates from the bolt manufacturer confirming that the galvanized anchor bolts meet the requirements of *Clause 307.7.3* and *Clause 307.7.5*. Bolts shall be tested for yield strength, ultimate strength and elongation in accordance with *ASTM A325* and tested for embrittlement in accordance with *CAN/CSA G164M, Clause 6.5*. If evidence of bolt strength cannot be produced from the bolt manufacturer, the Ministry may request that the supplier test (by a certified testing company) a percentage of bolts supplied. The quantity for testing shall be determined by the Ministry.

.4 **Fabrication.** Confirm all fabrication meets the requirements of *Clause 307.10*.

.5 **Tolerances.** Confirm all tolerances meet the requirements of *Clause 307.11*.

### 307.17 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials and purchase order number.

.2 Prior to shipping, the supplier must provide the Ministry Representative with a listing of how they plan ship the product. The list shall contain the maximum quantity of poles per truckload. All hardware shall be attached to its parent component.

.3 Any product damaged in shipping shall be repaired or replaced at no extra cost to the Ministry. The manufacturer and their shipper will assume all responsibility for getting the product to the Ministry in proper working order.
308 ELECTRICAL SYSTEMS FOR HIGHMAST POLES

308.1 SCOPE

.1 This specification shall apply to the supply of the electrical system for highmast poles. This specification does not include the supply of power cables up the pole (cables not included in this specification are shown by a dotted line on the MS series drawings).

.2 All items covered in this specification will be referred to as “product”.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

308.2 MATERIAL STANDARD DRAWINGS

.1 All products shall be supplied in accordance with the Material Standard drawings listed in Table 10.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware and electrical components for accuracy and availability. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.

.3 The supplier shall verify that the product shown on the drawings is fully interchangeable with current pre-approved product.
<table>
<thead>
<tr>
<th>DRAWING NO.</th>
<th>DRAWING TITLE</th>
</tr>
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<tbody>
<tr>
<td>MS360.1</td>
<td>Highmast Pole General Arrangement - Elevation (reference only)</td>
</tr>
<tr>
<td>MS373.1</td>
<td>High Mast Distribution Panel and Junction Box - Equipment Layout</td>
</tr>
<tr>
<td>MS373.2</td>
<td>High Mast Distribution Panel - Wiring Diagram</td>
</tr>
<tr>
<td>MS373.3</td>
<td>High Mast Junction Box - Wiring Diagram</td>
</tr>
<tr>
<td>MS373.4</td>
<td>High Mast Distribution Panel Assembly - Front View</td>
</tr>
<tr>
<td>MS373.5</td>
<td>High Mast Distribution Panel Assembly - Side View</td>
</tr>
<tr>
<td>MS373.6</td>
<td>High Mast Distribution Panel - Details</td>
</tr>
<tr>
<td>MS373.7</td>
<td>High Mast Distribution Panel - Details</td>
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<tr>
<td>MS373.8</td>
<td>High Mast Distribution Panel - Details</td>
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<tr>
<td>MS373.9</td>
<td>High Mast Distribution Panel - Details</td>
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<tr>
<td>MS373.10</td>
<td>High Mast Distribution Panel - Details</td>
</tr>
<tr>
<td>MS373.11</td>
<td>High Mast Junction Box - Assembly</td>
</tr>
<tr>
<td>MS373.12</td>
<td>High Mast Junction Box - Details</td>
</tr>
<tr>
<td>MS373.13</td>
<td>High Mast Junction Box - Details</td>
</tr>
<tr>
<td>MS373.14</td>
<td>High Mast Junction Box - Details</td>
</tr>
</tbody>
</table>

Table 10. Material standard drawings for highmast electrical system.

308.3 MATERIALS

.1 All materials shall be new.

.2 All electrical components shall be approved to the appropriate, nationally-recognized standards by organizations accredited by the Standards Council of Canada to do so.

.3 Unless otherwise noted, the enclosure shall be fabricated from 1/8” thick - 5052-H32 sheet aluminum.
308.4 CONNECTING HARDWARE

.1 Miscellaneous hardware other than screws, nuts, bolts and washers shall be stainless steel or zinc dichromate plated. Other hardware coatings must be submitted to the Ministry for approval.

.2 Connecting hardware (i.e. screws, nuts, bolts and washers) 3/8” diameter or smaller and shall conform to the following:

.1 All hardware shall have unified national thread form (ANSI) and shall be 18-8 or 316 stainless steel.

.2 All nuts and bolts 1/4-20 and larger shall have UNC (Unified National Course) threads and hexagon heads, and shall bear suitable markings to identify their grade and origin of manufacture.

.3 All machine screws smaller than 1/4-20 (e.g. 8-32 UNC, 10-24 UNC) shall be Robertson pan-head.

.4 No sheet metal or self-tapping screws shall be used.

.3 All mounting hardware shall be stainless steel.

308.5 FABRICATION

308.5.1 General

.1 The enclosures are designed to meet CSA enclosure 4X designation. Enclosures shall be manufactured using CNC equipment.

.2 Panels shall be approved to the appropriate, nationally-recognized standards by organizations accredited by the Standards Council of Canada to do so, and bear the organizations’ label inside the panel.

.3 The hardware and equipment lists shown on the MS series drawings describe the required components to fabricate the product. No substitutes are permitted without the written approval of the Ministry Representative. The supplier shall confirm that all components fit into the unit and shall produce a complete working product as specified. The supplier shall contact the Ministry Representative, if minor adjustments to component locations are required.
308.5.2  Welding

.1 All welds shall be in accordance with CAN/CSA W59.2 - Welded Aluminum Construction.

.2 All exterior seams shall be of continuously welded construction. All exterior welds shall be ground smooth.

.3 All welds shall be free of slag and spatter.

308.6  ENCLOSURE FINISH

.1 Enclosures shall be finished as follows:

.1 The enclosure shall be powder coated with ASA-61 grey in accordance with Appendix B - Powder Coat Specification.

.2 The final product shall be free of dents, scratches, weld burns and abrasions harmful to its strength and general appearance.

.3 All exterior corners shall be rounded to a radius of 3 mm (1/8 ins) minimum.

.4 All sharp edges shall be de-burred to a radius of 0.4 mm (1/64 ins) minimum in order to reduce hazards to service personnel.

308.7  ELECTRICAL SYSTEM

308.7.1  General

.1 The Electrical System is described in general as follows:

.1 Distribution panel complete with breakers, wiring, 600 volt to 120 volt transformer, receptacles, terminal blocks, mounting hardware and 3 meters of SOW cable complete with female plug and strain relief connectors.

.2 Junction box complete with wiring, terminal blocks and strain relief connectors (number of terminal blocks and strain relief connectors vary according to the number of luminaires - see Special Provisions), male plug and mounting hardware.

.3 Female plug at the top end and male plug at the bottom end.
The following electrical material are not part of this specification and are supplied by others:

1. Luminaires complete with SOW cable (i.e. from the luminaire to the junction box).
2. SOW cable from the junction box on the ring assembly to the female plug on the electrical panel at the base of pole.
3. Spare SOW cable from the ring assembly to the base of pole.
4. Camera(s), camera enclosure(s), camera receiver driver(s), fiber optic modem(s), fibre cable(s) and camera power cable.
5. 120 volt single phase external drive unit complete with SOW cable and control switch.

308.7.2 Highmast Distribution Panel
1. The highmast distribution panel shall be constructed and wired in accordance with the MS Series drawings.
2. The supplier’s trademark and product identification shall be secured to the outside of the panel.

308.7.3 Highmast Junction Box
1. The highmast junction box shall be constructed and wired in accordance with the MS series drawings. The suppliers shall note that the number of terminal blocks and strain relief connectors vary according to the number of luminaires (see Special Provisions for number of luminaires).
2. The supplier’s trademark and product identification shall be secured to the outside of the junction box.

308.8 COMPONENT LABELLING
1. Components shall be labelled using vinyl adhesive labels with 10 mm high black characters on a white background in the locations shown on the site plans. The transformers, breakers, receptacles and terminal blocks shall be labelled as shown on the drawings.
308.9 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials and purchase order number.

.2 All connecting and miscellaneous hardware shall be packaged in a plastic bag and stored inside the panels.

.3 Prior to shipping, the supplier must provide the Ministry Representative with a listing of how they plan to bundle, package, and ship the product. The list shall contain the maximum quantity in each bundle or on each pallet and the weight of the bundle or pallet. All hardware shall be attached to its parent component.

.4 Any product damaged in shipping shall be repaired or replaced at no extra cost to the Ministry. The manufacturer and their shipper will assume all responsibility for getting the product to the Ministry in proper working order.
309 WINCHES, STEEL CABLES, HEAD END ASSEMBLY, RING ASSEMBLY AND DRIVE UNIT FOR HIGHMAST POLES

309.1 SCOPE

.1 This specification shall apply to the supply of the following components for highmast poles:
   .1 Highmast double drum winches.
   .2 Steel raising and lowering cables (for 30, 38 or 45 meter highmast poles).
   .3 Head end assembly.
   .4 Ring assembly.
   .5 External drive unit.

.2 Each double drum winch shall be supplied with the following components as shown on the MS series drawings:
   .1 Linking gear box and protective cover.
   .2 Hand crank.
   .3 Raising and lowering cables complete with terminations.

.3 Each head end assembly complete with canopy shall be supplied with slip fit section designed to fit over pole and miscellaneous mounting hardware as shown on the MS series drawings.

.4 Each ring assembly shall be supplied with removable luminaire tenons, strain relief connectors (pre-assembled) and junction box mounting plate as shown on the MS series drawings.

.5 Each external drive unit shall be supplied complete with power cord and male plug, torque limiter, control switch and cable, and drive unit support frame. (This material is only required if the external drive unit is specified in the contract Special Provisions).
The supplier shall reference Chapter 307, *Highmast Pole Structures* and Chapter 308, *Electrical Systems for Highmast Poles* and for additional information. These Chapters will provide the reader with a complete understanding of all the components needed to make up a highmast pole. The supplier shall coordinate the design of the winch and peripherals with the highmast pole and electrical system suppliers to ensure that the pole will function as a complete unit. The Ministry Representative will provide the name of the highmast pole manufacturer and the electrical system manufacturer to the successful supplier.

Highmast winches, cables and drive units will be referred to as “product” in this specification.


**309.2 MATERIAL STANDARD DRAWINGS**

The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware sizes and quantities. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.

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<thead>
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</tr>
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<td>MS370.2</td>
<td>Highmast Winch Assembly for External Drive System</td>
</tr>
<tr>
<td>MS370.3</td>
<td>Highmast Winch Assembly for External Drive System</td>
</tr>
<tr>
<td>MS370.4</td>
<td>Highmast External Drive Unit Support Frame</td>
</tr>
<tr>
<td>MS371.1</td>
<td>Highmast Luminaire Ring - 6 Luminaire Layout</td>
</tr>
<tr>
<td>MS371.2</td>
<td>Highmast Luminaire Ring - 9 Luminaire Layout</td>
</tr>
</tbody>
</table>

Table 11. Material standard drawings for highmast winch assembly, ring assembly and drive units.
309.3 MATERIALS

.1 All material shall be new.

.2 All mounting hardware shall be type 18-8 or 316 stainless steel.

309.4 HIGH MAST POLE

.1 The highmast winch and internal drive unit (when specified) shall be designed to fit into a standard Ministry supplied high mast pole as shown in Chapter 307, Highmast Pole Structures. The type and height of the high mast poles will be provided in the contract Special Provisions.

309.5 WINCH AND DRIVE ASSEMBLY

309.5.1 General

.1 The winch shall be a double drum non-latching suitable for raising and lowering luminaires and closed circuit television cameras. The winch shall have a Safe Working Load (SWL) of 7358 N at 3 meters per minute. The winch shall be designed to continuously support the SWL. The SWL of the winch is defined as the maximum normal operating load of the winch (i.e. this load shall not be exceeded during normal working conditions).
The ultimate load of the winch shall be 5 times the SWL of the winch when measured with the full number of steel cable layers on the drum.

The functional layout of the winch and drive unit shall be as shown on drawing MS370.2 and .3.

A separate Test Certificate shall be issued with each winch. The testing shall be done in accordance with Clause 309.12, Testing.

309.5.2 Design

Components shall be designed for an estimated operating life of 25 years.

The winch shall be designed for operation under the damp and dirty conditions that may occur inside a pole.

The winch shall be provided with a self-contained lubrication system.

A waterproof cover shall be supplied to protect the winch from dirt and moisture after installation.

The winch shall have a self-contained lubrication system that does not require any attention other than adding lubricant at specified intervals.

The design of the winch shall be such that it can be installed in or removed from the highmast pole handhole.

The body of the winch shall be powder coated in accordance with Appendix B - Powder Coat Specification.

309.5.3 Drive and Speed of Operation

The winch shall be suitable for both hand and power operation.

The winch shall be rated to carry out one uninterrupted cycle of operation (raising and lowering) at the rated speed/load condition without causing over-heating or excessive wear (assuming the winch is lubricated according to suppliers instructions). The average rate of raising and lowering shall be not less than 3 meters per minute.
309.5.4 Security Against Runaway

.1 The winch shall be self-sustaining as a result of gear ratio or other direct mechanical means supplemented by the provision of a brake or other restraining device.

.2 The winch shall be entirely self-sustaining under all normal circumstances. Should the brake or restraining device fail, the winch gear ratio shall be designed to prevent uncontrolled or dangerous runaway speeds of the ring assembly.

.3 The gears shall be self-lubricating by means of an oil bath.

309.5.5 Drive Shaft Positive Locking Device

.1 The winch shall be fitted with a positive locking device that shall remain engaged to prevent rotation in the “lower” direction when the luminaire ring is engaged at the top of the pole.

.2 The device shall operate automatically under gravity to the locked position whenever the hand crank or gear box is removed. The device shall move automatically to the ‘off’ position when the hand crank or gear box is engaged. It is essential that the locking device remain engaged until the hand crank or gear box are securely attached to the drive shaft(s).

.3 The locking device shall be designed such that it will engage more firmly with increasing applied torque from the driving shaft. The device shall not depend on this driving torque to remain engaged.

.4 The device shall be designed such that it will become properly engaged if applied when the drive shaft is already rotating. The locking device shall be designed such that it will not become damaged or inoperable should the locking device be applied by accidental removal of the gearbox or hand crank. This includes conditions where the winch is being operated under load including failure of the brake or friction device.

.5 The device shall be of simple nature, unaffected by dirt or corrosion in service. Springs shall not be used.

309.5.6 Winch Drum

.1 The drum and flanges shall be of mild steel and plated to prevent corrosion.
Where multiple layering of the cable occurs, the drum flanges shall be designed to withstand the forces that will be imposed on them. The drums shall be tested to carry the full number of cable layers at a tension equivalent to five times the SWL of the winch. The tests on the drum and flanges shall be in accordance with the following criteria:

.1 Once the drum has the maximum number of cable layers, the tension shall be increased with the steel cable adjacent to the flange until failure of the cable occurs. The flanges shall remain intact and shall not be distorted such that the winch will continue to function normally.

.3 The drum shall be grooved except that in the case where the first layer always remains fully applied during all normal operations of the winch, a plain drum may be provided.

.4 The drum shall be designed so that the cable wraps neatly in even layers.

.5 The cable termination at the drum shall be designed such that it can be removed without having to draw the whole length of the cable through the hole in the flange. The cable termination shall be designed to present the steel cable into the first turn on the drum without undue bending of the cable. The cable shall be at an angle that will ensure proper lie against the flange. The cable termination shall be designed such that it can be inspected without dismantling any part to the winch. At least four turns of the cable shall remain on the drum when the luminaire ring is fully lowered.

### 309.5.7 Gearing

.1 Where gearing is not totally enclosed and permanently lubricated, it shall operate in an oil bath. The gears and oil shall be housed in a dirt and moisture resistant enclosure.

.2 The winch housing shall be designed to allow for ease of inspection of the gears. Means shall also be provided for checking the lubricant level as well as draining and refilling of the lubricant. The drain shall be situated in such a way that the oil from it can be easily collected to prevent it from draining into the base of the pole.

.3 The winch gearing shall be supplied lightly greased to protect against corrosion.
309.5.8 External Winch Drive Unit

.1 The winch shall be capable of operating by use of a hand crank or by external winch drive power tool.

.2 The power tool shall be DR Bender catalogue number KR 432 with the following specifications:

.1 120 volts, 60 Hz.
.2 1600 watts.
.3 14 amps.
.4 Radio suppressed and fan cooled.
.5 Reversible with four-speed operation - gear 1 - 80 RPM, gear 2 - 135 RPM, gear 3 - 250 RPM and gear 4 - 470 RPM.
.6 The power tool shall be rated for raising loads of up to 12263 N.

.3 The power tool shall be supplied with a support frame to hold the power tool in place while driving the winch. The power tool shall also be supplied with a 3 conductor number 12 SOW power cord and 20A weatherproof male plug, and a remote control push button station with 8 meters of 4 conductor No. 16 SDN cable. The remote control pushbutton shall be “Bryant PCS-002” or approved alternative. The power cord shall be connected directly to the motor and not through the remote control push button station as shown on MS370.3.

.4 The power tool shall be supplied with a heavy duty torque limiter as specified below.

309.5.9 Torque Limiter

.1 The torque limiter is a device located between the winch drive unit and the winch drive shaft. The torque limiter shall be designed to slip when the luminaire ring is engaged at the top of the pole while the drive unit is still turning. The torque limiter limits the applied torque to ensure the head end equipment and cable is not damaged. The torque limiter shall be adjustable.

309.5.10 Hand Crank

.1 A hand crank shall be provided with each winch for use in levelling the luminaire ring.
309.6 RAISING AND LOWERING CABLES

.1 Raising and lowering cables shall be flexible stainless steel, grade 302, 7 strand x 19 lay construction.

.2 Each cable shall have a minimum safety factor of 5 times the SWL of the winch.

.3 Cables shall be a minimum of 6 mm in diameter.

.4 All raising and lowering cable fittings and terminations shall be factory made and their load rating shall be a minimum of 95% of the minimum breaking strength of the cable. All fittings used in conjunction with the wire cable(s) shall be copper alloy compression type fittings (swaged fittings). All cable terminations shall be certified to have been made strictly in accordance with the manufacturer’s instructions.

.5 The cables shall be cut to the correct lengths and pre-rigged for ease of installation.

309.7 HEAD END ASSEMBLY

.1 The head end assembly shall consist of 2 sets of pulleys for the power/communication and support cables. The assembly shall be equipped with the necessary guides and stops for the luminaire/camera ring. A functional layout of the head end assembly is shown drawing MS370.1.

.2 The mast head assembly shall be designed to slip fit onto the top of the pole. Locking bolts shall be provided to prevent the head end unit from rotating.

.3 The whole mechanical assembly shall be designed and constructed for a minimum of 25 years of operation without the need for maintenance. The assembly shall be of welded steel construction and hot dipped galvanized.

.4 Pulleys shall be designed to accommodate the steel cables, multiconductor power cable and multiconductor fiber optic cable. The pulleys shall be of a minimum radius of 250 mm. The pulleys shall be made of corrosion resistant material. The pulleys shall have maintenance free bearings and shall be protected from moisture or dirt. The bearings shall be maintenance free for over 25 years.

.5 Four pulleys shall be provided. Two for steel cables, one for power cable and one for future communication cable.
.6 Pulleys shall be smooth and free of defects to avoid jamming or damage to the cables or steel cable during raising and lowering.

.7 The pulley shafts shall be made of corrosion resistant material and their diameter shall be large enough to reduce loading on the bearing. The shafts shall be positively secured in the head frame to prevent rotation.

.8 The head end assembly shall be designed with separate openings for hoisting steel cables and power/communication cables. The design shall ensure that the steel lifting cables and power/communication cables are separated before passing over their respective pulleys and that they will not leave the grooves of the pulley. Further, a divider bar shall be provided to ensure separation of the hoisting cables and the power/communication cables during raising and lowering.

.9 A single hot dipped galvanized steel removable cover assembly shall be provided to cover the pulley assembly.

.10 The head end assembly shall be supplier fully assembled and tested in accordance with Sub-Clause 309.12.3

309.8 RING ASSEMBLY

.1 The ring assembly shall consist of a ‘C’ channel ring complete with lifting lugs and bumper plate, luminaire mounting tenons complete with strain relief connectors for electrical cable and a junction box mounting bracket.

.2 Steel pipe shall conform to ASTM A53 GRADE B.

.3 Connecting hardware shall consist of steel nuts, bolts and washers and shall conform to the following:

.1 All nuts and bolts shall bear suitable markings to identify their grade and origin of manufacture. All nuts and bolts shall have UNC (Unified National Course) threads and hexagon heads.

.2 Bolts, threaded rod, nuts, and washers larger shall conform to the following:

.1 Bolts and threaded rod shall be SAE Grade 5.

.2 Nuts shall be SAE Grade 2 Heavy Hex.

.3 Flat washers shall be hardened steel circular type in accordance with ASTM F436.
All spring lock washers shall be manufactured from mild steel.

All nuts, bolts and washers shall be galvanized after fabrication. All galvanizing shall meet the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as noted in CAN/CSA G164, Appendix A.

All nut threads shall be sized to accept galvanized bolts without removing the protective coating.

After fabrication and galvanizing, all bolts shall be capable of withstanding an elongation of no less than 13% prior to fracture failure.

The highmast ring assembly shall be manufactured in accordance with drawings MS371.1 to .7.

The ring complete with equipment mounting brackets shall be galvanized after fabrication.

The ring assembly shall not be out of round by more than 12 mm.

309.9 GALVANIZING

Where specified steel shall be hot-dip galvanized after fabrication to the requirements of CAN/CSA G164M. The galvanizer shall safeguard against embrittlement as required in CAN/CSA G164M, Appendix A. Galvanized members shall be subject, at the discretion of the Ministry, to the tests for embrittlement outlined in CAN/CSA G164M, Section 5.5. The following galvanizing requirements shall also apply:

All bolts, nuts and washers shall be galvanized in accordance with Clause 306.11.4

All steel surfaces shall be free of oil, grease, welding slag, paint, varnish, rust, or anti-spatter compounds prior to galvanizing.

The galvanizing shall be continuous and uniform in appearance, colour and texture.

All surfaces shall be power washed to remove galvanizing residues.

Any sharp edges caused by galvanizing drippings shall be filed smooth and coated with an approved cold galvanizing compound.

All threaded holes shall be re-tapped after galvanizing and painted with an approved cold galvanizing compound.
.7 All loose galvanizing slag and spatter shall be removed from all components after galvanizing.

### 309.10 ON-SITE SUPERVISION

.1 The supplier shall provide qualified personnel to supervise the installation of all product and shall certify in writing that all product are correctly installed.

### 309.11 INSTALLATION AND MAINTENANCE MANUAL

.1 The supplier shall provide one installation and maintenance manual for each pole. This documentation shall be reviewed by the Ministry Representative.

.2 The installation and maintenance manual shall provide a minimum of the following:

  .1 Detailed step-by-step instructions on how to install the raise lower system.
  .2 Detailed description of how to raise and lower the luminaire ring.
  .3 Preventive maintenance tasks, procedures and recommended maintenance intervals.
  .4 Corrective maintenance instructions on how to repair or replace defective components.

### 309.12 TESTING

### 309.12.1 Winch Design Tests (For Pre-Approval Only)

.1 The supplier shall perform the testing to ensure their winch design meets the requirements of this specification. Testing shall be repeated after any alteration of design or components.
.2 The tests shall be designed so that the supplier will check all aspects of the winch design and construction in regards to the factor of safety for the whole winch. Components shall also be tested under static and running conditions. The components shall be tested for durability, security, reliability and resistance to corrosion, dirt and moisture of the winch in service. The test shall normally be taken to the limits of strength and endurance of the winch. Testing shall include the following:

.1 Operating the winch at varying loads and speeds to determine that all components are operating within the normal temperature limits for the materials involved. Life tests shall also be performed on components. The operating times shall be in excess of those likely to be experienced during the service life of the winch (25 years).

.2 Proof that the winch is self-sustaining under all normal circumstances in accordance with Sub-Clause 309.5.4.

.3 Proof that dangerous runaway speeds will not occur in the event of failure of the brake or restraining device as required by Sub-Clause 309.5.4.

.4 Proof that the drive shaft locking device will meet the requirements of Sub-Clause 309.5.5.

.5 Provide destructive tests on the winch drum flanges on accordance with Sub-Clause 309.5.6.

.6 Confirm that the steel cable stacks on the drum as required by Sub-Clause 309.5.6.

309.12.2 Product Tests (For Production Run)

.1 The supplier shall perform factory load tests on each winch prior to delivery. This test shall involve connecting the end of the support cable to a load of 1.5 times the SWL. The winch drum shall be filled with steel cable to its working capacity.

.2 A separate Test Certificate shall be issued with each winch and shall be suitably identified in a permanent manner to correspond with the numbering of its Test Certificate. The load test certificates shall be submitted to the Ministry Representative for review. Load test data shall meet the satisfaction of the Ministry prior to issuing final payment.
309.12.3  Head End Assembly Design Test

.1 The head end assembly shall be pre-assembled and tested to support a load of 7358 N throughout its full range of operation.

.2 The test shall be designed to check all aspects of the head end assembly operation. The head end assembly shall be tested under static and running conditions. The components shall be tested for durability, security, reliability and resistance to corrosion.

.3 The head end assembly also pass the field tests listed under Sub-Clause 309.12.4.

309.12.4  Field Tests

.1 Field test shall be carried out on each completed highmast installation. The test shall consist of the following:

.1 One successful raise and lower cycle with the ring fully loaded.

.2 Correct operation of the winch including correct layering of the steel cables.

.3 Prove the operation of the drive shaft positive locking device to hold the test load.

309.13  SHOP DRAWINGS AND PRODUCT INFORMATION (FOR PRE-APPROVAL ONLY)

.1 The supplier shall submit four copies of the following information:

.1 Shop drawings of the winch, head end assembly, drive unit.

.2 Technical brochures and test data.

.2 The Ministry Representative will review and return shop drawings in accordance with the agreed upon schedule. This review by the Ministry Representative is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Ministry Representative approves the detail design inherent in the shop drawings. The detailed design shall remain with the supplier and review by the Ministry Representative shall not relieve the supplier of the responsibility for errors or omissions in the shop drawings or of the responsibility for meeting all requirements of these specifications.
309.14 IDENTIFICATION

.1 Each winch shall be fitted with a nameplate of a permanent nature, positioned such that it can be readily visible through the door opening.

.2 The nameplate shall carry the supplier’s name and type number or other identification, serial number, SWL and speed of operation or speeds where this may vary with load or ambient conditions, type of lubricant including any warning regarding the use of the correct lubricant, and year of manufacture. The label shall also contain the recommended lubricant.

.3 Rings shall be labelled with their number of tenons.

.4 The supplier shall also label all other parts for easy field assembly.

309.15 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 The winch, drive unit and cables shall be packaged and labelled to match the height and style of pole (i.e. Ministry standard 30, 38 or 45 meter high mast pole). Rings shall be supplied with all tenons attached (rings may be supplied in two sections).

.3 Prior to shipping, the supplier must provide the Ministry with a listing of how they plan to bundle, package, and ship the product. The list shall contain the maximum quantity in each bundle or on each pallet and the weight of the bundle or pallet.

.4 Any product damaged in shipping shall be repaired or replaced at no extra cost to the Ministry. The manufacturer and their shipper will assume all responsibility for getting the product to the Ministry in proper working order.
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401 SERVICE, DISTRIBUTION AND DISCONNECT PANELS

401.1 SCOPE

.1 This specification shall apply to the supply of service, distribution and disconnect panels. Service, distribution and disconnect panels shall generally consist of the following:

.1 30A-120/240V Service Panel including all materials as noted on Material Standard Drawing Series MS400.

.2 100A-120/240V Service/Distribution Panel including all materials as noted on Material Standard Drawing Series MS401.

.3 100A-120/240V Service Disconnect Panel including all materials as noted on Material Standard Drawing Series MS402.

.4 100A-120/208V Service/Distribution Panel including all materials as noted on Material Standard Drawing Series MS403.

.2 All items listed above and shown on the Material Standard drawings will be referred to as “product” in this specification.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

401.2 PRODUCT APPROVAL

.1 In addition to the requirements of Chapter 102, the supplier shall provide detailed shop drawings for each panel in Autocad format.
401.3 MATERIAL STANDARD DRAWINGS

.1 All products shall be supplied in accordance with the Material Standard drawings listed in Table 1. Minor variations will be permitted and must be identified on the shop drawings.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware and electrical components. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.

.3 The supplier shall verify that the product shown on the drawings is fully interchangeable with current pre-approved product.

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<tr>
<th>DRAWING NO.</th>
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<tr>
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<td>30A-120/240V Service Panel Parts List</td>
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<td>MS402.1</td>
<td>100A-120/240V Service Disconnect Panel Parts List</td>
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<td>100A-120/208V Service/Distribution Panel Parts List</td>
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<td>100A-120/208V Service/Distribution Panel Details</td>
</tr>
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</tbody>
</table>

Table 1. Material Standard Drawings for Service, Distribution and Disconnect Panels.

401.4 PRODUCT OPERATING CONDITIONS

.1 Service panels, service/distribution and service disconnect panels will generally be mounted on steel poles. Disconnect panels will generally be mounted on wood poles.
The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia.

401.5 MATERIALS

401.5.1 General Material Requirements

.1 General material requirements are as follows:

.1 All materials shall be new.

.2 All electrical components shall be approved to the appropriate, nationally-recognized standards by organizations accredited by the Standards Council of Canada to do so.

401.5.2 Sheet Steel

.1 All sheet steel shall be grade 304-4 stainless steel.

401.5.3 Connecting Hardware

.1 Miscellaneous hardware other than screws, nuts, bolts and washers shall be stainless steel or zinc dichromate plated. Other hardware coatings must be submitted to the Ministry for approval.

.2 Connecting hardware (i.e. screws, nuts, bolts and washers) 3/8” diameter or smaller and shall conform to the following:

.1 All hardware shall have unified national thread form (ANSI) and shall be 18-8 or 316 stainless steel.

.2 All nuts and bolts 1/4-20 and larger shall have UNC (Unified National Course) threads and hexagon heads, and shall bear suitable markings to identify their grade and origin of manufacture.

.3 All machine screws smaller than 1/4-20 (e.g. 8-32 UNC, 10-24 UNC) shall be Robertson pan-head.

.4 All screw heads shall be sized so only one screwdriver is required when working on the panels.

.5 No sheet metal or self tapping screws shall be used.
401.5.4 Main Breakers and Load Centres

.1 Main breakers and load centres shall be Square “D” type as noted on the Material Standards drawings.

401.5.5 Miscellaneous

.1 Miscellaneous hardware such as fittings, chase nipples, conduit hubs, plugs, threadless connectors, etc., shall be as noted on the Material Standards drawings.

401.6 FABRICATION

.1 The supplier shall confirm all drawing dimensions and that all parts fit together prior to fabrication.

.2 All fabrication shall conform to the following:

.1 Service, distribution and disconnect panel enclosures shall be fabricated to conform to CSA Enclosure 3R. All seams shall be continuously welded and all flat connecting surfaces shall be spot welded.

.2 Welds shall have no cracks, inadequate penetration or lack of fusion. All welds shall be free of any sharp edges and shall be cleaned with a stainless steel brush after fabrication. All seam welds shall be ground smooth.

.3 Panel enclosures and covers shall be free of sharp edges.

.4 Panels shall be approved to the appropriate, nationally-recognized standards by organizations accredited by the Standards Council of Canada to do so, and bear the organizations’ label inside the panel.

401.7 IDENTIFICATION

.1 All products shall be labelled with the supplier’s company name, model number, panel rating and the date of manufacture. This label shall be located on the inside of the panel in an easy to read location.
401.8 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 All connecting and miscellaneous hardware shall be packaged in a plastic bag and stored inside the panels.

.3 All panels shall be supplied with the main breakers installed.

.4 Product shall be neatly stacked and secured to wood pallets.

.5 Any product damaged in shipping shall be replaced at no extra cost to the Ministry.
402 ELECTRICAL KIOSKS

402.1 SCOPE

.1 This specification shall apply to the design, testing and supply of single door kiosks, double door kiosks and pole mounted cabinets. This specification is intended to establish the minimum quality benchmark for the enclosure, heating, cooling, and wiring. Kiosks will vary in size and shape depending on the project. The Supplier shall provide shop drawings of the kiosk meeting the requirements of the contract special provisions issued with the contract. Additional information such as control wiring and electrical equipment may also be included in the special provisions for each contract.

.2 For the purpose of this document, the kiosk shall mean a CSA-4X housing complete with heating and ventilation designed to contain electrical and electronic components.

.3 All kiosks shall bear approval to nationally-recognized standards by organizations accredited by the Standards Council of Canada (e.g. CSA or Warnock Hersey).

.4 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

402.2 MATERIAL STANDARD DRAWINGS

.1 All kiosks shall be supplied in accordance with the drawings listed in Table 2 and drawings contained in the contract special provisions.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit by preparing detailed shop drawings. The supplier shall also verify hardware and electrical components. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.
.3 All kiosks shall be supplied in accordance with this specification and special provisions.

<table>
<thead>
<tr>
<th>DRAWING NO.</th>
<th>DRAWING TITLE</th>
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<tr>
<td>MS410.1</td>
<td>Dual Door - Electrical Kiosk</td>
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<tr>
<td>MS410.2</td>
<td>Single Door - Electrical Kiosk</td>
</tr>
<tr>
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<td>MS410.4</td>
<td>General Assembly – Photo’s</td>
</tr>
<tr>
<td>MS410.5</td>
<td>General Assembly – Photo’s</td>
</tr>
</tbody>
</table>

Table 2. Generic Drawings for Electrical Kiosks.

402.3 MATERIALS

402.3.1 General Material Requirements

.1 All materials shall be new.

.2 Unless otherwise noted, equipment shall be fabricated from 5052-H32 sheet aluminum of at least 3.2 mm (1/8 ins) thick.

.3 Use stainless steel hardware, Grade 16 stainless unless otherwise noted.

402.3.2 Connecting Hardware

.1 Miscellaneous hardware other than screws, nuts, bolts and washers shall be stainless steel. Other hardware coatings must be submitted to the Ministry for approval.

.2 Connecting hardware (i.e. screws, nuts, bolts and washers) 3/8” diameter or smaller and shall conform to the following:

.1 All hardware shall have unified national thread form (ANSI) and shall be 18-8 or 316 stainless steel.

.2 All nuts and bolts 1/4-20 and larger shall have UNC (Unified National Course) threads and hexagon heads, and shall bear suitable markings to identify their grade and origin of manufacture.
.3 All machine screws smaller than 1/4-20 (e.g. 8-32 UNC, 10-24 UNC) shall be Robertson pan-head. All screw heads shall be sized so only one screwdriver is required when working on the panels.

.4 No sheet metal or self tapping screws shall be used.

402.4 FABRICATION MECHANICAL REQUIREMENTS

402.4.1 General Requirements

.1 The kiosk shall be manufactured using CNC equipment. The general appearance for a double door kiosk, single door kiosk and pole mounted cabinet are shown on the drawings.

.2 The kiosk enclosures shall be of marine grade aluminum, enclosed free standing, floor mounting (except for pole mount units), dead front, outdoor tamperproof and non-walk in units.

402.4.2 Welding

.1 All welds shall be in accordance with CAN/CSA W59.2 - Welded Aluminum Construction.

.2 All exterior seams shall be of continuously welded construction. All exterior welds shall be ground smooth.

.3 All welds shall be free of slag and spatter.

402.4.3 Kiosk Doors and Hinges

.1 Kiosk doors with hidden hinges shall be fabricated as shown on the drawings. Details of the hinge shall be shown on the shop drawings including any variations. Variations to the door and hinge design shall be approved by the Ministry Representative.

.2 Each door shall have a hydraulic dampener to hold the door open.

402.4.4 Door Gaskets

.1 The gasket shall be of one continuous piece per side (i.e. four strips per opening) and shall be permanently bonded to the metal.
The gasket shall be of an appropriate length so as not to have gaps at gasket joints or to shrink over time. The surface of the gasket shall be covered with a silicon lubricant to prevent sticking to the mating surface. The hinge shall be designed to prevent binding of the gasket.

### 402.4.5 Kiosk Door Locks

.1 The lock shall be installed as shown on the drawings.

.2 The door locks shall be rigidly mounted to the inner skin of the door with four machine screws. The screws shall not be accessible nor visible on the outside of the door.

.3 The door shall lock without the use of a key. The use of a keyed door lock shall be supplied only if noted in the contract special provisions.

.4 The door handle shall be galvanized steel and powder coated the same colour as the kiosk.

### 402.4.6 Cabinet Internal Lighting

.1 The supplier shall design the internal kiosk illumination to provide an average vertical illuminance of 300 lux measured along the back plane of the kiosk with influence from external illumination. The average to minimum uniformity shall be 3 to 1. The light source shall be incandescent or halogen and shall be contained in a CSA approved luminaire. The luminaire shall be recessed and the lamp protected from damage. The lamps shall be replaceable without the use of tools.

.2 There shall be a door switch on each door wired to turn on and off the kiosk lighting.

### 402.4.7 Receptacles

.1 Provide at least one 120V, single phase, 60Hz, U-ground, duplex receptacle in each compartment.

### 402.4.8 Kiosk Environmental Requirements

.1 General
.1 The supplier shall provide heaters of suitable wattage and fans of suitable CFM for the volume and internal heat generation of the components inside of the enclosure to prevent condensation from –20 to +50 degrees Celsius under all prevailing temperature and humidity conditions. In addition, provide sufficient airflow to keep the equipment temperature to below its maximum temperature rating (i.e. to prevent equipment overheating of the equipment under all prevailing temperature conditions for the area in which it will be installed). Provide positive pressure ventilation to ensure that dust does not enter the cabinets (i.e. draw air through a filter in front of fan).

.2 The suppliers shall insulate all sides and roof of the kiosk unless otherwise stated by the contract special provisions. The insulation shall be a minimum of 13mm thick rigid foam and located between the outer shell and the mounting panels.

.3 The Supplier shall provide heat load calculations with the shop drawings stamped by a Professional Mechanical Engineer.

.2 Special Heating and Cooling

.1 Where specified in the special provisions, the kiosk may require that the temperature be maintained at 21 degrees Celsius with a humidity of between 0% and 70% humidity non-condensing for specialized electronic systems. The kiosk shall be fitted with a heat exchanger or air condition to maintain the specified environmental criteria.

.3 Ventilation

.1 Ventilating louvers shall be vermin, insect and rain proof with easily replaceable fiberglass, non-circular automotive type filters (i.e. Fram style filter with rubber sealing gasket).

.2 Each kiosk shall be equipped with one or more 125 V AC electric fans (Standard of acceptance: Nidec Part number TA600-A30318 or approval alternative). The number of ventilation fans and louvers will vary according to the kiosk size, prevailing temperature conditions and kiosk equipment heat load.

.3 Electrical connections shall be by two insulated spade connectors.

.4 There shall be no exposed electrical parts.

.5 Fans shall be covered with a protective guard.

.6 Fans shall be serviceable and replaceable without having to remove any other component in the kiosk.

.4 Kiosk Heating
.1 Each kiosk shall be equipped with one or more 125 VAC finned electrical heater strips. The strip heaters shall be Watlow part number FS-12-120-500-X6-86 (part number indicated a 500 watt unit; however wattage shall vary with the design).

.2 Heaters shall be serviceable and replaceable without removing any component in the cabinet. Heaters shall be located to prevent burning of adjacent components.

.3 Heaters shall be suitably shielded to prevent accidental burning.

.4 There shall be no exposed electrical parts.

.5 Kiosk Fan and Heater Thermostat

.1 The kiosk heater/fan thermostat shall be a two stage electronic thermostat rated to switch the fan and heating load. The unit shall have two programmable temperature set points for staged heating and cooling. The thermistor shall be located away from the heat and cooling sources and not in contact with the outer cabinet housing. The product shall be RANCO ETC-211000-000 or approved alternative.

.2 The thermostat shall be serviceable and replaceable without removing any component in the cabinet.

.3 There shall be no exposed electrical parts.

402.4.9 Equipment Mounting Panels

.1 Equipment mounting panels shall be constructed from 5052-H32 sheet aluminum of at least 4.7 mm thick. The equipment mounting panels shall extend horizontally from wall to wall and vertically from the fan/light mounting panel to the bottom of the kiosk base as shown on the drawings.

402.4.10 Fold Down Table for Laptop

.1 Provide a fold down table inside of one of the doors to support a computer laptop.

402.4.11 Foundation Template

.1 Where required by the special provisions, provide a 25mm thick, plywood foundation template showing the conduit entry and anchor locations.
402.5 KIOSK ELECTRICAL REQUIREMENTS

402.5.1 General Requirements

.1 All equipment shall be as noted on the drawings and be CSA or ULC certified. The Ministry prior to start of fabrication must approve alternative products.

.2 The supplier shall submit equipment layout details with the shop drawings.

.3 For power distribution kiosks, an inner mask shall be installed to protect personnel from electrical hazard. The mask shall have cut-outs for circuit breaker toggle mechanisms etc. Knock outs in the mask shall be provided for all spare breaker spaces.

.4 All equipment shall be mounted on to the equipment mounting panels and shall be secured using 8-32 inserts.

.5 Factory assemble and test control panels and component assemblies.

.6 All panels shall be supplied with the breakers installed.

402.5.2 Control Wiring

.1 This section provides the technical requirements for kiosk control wiring. All wiring shall be completed in accordance with the special provisions and the following detailed requirements.

.2 Conductors inside cabinets shall be stranded copper TEW 105 degree C insulation with 26 strands per conductor. Provide conductor size and color coding for control wiring as shown in Table 3.

.3 Neatly bundle and ty-rap wiring to the equipment mounting panel at 150mm intervals. Panduit or equivalent wireways may be used in places were there is a large quantity of wire travelling vertically and horizontally. Show the proposed location and use of Panduit wireways on the equipment layout drawings.

.4 Lugs, terminals and screws used for termination of wiring to be suitable for copper conductors. All wires connected to terminal blocks shall be terminated using copper ferrules.

.5 All wiring shall take the neatest route to its termination point.

.6 All wires shall be free of splices or through connections in their entirety.
.7 Where wiring exits the roof compartment to feed the fans the holes shall be grommeted.

.8 Provide 8-32 inserts and ty-rap mounts for the attachment of wiring as shown on Material Standards drawings MS410.4 and MS410.5.

.9 Wiring and terminal blocks shall be labelled according to the conventions shown in Table 4.

.10 All control wiring shall be labelled using Grafoplast or Brady heat shrink wire markers.

.11 Terminal blocks shall be supplied from Wiedmuller, Weilland or approved alternative. A detailed description of the required Wiedmuller parts is listed in Table 5.

.12 The field terminal blocks shall be located near the bottom of the kiosk and mounted on a standoff so that the terminals are angled at 45 degrees to allow for ease of field terminations.

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<td>Low voltage control wiring</td>
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<tr>
<td>Red</td>
<td># 14</td>
<td>120 volt control wiring</td>
</tr>
<tr>
<td>Black</td>
<td># 14</td>
<td>Hot</td>
</tr>
<tr>
<td>White</td>
<td># 14</td>
<td>Neutral</td>
</tr>
<tr>
<td>Green</td>
<td># 14</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Table 3. Conductor Color Code for Control Wiring.
### Table 4. Control Wire Labeling Conventions.

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>WDU6 Terminal</td>
<td>102020</td>
</tr>
<tr>
<td>WPE6 Ground Terminal</td>
<td>101020</td>
</tr>
<tr>
<td>WAP2.5-10 End Section</td>
<td>105000</td>
</tr>
<tr>
<td>WEW 35/2 End Bracket</td>
<td>106120</td>
</tr>
<tr>
<td>WTW 2.5 - 10 Partition</td>
<td>105010</td>
</tr>
<tr>
<td>WSI 6/2 Fuse Terminal</td>
<td>101400</td>
</tr>
<tr>
<td>WOV6 Jumper Bar</td>
<td>As Required</td>
</tr>
<tr>
<td>TS35 Mounting Bar</td>
<td>38340</td>
</tr>
</tbody>
</table>

Table 5. Terminal Block Part List.
402.6 KIOSK FINISH

.1 The kiosk shall be finished as follows:

.1 The enclosures shall be powder coated ASA-61 grey in accordance with Appendix B - Powder Coat Specification.

.2 The final product shall be free of dents, scratches, weld burns and abrasions harmful to its strength and general appearance.

.3 All exterior corners shall be rounded to a radius of 3.17 mm (1/8 ins) minimum.

.4 All sharp edges shall be de-burred to a radius of 0.4 mm (1/64 ins) minimum in order to reduce hazards to service personnel.

402.7 MANUFACTURERS IDENTIFICATION

.1 The Ministry will allow the manufacturer to externally identify the kiosk as to its origin.

.2 The location, size and method must be visually pleasing and approved by the Ministry prior to implementation.

.3 All labelling installed by the manufacturer shall be set square on the kiosk.

.4 Adhesive stickers shall not be used in labelling the kiosk exterior.

402.8 LABELLING

.1 Kiosk Nameplate

.1 All product shall be labelled with the supplier’s company name, model number, panel rating and the date of manufacture. This label shall be located on the inside of the kiosk in an easy to read location.

.2 The supplier shall also provide a laser engraved label on the outside of each kiosk. The nameplates shall have 15 mm high characters and shall be attached to the door using a minimum of 4 stainless steel 8-32 machine screws complete with blind PEM fasteners. The wording for the nameplates will be provided by the Ministry Representative.

.2 Equipment Labelling
.1 Equipment within the kiosk shall be labelled with embossed plastic labels with 7mm high letter. Identify equipment according to the equipment identifications shown on the contract drawings.

.2 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics. For disconnects, starters and contactors, indicate equipment being controlled and voltage. For transformers, indicate capacity, primary and secondary voltages.

.3 Indicate proposed labelling on the shop drawings.

402.9 PLAN POUCH

.1 The supplier shall supply and mount a waterproof plan pouch (400 high x 300 wide) on the inside of the left door. The pouch shall be secured to the inside of the door using two stainless steel fasteners in the location shown on the drawings.

402.10 SHOP DRAWINGS

402.10.1 Submission

.1 The supplier shall provide detailed shop drawings for each kiosk design for review and acceptance by the Ministry Representative. The supplier shall submit four copies of the following information prior to production:

.1 Detailed dimensioned layout shop drawings (i.e. manufacturing drawings) including plans, elevations, sections, equipment layout and wiring diagrams (if required) for each kiosk.

.2 Wiring diagrams for the power distribution, fan and heating.

.3 Equipment part numbers and mounting details.

.4 Technical brochures for materials and equipment as required.

402.10.2 Drawing Format

.1 The drawing format shall be as follows:

.1 In Autocad format (most current release.)

.2 Produced on ISO A1 size paper (other sizes shall meet the approval of the Ministry Representative).
402.10.3 Ministry Review

.1 The Ministry Review of the shop drawings will be as follows:

.1 Drawings will be reviewed by the Ministry Representative solely to ascertain conformance with the general design concept. Responsibility for approval of detail design inherent in the drawings rests solely with the supplier. The review by the Ministry Representative shall not constitute approval.

.2 Review by the Ministry Representative shall not relieve the supplier of its responsibility for errors or omissions in the drawings or for proper completion of the work in accordance with the contract documents. The Ministry Representative may review all design drawings and return any comments to the supplier seven days after receipt.

.3 The supplier is responsible for verification and correlation of field dimensions, fabrication processes, techniques of construction, installation and co-ordination of all parts of the work.

.4 After the Ministry Review, the drawings will be returned to the supplier. The supplier shall revise the drawings to the satisfaction of the Ministry Representative prior to fabrication.

402.11 PROGRESS PHOTOGRAPHS

.1 The supplier shall submit digital progress photographs when work is 50%, 75% and 100% complete.

402.12 PRODUCT REVIEW.

.1 The Ministry will require the following conditions to be met prior to delivery:

.1 The cabinets and wiring have been reviewed and accepted by the Ministry Representative.

.2 The cabinets shall be complete and operational.
.3 All control wiring shall be tested to the satisfaction of the Ministry Representative.

.4 Rejected equipment shall be repaired or replaced within a time period acceptable to the Ministry. All costs associated with these repairs and for the testing of a failed product will be borne exclusively by the supplier.

402.13 TESTING

.1 The supplier shall prepare and submit an acceptance test plan for approval prior to performing equipment testing.

.2 The supplier shall perform testing of all control wiring including heating and ventilation within each kiosk. The Ministry Representative may witness the tests at their discretion.

402.14 FACTORY CLEANING

.1 The supplier shall vacuum clean and dust interior, behind grilles, louvers and screens prior to delivery. Remove dirt and other disfiguration from exterior surfaces.

.2 Clean equipment and fixtures to a sanitary condition; remove debris and surplus materials.

402.15 PACKAGING

.1 Shipping documentation shall include the purchase order number and an itemized bill of materials.

.2 Each kiosk shall each be lag bolted to two 4” x 4” posts along the shorter sides of the kiosk to be used for support when kiosk is being lifted or moved.

.3 Any product damaged in shipping shall be repaired or replaced at no extra cost to the Ministry. The manufacturer and their shipper will assume all responsibility for getting the product to the Ministry in proper working order.
402.16  CLOSEOUT SUBMITTALS

.1 The supplier shall submit the following information within two weeks of delivery to the Ministry:

.1 As built cabinet drawings and wiring diagrams.
.2 Final test certificates.
.3 Spare parts, maintenance materials and special tools if requested in the contract Special Provisions.
.4 Original equipment manufacturers detailed product sheets and manuals.
403  TELEPHONE DEMARCATION PANELS

403.1  SCOPE

.1  This specification shall apply to the supply of Telephone Demarcation Panels including all materials as noted on Material Standard Drawing Series MS420.

.2  All items listed above and shown on the Material Standard drawings will be referred to as “product” in this specification.

.3  Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

403.2  MATERIAL STANDARD DRAWINGS

.1  All products shall be supplied in accordance with the Material Standard drawings listed in Table 6. Minor variations will be permitted and must be identified on the shop drawings.

.2  The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware and electrical components. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.

.3  The supplier shall verify that the product shown on the drawings is fully interchangeable with current pre-approved product.
<table>
<thead>
<tr>
<th>DRAWING NO.</th>
<th>DRAWING TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS420.1</td>
<td>Telephone Demarcation Panel Parts List</td>
</tr>
<tr>
<td>MS420.2 to MS420.13</td>
<td>Telephone Demarcation Panel Details</td>
</tr>
</tbody>
</table>


### 403.3 PRODUCT OPERATING CONDITIONS

.1 The product will generally be mounted on steel poles.

.2 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia.

### 403.4 MATERIALS

#### 403.4.1 General Material Requirements

.1 General Material Requirements are as follows:

.1 All materials shall be new.

.2 All electrical components shall be approved to the appropriate, nationally-recognized standards by organizations accredited by the Standards Council of Canada to do so.

#### 403.4.2 Sheet Steel

.1 All Sheet Steel shall be grade 304-4 Stainless Steel.

#### 403.4.3 Connecting Hardware

.1 Miscellaneous hardware other than screws, nuts, bolts and washers shall be stainless steel or zinc dichromate plated. Other hardware coatings must be submitted to the Ministry for approval.
.2 Connecting hardware (i.e. screws, nuts, bolts and washers) 3/8” diameter or smaller and shall conform to the following:

.1 All hardware shall have unified national thread form (ANSI) and shall be 18-8 or 316 stainless steel.

.2 All nuts and bolts 1/4-20 and larger shall have UNC (Unified National Course) threads and hexagon heads, and shall bear suitable markings to identify their grade and origin of manufacture.

.3 All machine screws smaller than 1/4-20 (e.g. 8-32 UNC, 10-24 UNC) shall be Robertson pan-head. All screw heads shall be sized so only one screwdriver is required when working on the panels.

.4 No sheet metal or self tapping screws shall be used.

403.4.4 **Miscellaneous**

.1 Miscellaneous hardware such as plywood, fittings, bullet hubs, plugs, threadless connectors, etc., shall be as noted on the Material Standards drawings.

403.5 **FABRICATION**

.1 The supplier shall confirm all drawing dimensions and that all parts fit together prior to fabrication.

.2 All fabrication shall conform to the following:

.1 Telephone demarcation panel enclosures shall be fabricated to conform to CSA Enclosure 3R standards. All seams shall be continuously welded and all flat connecting surfaces shall be spot welded.

.2 Welds shall have no cracks, inadequate penetration or lack of fusion. All welds shall be free of any sharp edges and shall be cleaned with a stainless steel brush after fabrication. All seam welds shall be ground smooth.

.3 Panel enclosures and covers shall be free of sharp edges.

.4 Panels shall be approved to the appropriate, nationally-recognized standards by organizations accredited by the Standards Council of Canada to do so, and bear the organizations’ label inside the panel.
403.6 IDENTIFICATION

.1 All products shall be labelled with the supplier’s company name, model number, panel rating and the date of manufacture. This label shall be located on the inside of the panel in an easy to read location.

403.7 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 All connecting and miscellaneous hardware shall be packaged in a plastic bag and stored inside the panels.

.3 Product shall be neatly stacked and secured to wood pallets.

.4 Any product damaged in shipping shall be replaced at no extra cost to the Ministry.
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501 HID LUMINAIRES HID

501.1 SCOPE

.1 This specification shall apply to the supply of luminaires using high intensity discharge lamps. Luminaires shall generally consist of the following:

.1 150W High Pressure Sodium (HPS) cobrahead luminaires with standard glass refractor.
.2 150W HPS flat glass cobrahead luminaire.
.3 250W HPS cobrahead luminaire with standard glass refractor.
.4 250W HPS flat glass cobrahead luminaire.
.5 400W HPS cobrahead luminaire with standard glass refractor.
.6 400W HPS flat glass cobrahead luminaire.
.7 Highmast Luminaires.
.8 150W HPS wall mount luminaire.
.9 100W HPS Type A sign luminaire (Flood light with flat lens).
.10 175 W Mercury Vapour (MV) Type A sign luminaire (Flood light with flat lens).
.11 250W MV Type A sign luminaire (Flood light with flat lens).
.12 250W MV Type B sign luminaire (Refractor Style).
.13 150W HPS post top luminaire.
.14 Glare shields for 150W HPS cobrahead luminaires.
.15 Glare shields for 250 and 400W HPS cobrahead
.16 Replacement parts as noted in the special provisions.

.2 All items listed above and shown on the Material Standard drawings will be referred to as “product” in this specification.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

501.2 PRODUCT APPROVAL

.1 In addition to the requirements of Chapter 102, the supplier shall provide the following information:

.1 Ballast wiring diagram.
.2 Provide a computer photometric disk in IES format complete with photometric information in accordance with Clause 501.4.2.

.3 Test data verifying the ballast circuit will operate when the lamp has failed as defined in 501.4.3.6.

.4 Test data verifying that cobrahead and sign luminaires are capable of passing the vibration test in accordance with Paragraph 501.4.5.1.5.

.5 For high mast luminaires, provide the following:
   .1 Detailed dimensioned layout drawings including plans, elevations, and weight of the luminaire.
   .2 Details of the optical system being used complete with shield or louver details (if required).

.6 All testing including photometric testing shall be performed by an independent test lab. Tests from the supplier’s lab are acceptable provided their lab is certified by CSA or UL. The supplier shall provide the name of the testing labs and their certification.

501.3 MATERIAL STANDARDS DRAWINGS

.1 All products shall be supplied in accordance with the Material Standards drawings listed in:
**501.4 GENERAL MATERIAL AND FABRICATION REQUIREMENTS**

**501.4.1 General**

.1 Material shall be new.

.2 All luminaires shall be designed to avoid reflecting energy towards the arc tube. When going from stabilized bare lamp operation to stabilized operation in the luminaire, the voltage of new lamps shall not increase more than specified by the lamp manufacturer. The estimated voltage rise limits shall meet the requirements of ANSI as summarized in Table 2.
<table>
<thead>
<tr>
<th>Lamp Wattage’s</th>
<th>100W</th>
<th>150W</th>
<th>250W</th>
<th>400W</th>
<th>1000W</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI voltage</td>
<td>7</td>
<td>7</td>
<td>10</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>Rise Limits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Estimated Voltage Rise Limits.

501.4.2 Photometric Requirements

.1 The supplier shall provide photometric tests by a certified (CSA or UL) independent testing laboratory for each type of luminaire. The suppliers shall also provide the following data:

.1 Photometric file in IES format complete with a printed copy stamped by the independent photometric laboratory.

.2 Isolux diagrams, mounting height correction factors and coefficient of utilization curves (for roadway luminaires).

.3 Isocandela curves with longitudinal and cut off classification, location of maximum candela and efficiency.

.4 Luminous intensity table in IES format.

501.4.3 Electrical Requirements

.1 All luminaires (including internal components) shall be approved to the appropriate, nationally-recognized standards by organizations accredited by the Standards Council of Canada to do so, and bear the organizations’ label inside the housing. As a minimum, luminaires shall meet the requirements of CAN/CSA Standard C22.2 No. 9-M1996, Luminaires.

.2 Luminaire housings shall have a terminal block to accept up to a maximum No. 8 AWG power and neutral conductors and shall be accessible without having to remove internal components.

.3 Internal components shall meet the minimum requirements of the latest issue of CAN/CSA-C22.2 No. 74, Lamp holders and Control Equipment for Use with Electric Discharge Lamps.

.4 Ballast circuits shall meet the requirements of ANSI C82.2-1984. Ballast circuits for HPS lamps shall be capable of operating the lamp within the applicable ANSI trapezoid. Insulation shall be class H, 180 degrees C. The total operating temperature rise of the luminaire shall not exceed the ANSI standard of 165 degrees C when tested in accordance with C22.2 No 9.

.5 HPS and MV ballast circuits shall have the following features:

.1 A power factor of 90% or better.

.2 The ballast circuit design for the HPS luminaire shall be one of the following:
.1 Magnetic regulator.
.2 Constant wattage isolated (CWI) with capacitor in series with the lamp.
.3 Constant wattage autotransformer (CWA) with the capacitor in series with the lamp.

.3 The ballast circuit design for the MV sign luminaires shall be one of the following:
   .1 CWI with capacitor in series with the lamp.
   .2 CWA with the capacitor in series with the lamp.

.4 120 volts phase to neutral (unless otherwise noted).
.5 Allowable line voltage variation of ±10%.
.6 Starting current less than the luminaires operating current.
.7 Minimum starting temperature of minus 40 degrees C for H.P.S. luminaires and minus 30 degrees C for M.V. luminaires.
.8 Average operating life of 60,000 hours (approximately 15 years).

.6 The ballast circuit (i.e. starters, capacitors and transformers) shall be designed to operate without failure for up to three months while the lamp is in open or short circuit failure or the lamp has reached the end of life and starts to cycle.

.7 Capacitors shall rated for 90 degrees C and shall be positioned to prevent overheating of the capacitor.

.8 Starters shall be encapsulated.

.9 Lamp holders shall be glazed porcelain, with anti-vibration lamp grips and spring-loaded centre contact. Lamp holders shall be minimum 4 kV pulse rated and shall accommodate mogul screw type based lamps.

.10 The ballast circuit shall be removable as a complete unit. This shall be achieved by mounting the components on a removable plate or mounted on the lower door housing for double door style roadway luminaires.

.11 The transformer, starter, capacitor and lamp socket shall be individually removable by using quick disconnect style connectors (i.e. molex style). Connectors shall be designed not to vibrate loose.

.12 All wiring shall be colour coded No.18 AWG stranded and rated for 125 degrees C. Green shall only be used for bonding conductors and white for neutral conductors.

501.4.4 Finish

.1 All housings and related attachments shall be powder coated (inside and out) with ASA-61 grey in accordance with Appendix B - Powder Coat Specification. Other colours shall be approved by the Ministry.
.2 Luminaire housings shall have a smooth finish after being coated.

501.4.5 Mechanical Requirements

.1 The following mechanical requirements apply to all luminaires including decorative luminaires that are used by the Ministry from time to time.

.1 Luminaire housings shall have a smooth finish without any blemishes and rough or sharp edges.

.2 Nuts, bolts, washers and miscellaneous hardware shall be stainless steel, zinc dichromate plated or brass. Other non-corrosive hardware coatings must be submitted to the Ministry for approval.

.3 Stainless steel shall not be used for self-tapping screws or where screws are threaded into the aluminum casting. For this application, all hardware shall be zinc dichromate plated.

.4 Installation instructions shall be supplied with each luminaire.

.5 Luminaires shall meet the requirements of ANSI-C136.31-2001, American National Standard for Roadway Lighting Equipment – Luminaire Vibration. Note that the vibration criteria for normal roadway applications shall meet the requirements of Table 1. Table 2 vibration test criteria shall apply for roadway luminaires mounted on bridges.

501.4.6 Luminaire Markings

.1 All labels shall be permanent and weatherproof.

.2 Luminaires shall have NEMA wattage labels located in such a way that they can be easily read from the ground (Note: The NEMA wattage labels for the highmast luminaires shall be the same size as those used for the cobra style luminaires).

.3 A label showing the month and year of manufacture shall be located adjacent to the NEMA wattage label. The label shall have black characters on a white background and shall be made from the same adhesive material as the NEMA wattage label. The character height shall be the same as the character height in the NEMA wattage label. The month/year label shall consist of 4 characters: two alpha characters for the month and two numbers for the year. Examples of month/year labels are shown in Table 3.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Example Label</td>
<td>JA97</td>
<td>FB98</td>
<td>MR99</td>
<td>AR00</td>
<td>MY01</td>
<td>JE02</td>
</tr>
</tbody>
</table>
A wiring diagram shall be glued to the interior cavity of each luminaire. This diagram shall be completely visible without requiring the removal of any internal equipment.

A label shall be attached to the interior of the luminaire housing indicating the following information and shall be completely visible without requiring the removal of any internal equipment.

1. Manufacturer’s trademark, product identification and date of manufacture.

2. Suitable supply voltage and frequency.

3. Lamp type, lamp wattage and the nominal lamp operating voltage.

The following additional markings shall be installed on highmast luminaires:

1. A permanently attached non-corrosive nameplate shall be attached to the exterior surface of the highmast luminaire and located so the marking is clearly visible during relamping. The nameplate shall include the manufacturer’s name or trademark, catalogue number, electrical rating, input amperes, luminaire voltage, date of manufacture and the ANSI/IES photometric classification and distribution type.

2. A label showing the luminaire circuit number shall be located adjacent to the NEMA wattage label and the month/year label. The circuit number label shall have black characters on a white background. The character height shall be the same as the characters in the NEMA wattage label. The circuit number label shall generally consist of five characters. An example of the high mast labelling is “P1-1A”, where “P1” defines the pole number, “1” defines the phase number and “A” defines the first luminaire on phase 1 (i.e. “B” would be the second luminaire on phase 1). The circuit numbers will be provided by the Ministry.

3. For asymmetrical luminaires which require adjustable optical systems, an externally embossed identification marks shall be provided around the optical assembly in 30 degree increments.

### Table 3. Examples of Luminaire Month/Year Label.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Example Label</td>
<td>JL03</td>
<td>AU04</td>
<td>SP05</td>
<td>OC06</td>
<td>NV07</td>
<td>DC08</td>
</tr>
</tbody>
</table>

501.4.7 Installation Instructions

1. Provide detailed installation and wiring instructions with each luminaire.
501.5 COBRAHEAD LUMINAIRE.

501.5.1 General Requirements

.1 Cobrahead luminaires shall be supplied in 150W, 250W or 400W HPS and shall meet the photometric performance requirements.

.2 Upper and lower housings shall be die-cast aluminum joined together by an integrally cast hinge and a spring stainless steel hinge keeper. Housings made of composite materials will be considered. A spring loaded die-cast aluminum latch mechanism shall be integral with the lower housing. The latch shall be operable without tools and while wearing lineman’s gloves.

.3 A photometric distribution label outlining the settings required to obtain the various distributions shall be provided inside the housing of each luminaire.

.4 Luminaires shall be equipped with an adjustable slip fitter cradle, bolts and a bracket to clamp onto a pole tenon. The slip fitter shall accept 40 mm to 63 mm outside diameter tenon sizes and shall be easily field adjustable from plus 5 degrees to minus 3 degrees vertically. A 1.6 mm thick polyethylene fauna guard shall seal any gaps between pole tenon and luminaire.

.5 Luminaires shall have a boss casting on top of the upper housing to accommodate a twist lock photocell (photocell socket not supplied with luminaire). Luminaires shall have a levelling pad on the top of the upper housing.

.6 The reflector shall be securely bolted to the upper luminaire housing. The reflector shall have a chemically brightened and anodized finish. Reflectors shall be sealed against the lower housing with a non-wicking polyester felt gasket to filter out any dust. A polyester filter shall also be provided between the reflector and the lamp holder bracket/socket assembly.

501.5.2 Optical Assembly for Glass Refractor Luminaire

.1 Cobra style luminaires with glass refractors shall be capable of IES Type II and Type III distributions, through an easy lamp holder adjustment. Luminaires shall be supplied pre-set with IES Type II or Type III medium semi cut-off distribution (MSC) as required to meet Clause 501.5.4, Photometric Performance.

.2 Standard glass refractors shall be prismatic and shall be manufactured out of borosilicate glass.

.3 Refractors shall be rigidly secured to the lower housing and shall be easily removable in the field. Refractors shall fit tightly against reflector to prevent entry of moisture or dust.
.4 Glare shields, where specified, shall be mounted around refractors to reduce glare and up light. Glare shields shall be manufactured out of aluminum and designed for easy field installation without drilling the luminaire housing. The design of the glare shield shall be approved by the Ministry.

501.5.3 Optical Assembly for Flat Glass

.1 The reflector shall be in one piece and specifically designed for flat glass full cut-off distribution. Standard flat glass cobra style luminaires shall be capable of IES Type II and Type III distributions, through an easy lamp holder adjustment. Luminaires shall be supplied pre-set with IES Type II or Type III medium cut-off (MC) distribution as required to meet Clause 501.5.4, Photometric Performance.

.2 The luminaire housing shall be designed such that the lens is parallel to the ground giving a total “cut off” distribution (i.e. no light emitted above 90 degrees).

.3 Flat glass lens shall be manufactured out of heat and impact resistant clear tempered glass. Glass shall be a minimum of 5 mm thick.

.4 The lens shall be rigidly secured to the lower housing and shall be easily removable in the field. The lens shall fit tightly against reflector to prevent the entry of moisture or dust. This shall be accomplished by installing a continuous rubber gasket around the lens.

501.5.4 Photometric Performance

.1 The flat glass and glass refractor style cobrahead luminaires shall meet the photometric performance criteria listed in Table 4.
## Table 4. Photometric Performance Criteria for Cobrahead Luminaires

1. Note 1: Average Illuminance as low as 12.5 is acceptable provided the Ave/Min uniformity is equal to or less than 3:1.
2. Note 2: Ave/Min uniformity as high as 3.5:1 is acceptable provided the Average Illuminance is equal to or greater than 13.
501.6  HIGHMAST LUMINAIRE

501.6.1  General Requirements
.1  Highmast luminaires shall be supplied in various wattage’s of HPS as required by the Ministry.

501.6.2  Photometric Requirements
.1  Luminaires shall be supplied in various ANSI/IES photometric distributions as required by the Ministry.

501.6.3  Electrical Requirements
.1  All electrical requirements for highmast luminaires shall be in accordance with the requirements of Sub-Clause 501.4.3 with exception of the ballast voltage. The ballast voltage shall be specified in the Special Provisions.

501.6.4  Mechanical Requirements
.1  Installation instructions shall be supplied with each luminaire.
.2  The luminaire shall comprise of a cast aluminum ballast housing, spun or formed aluminum optical housing and a glass lens or refractor and stainless steel hardware.
.3  The maximum exposed projected area (EPA) of the luminaire shall be 0.25 square meters (this area does not include shroud attachments).
.4  All external hardware shall be stainless steel.
.5  The mounting arrangements shall consist of a slip fitter assembly for a 2” nominal pipe tenon (2.375” OD). The slip fitter shall be secured by means of non-corrosive hardware with an independent levelling device.
.6  The optical assembly shall consist of a precision formed, specular aluminum reflector with anodized finish accurately positioned within the luminaire outer housing. The assembly shall be sealed at the top by means of a high temperature neoprene or silicone rubber gasket between the ballast casting and reflector, and at the bottom by means of a hinged door assembly. The optical assembly shall be designed to prevent the entry of water and dust.
.7 The door assembly shall consist of a gasketed door frame, a clear tempered shock-resistant glass lens, and shall be attached to the reflector housing by means of stainless steel toggle latches, one which shall be hinged. Alternative means of accessing the lamp shall be by lowering the reflector assembly at the connection to the ballast casting. This connection shall be made using a bayonet style mounting arrangement, secured with three knurled thumb screws. Safety cables shall be provided to retain the reflector and lens when replacing the lamp.

.8 For luminaires with asymmetrical distribution, the optics shall be field rotatable.

.9 The lamps shall be removable without the use of tools.

.10 Where specified by the Ministry, the luminaires shall be supplied complete with external cut-off shields or internal louvers to control the emitted flux. The shield or louvers shall be mounted in a manner approved by the Ministry so as to prevent loosening, turning or falling when subjected to vibration or wind loading in the installed position and to permit relamping without removing or distorting the alignment of the shield or louvers.

.11 Lamps shall be supported at both ends to reduce vibration.

501.7 WALL MOUNT LUMINAIRE S

.1 Wall Mount luminaires shall be 150 W HPS and shall generally conform to Material Standards drawing MS501.1.

.2 Wall mount luminaires shall be designed to provide a high level of illumination and uniformity onto the road surface. Wallmount luminaires will be assessed on their performance characteristics versus current pre-approved products.

.3 Luminaires shall consist of two piece die-cast aluminum housing joined together by two integrally cast hinges and two threaded holes for locking bolts. Luminaires must have a flat back surface for wall mounting.

.4 Luminaires shall have a wide beam spread with a 150W H.P.S. coated lamp.

.5 Reflectors shall be precision formed aluminum with a specular anodized finish.

.6 Refractors shall be prismatic, borosilicate glass (minimum 6 mm thick). A clear shatterproof polycarbonate shield shall fit over the glass refractors. Both glass refractor and polycarbonate shield shall be easily removable in the field.

.7 Housings shall be sealed and gasketed to CAN/CSA Enclosure 3R Specifications.
A 3/4 inch NPT reinforced threaded hole complete with thread plugs shall be provided in each side and the top of each luminaire housing for conduit or cable entry. A knockout entry in the back of each luminaire shall also be provided for wiring through the back of the luminaire. Luminaires shall be CSA approved for a through wireway and have room for wiring connections inside the luminaire.

501.8 SIGN LUMINAIRES

501.8.1 General Requirements

.1 Sign luminaires shall meet the photometric performance criteria defined in Sub-Clause 501.8.4.

.2 All sign luminaires shall be supplied complete with a 5 meter length of #16 SOW cable pre-installed with a strain relief connector.

.3 For the purpose of this specification a Type A sign luminaire has the following features:
   .1 Cast aluminum flood light style with a flat lens (i.e. using reflector only to control the light).
   .2 Adjustable aiming by using a trunnion mount (i.e. aiming the luminaire) or movable reflector (i.e. aiming the reflector with a fix mounted luminaire).
   .3 Supplied with slip fitter mount or an alternative form of attachment to a pipe tenon.
   .4 Supplied with ballast for 100 W HPS, 175 MV or 250W MV.

.4 For the purpose of this specification a Type B sign luminaire has the following features:
   .1 Cast aluminum housing with a refractor (i.e. using reflector and refractor to control the light).
   .2 Slip fitter cradle for attachment to a pipe tenon.
   .3 Supplied with ballast for 250 W MV design.

.5 Sign luminaires shall consist of two piece die-cast aluminum housing joined together by two integrally cast hinges and threaded holes for locking bolts. It is preferred that the lock bolts be designed so that the sign luminaire can be opened without the use of tools.

.6 Reflectors shall be precision formed aluminum with specular anodized finish and shall be securely bolted to the lower housing.

.7 Housings shall be sealed and gasketted to CAN/CSA Enclosure 3R Specifications.
501.8.2 Type A Sign Luminaires

.1 The detailed requirements for a Type A sign luminaire are contained in the following paragraphs.

.2 Type A sign luminaires shall be 100 W HPS, 175 W MV or 250W MV as specified by the Ministry. A typical Type A sign luminaire is shown on Material Standard drawing MS502.1.

.3 Lenses shall be manufactured from 5 mm thick heat and impact resistant clear tempered glass. The lens shall be sealed to the housing with an extruded gasket.

.4 Glass refractors shall be secured to upper luminaire housings and shall be easily field removable. Refractors shall seal against upper luminaire housings and lower housing gaskets.

.5 Brackets shall permit mounting in either an upwards or downwards direction.

.6 Type A sign luminaires shall be supplied with an adjustable galvanized steel trunnion mounting bracket with a pipe slip fitter as shown on Material Standard drawings MS502.1 and .2. The Trunnion bracket shall provide for 180 degrees luminaire adjustment. The trunnion bracket shall have a minimum of 3 - 11 mm diameter holes positioned so that they line up with the holes in the slip fitter (i.e. two holes for mounting and one hole for the SOW cable). The pipe slip fitter shall be secured to a pipe tenon using two 5/16” stainless steel U-bolts nuts and washers. The slip fitter shall bolt to the trunnion mounting bracket using two 5/16” stainless steel hex head bolts nuts and washers.

.7 Where the Type A sign luminaire has an internally adjustable reflector, the luminaire may have an adjustable slip fit cradle to clamp onto a pipe tenon similar to the Type B sign luminaire. The internal optics shall be factory set to meet the photometric performance criteria.

501.8.3 Type B Sign Luminaires

.1 The detailed requirements for a Type B sign luminaire are contained in the following paragraphs.

.2 Type B sign luminaires shall be 250W MV and shall generally conform to the size and shape shown on Material Standard drawing MS502.1.

.3 Refractors shall be manufactured from 10 mm thick prismatic borosilicate glass.

.4 Glass refractors shall be secured to upper luminaire housings and shall be easily field removable. Refractors shall seal against upper luminaire housings and lower housing gaskets.
.5 Luminaires shall be capable of operating and mounting from a top or bottom position in relation to the sign.

.6 Luminaires shall be supplied with an adjustable slip fit cradle, bolts and bracket to clamp onto a tenon. The slip fitter shall accept 32 mm to 50 mm (outside diameter) tenons and shall be easily field adjustable ±3 degrees vertically. Clamping bolts shall be accessible from outside the luminaire housing. Clamping brackets shall fit tight against luminaire housings and mounting pipes to seal out any large gaps. A gasket shall be provided to prevent water from seeping along the tenon into the luminaire.

501.8.4 Photometric Performance

.1 Sign luminaires shall meet the photometric performance criteria listed in Table 5. The illuminance values in table 5 are not intended to meet IES requirements for sign lighting. They are used solely to establish the photometric performance of luminaires.
### Table 5. Photometric Performance Criteria for Sign Luminaires.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>175 W MV Type A Sign Luminaire (Flood style)</th>
<th>250 W MV Type A Sign Luminaire (Flood style)</th>
<th>250 W MV Type B Sign Luminaire (Refractor Style)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamp Lumens (Using 175 or 250 MV coated lamps)</td>
<td>8500</td>
<td>13000</td>
<td>13000</td>
</tr>
<tr>
<td>Light Loss Factor</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
</tr>
<tr>
<td>Ave./Min. Uniformity</td>
<td>3:1</td>
<td>3:1</td>
<td>4:1</td>
</tr>
<tr>
<td>Max./Min. Uniformity</td>
<td>4:1</td>
<td>6:1</td>
<td>10:1</td>
</tr>
<tr>
<td>Minimum Average Illuminance (Lux)</td>
<td>210</td>
<td>220</td>
<td>215</td>
</tr>
<tr>
<td>Tilt (reflector)</td>
<td>as required</td>
<td>as required</td>
<td>Level</td>
</tr>
<tr>
<td>Sign Size (mm) (W x H)</td>
<td>3000 x 1800</td>
<td>4000 x 3700</td>
<td>4600 x 2400</td>
</tr>
<tr>
<td>Calculation Grid Pattern, Luminaire Location and Orientation</td>
<td>Refer to drawing MS503.1</td>
<td>Refer to drawing MS503.2</td>
<td>Refer to drawing MS503.3</td>
</tr>
</tbody>
</table>

#### 501.9 POST TOP LUMINAIRES

##### 501.9.1 General Requirements

.1 Post Top luminaires shall be designed to provide a high level of illumination and uniformity onto the road surface. Post Top luminaires will be assessed on their performance characteristics versus current pre-approved products.

.2 Post Top luminaires shall consist of three components:

.1 Refractor and hood assembly.

.2 Base assembly.

.3 Ballast, starter, capacitor, and lamp holder assembly (mounted in the base assembly).
.3 Refractor/hood assemblies shall consist of an IES Type II distribution refractor (as specified), complete with a minimum spun aluminum hood. Refractors shall be fully secured and sealed against the hood assembly and cast base. Refractors and hoods shall be easily field removable for easy lamp or refractor replacement. Refractor/hood assemblies shall have provisions to accommodate a twist lock photo-electric cell socket and a field installable 150 degree specular alzak aluminum house-side shield.

.4 Wiring from the photocell shall run inside the refractor, hood, and base assembly into the pole. Photocell wiring inside the refractor shall run inside a sleeve. Sleeve shall withstand lamp temperatures and not effect light output.

.5 Base assembly shall be cast aluminum with three locking/levelling bolts to fasten the assembly to a 90 mm (outside diameter) pole tenon, without the use of any adapters.

.6 Refractors shall be round prismatic, manufactured out of polycarbonate and shall be shatterproof.

.7 IES distribution type of refractor and orientation of the optics (street side or house side) shall be clearly marked on refractor to avoid errors during installation.

501.10 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 Each luminaire or accessory shall be individually packaged in a cardboard box to prevent damage when transporting. The exterior of the packaging shall be identified with the supplier’s name and luminaire model number.

.3 Luminaires shall be neatly stacked and secured to wood pallets.

.4 All product damaged in shipping shall be replaced at no extra cost to the Ministry.
502  HIGH INTENSITY DISCHARGE LAMPS

502.1  SCOPE
.1  This specification shall apply to the fabrication supply and delivery of High Intensity Discharge (HID) lamps. HID lamps shall generally consist of the following:
   .1  High Pressure Sodium (HPS) lamps.
   .2  Mercury Vapour (MV) lamps.
   .3  Low Pressure Sodium (LPS) lamps.
.2  All items listed above will be referred to as “product” in this specification.
.3  Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

502.2  PRODUCT OPERATING CONDITIONS
.1  The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia.

502.3  MATERIALS
.1  All lamps shall meet the minimum specifications listed in Table 6 to Table 9.
.2  Rated lamp life shall apply to the lamp in either a vertical or horizontal operating position.
.3  All lamps shall have a mogul screw type base.
.4  All lamps shall meet all applicable ANSI standards.

502.4  IDENTIFICATION
.1  All HID lamps shall have the Manufacturer’s trademark, product identification and wattage labelled on each bulb.
502.5 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 Products shall be packaged in a cardboard box to prevent damage when transporting. The exterior of the box shall be identified with the lamp type and wattage.

.3 Any product damaged in shipping shall be replaced at no cost to the Ministry.

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>150W HPS (CLEAR)</th>
<th>250W HPS (CLEAR)</th>
<th>400W HPS (CLEAR)</th>
<th>1000W HPS (CLEAR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Type</td>
<td>Mogul Screw</td>
<td>Mogul Screw</td>
<td>Mogul Screw</td>
<td>Mogul Screw</td>
</tr>
<tr>
<td>Minimum Average Rated Life (hours)</td>
<td>24,000</td>
<td>24,000</td>
<td>24,000</td>
<td>24,000</td>
</tr>
<tr>
<td>Nominal Lamp Volts</td>
<td>55</td>
<td>100</td>
<td>100</td>
<td>250</td>
</tr>
<tr>
<td>Minimum Initial Rated Lumens</td>
<td>16,000</td>
<td>28,000</td>
<td>50,000</td>
<td>140,000</td>
</tr>
<tr>
<td>Bulb</td>
<td>E 23.5</td>
<td>E-18</td>
<td>E-18</td>
<td>E-25</td>
</tr>
<tr>
<td>ANSI Code</td>
<td>S55SC-150</td>
<td>S50VA250</td>
<td>S51WA400</td>
<td>S52XB1000</td>
</tr>
<tr>
<td>Light Center Length (inches)</td>
<td>5</td>
<td>5 3/4</td>
<td>5 3/4</td>
<td>8 3/4</td>
</tr>
<tr>
<td>Overall Length (inches)</td>
<td>7 3/4</td>
<td>9 3/4</td>
<td>9 3/4</td>
<td>15 1/16</td>
</tr>
</tbody>
</table>

Table 6. Clear HPS lamp characteristics
### Characteristics

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>100W HPS (COATED)</th>
<th>150W HPS (COATED)</th>
<th>250W HPS (COATED)</th>
<th>400W HPS (COATED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Type</td>
<td>Mogul Screw</td>
<td>Mogul Screw</td>
<td>Mogul Screw</td>
<td>Mogul Screw</td>
</tr>
<tr>
<td>Minimum Average Rated Life (hours)</td>
<td>24,000</td>
<td>24,000</td>
<td>24,000</td>
<td>24,000</td>
</tr>
<tr>
<td>Nominal Lamp Volts</td>
<td>55</td>
<td>55</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Minimum Initial Rated Lumens</td>
<td>8,800</td>
<td>15,000</td>
<td>26,000</td>
<td>47,500</td>
</tr>
<tr>
<td>Bulb</td>
<td>E 23.5</td>
<td>E 23.5</td>
<td>E-28</td>
<td>E-37</td>
</tr>
<tr>
<td>ANSI Code</td>
<td>S54MC100</td>
<td>S55MD150</td>
<td>S50VC250</td>
<td>S51WB400</td>
</tr>
<tr>
<td>Light Center Length (inches)</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Overall Length (inches)</td>
<td>7 3/4</td>
<td>7 3/4</td>
<td>9</td>
<td>11 5/16</td>
</tr>
</tbody>
</table>

Table 7. Diffuse coated HPS lamp characteristics

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>175W MV (COATED)</th>
<th>250W MV (COATED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Type</td>
<td>Mogul Screw</td>
<td>Mogul Screw</td>
</tr>
<tr>
<td>Minimum Average Rated Life (hours)</td>
<td>24,000</td>
<td>24,000</td>
</tr>
<tr>
<td>Nominal Lamp Volts</td>
<td>129</td>
<td>129</td>
</tr>
<tr>
<td>Minimum Initial Rated Lumens</td>
<td>8,500</td>
<td>13,000</td>
</tr>
<tr>
<td>Minimum Lamp Colour Temperature (Kelvin)</td>
<td>3,300</td>
<td>3,300</td>
</tr>
<tr>
<td>Colour Rendering Index (CRI)</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Bulb</td>
<td>ED-28</td>
<td>ED-28</td>
</tr>
<tr>
<td>Light Center Length (inches)</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Overall Length (inches)</td>
<td>8 5/16</td>
<td>8 5/16</td>
</tr>
</tbody>
</table>

Table 8. MV lamp characteristics.
## Table 9. Low pressure sodium lamp characteristics.

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>35 LPS (CLEAR)</th>
<th>55 LPS (CLEAR)</th>
<th>90 LPS (CLEAR)</th>
<th>180 LPS (CLEAR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Type</td>
<td>B22D</td>
<td>B22D</td>
<td>B22D</td>
<td>B22D</td>
</tr>
<tr>
<td>Minimum Average Rated Life (hours)</td>
<td>18,000</td>
<td>18,000</td>
<td>16,000</td>
<td>16,000</td>
</tr>
<tr>
<td>Minimum Initial Rated Lumens</td>
<td>4,600</td>
<td>7650</td>
<td>12,750</td>
<td>33,000</td>
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<tr>
<td>Bulb</td>
<td>T-16</td>
<td>T-16</td>
<td>T-21</td>
<td>T-21</td>
</tr>
<tr>
<td>Light Center Length (inches)</td>
<td>7 5/16</td>
<td>9 1/2</td>
<td>11 1/2</td>
<td>22 7/8</td>
</tr>
<tr>
<td>Overall Length (inches)</td>
<td>12 3/16</td>
<td>16 3/4</td>
<td>20 3/4</td>
<td>44 1/4</td>
</tr>
</tbody>
</table>
503 PHOTOCONTROLS

503.1 SCOPE
.1 This specification shall apply to the fabrication, supply and delivery of electronic photo controls (referred to as PEC).
.2 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

503.2 COVER, BASE, PLUG BLADES AND GASKET
.1 The housing and locking plug blades shall meet the requirements of ANSI C136.10-1996, IEEE and NEMA standards.
.2 The cover shall be made of high impact resistant, UV stabilized polypropylene. The colour shall meet the requirements of ANSI (i.e. grey - 105 to 130 VAC operation). The clear window shall be made from UV stabilized and UV absorbing acrylic (i.e. to prolong the life of the photo sensor).
.3 The plug blades shall be solid brass three pole locking.
.4 The base shall be heat resistant thermoplastic (ABS) or approved equivalent with a neoprene sealing gasket. The unit shall be capable of withstanding long term exposure to a 100% relative humidity non condensing. The base shall be suitable for 105 degree C operation.

503.3 PHOTORESISTOR
.1 The photo sensor shall be cadmium sulphide or silicon and hermetically sealed. Plastic coated cadmium sulphide cells are not acceptable.

503.4 ELECTRONICS
.1 The PEC shall have an electronic switching circuit that drives a relay full-on and full-off with no AC noise, chatter and chatter-induced RFI. The operating points shall be electronically controlled allowing a close off/on ratio.
.2 The PEC shall be rated for 105 to 130 volt ac operation unless otherwise specified in the special provisions. The load rating shall be 1000 watt tungsten or an 1800 VA ballast load. The PEC shall consume no more than 1 watt.

.3 The PEC shall operate from -40 degrees C to +70 degrees C.

503.5 TURN ON/TURN OFF AND TIME DELAYS

.1 Turn on is 15 lux +/- 3 lux. The average turn off to turn on ratio shall be 1.5:1.

.2 The PEC shall have a 2 to 4 second off only time delay to prevent false switching. The PEC shall turn on instantaneously. Time delays shall work consistently over the entire ambient temperature range.

.3 The PEC shall fail on.

503.6 SURGE PROTECTION

.1 The unit shall contain an MOV capable of withstanding 160 joules with 6500 A surge current as per high surge level of ANSI C136.10-1996, Section 11.4.5.

503.7 DIELECTRIC STRENGTH

.1 The dielectric strength shall be a minimum of 5 KV between any current carrying part and metal mounting surface.

503.8 RATED LIFE

.1 The PEC shall be rated for a minimum of 5000 on-off operations (13.7 years).

503.9 APPROVAL

.1 The PEC shall be approved to the appropriate, nationally-recognized standards by organizations accredited by the Standards Council of Canada to do so, and bear the organizations’ label on the housing.
503.10 IDENTIFICATION

.1 The PEC shall be labelled with the manufactures name and part number on the housing.

503.11 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 Products shall be packaged in a cardboard box to prevent damage when transporting. The exterior of the box shall be identified.

.3 Any product damaged in shipping shall be replaced at no cost to the Ministry.
504 LED ROADWAY LUMINAIRES

504.1 SCOPE
.1 This specification shall apply to the supply of roadway luminaires using Light Emitting Diodes (LED) as the light source.
.2 All items listed will be referred to as “product” in this specification.

504.2 PRODUCT APPROVAL
.1 Supplier shall refer to Section 100, Chapter 102 of the Ministry of Transportation Electrical and Signing Materials Standards (this document) for the Product Approval Process, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions. Warranty requirements are detailed in section 504.3.5 and take precedence over those cited in Chapter 102.2.
.2 In addition to the requirements of Chapter 102, the supplier must provide documentation confirming compliance with the requirements of this specification. To assist with this, a compliance checklist is provided in section 504.3.6 with details of how to use in section 504.3.7.

504.3 MATERIAL AND FABRICATION REQUIREMENTS

504.3.1 Mechanical
.1 Components shall be new. Components fabricated from recycled materials are acceptable.
.2 The luminaire must be a single, self-contained unit of modular design allowing easy component replacement.
.3 Housing material shall be die-cast or extruded aluminum.
.4 Housing must be listed by ULC, CSA, or equivalent for use in wet conditions.
.5 Luminaire housing shall have a minimum ingress protection rating of IP54.
.6 Optical assembly shall have a minimum ingress protection rating of IP66.
.7 Driver housing shall have a minimum ingress protection rating of IP54.
Driver / power supply unit shall have an ingress protection rating of IP66.

Nuts, washers, bolts, and miscellaneous hardware shall be stainless steel, zinc dichromate plated, or brass. Other non-corrosive hardware coatings must be submitted to the Ministry for approval.

Stainless steel shall not be used for self-tapping screws or where screws are threaded into the aluminum casting. For this application, all hardware shall be zinc dichromate plated.

Fasteners requiring loosening to allow component replacement shall be captive.

If equipped with a door to access internal components, the door must be able to be opened without tools and be restrained from falling if it can detach from the enclosure.

Coated aluminum shall be powder coated and ASA-61 grey in colour, or similar, in accordance with Appendix B – Powder Coat Specifications from the Ministry of Transportation Electrical and Signing Materials Standards (this document).

Maximum Effective Projected Area (EPA) of the complete luminaire shall not exceed 0.13m² (1.4 sq. ft.).

Maximum weight of the complete luminaire shall not exceed 15.9kg (35lbs).

Vibration tolerance shall meet requirements of ANSI-C136.31 American National Standard for Roadway Lighting Equipment – Luminaire Vibration. For normal roadway applications luminaires shall be rated for 2G, minimum. For high-vibration installations such as bridges and viaducts luminaires shall be rated for 3G, minimum.

Salt spray testing in compliance with ASTM B117 Standard Method of Salt Spray (fog) Testing, minimum ASTM D1654-08 rating of 5 or higher at 1000 hours.

Luminaires shall be equipped with an adjustable slip fitter cradle, bolts, and bracket to clamp onto a pole tenon. The slip fitter shall accept 40mm to 63mm outside diameter tenon sizes and shall be easily field adjustable from +/− 5° vertically. A polyethylene fauna guard shall seal any gaps between the pole tenon and luminaire.

504.3.2 Electrical

All luminaires must be CSA or ULC approved, or equivalent. Internal components shall be approved to the appropriate nationally recognized standards by an organization accredited by the Standards Council of Canada, and bear the organizations’ label inside the housing. Additionally:

Electrical parts shall be new.
Bonding shall be in accordance with the requirements of the Canadian Electrical Code (CEC).

Power connection shall be through an internally housed, easily accessible terminal block able to accommodate wire sizes 14 to 8 AWG.

Wiring shall be rated for 125°C minimum and colour coded as follows:

1. Green: Ground
2. White: Neutral
3. Black: Line

The luminaire must be available in models capable of operating at supply voltages of 120-277 volts, or 347-480 volts at 60Hz.

The driver / power supply shall be tolerant of voltage fluctuations of +/- 10% of the rated supply voltage.

The maximum LED drive current shall be no greater 60% of the LED rating.

Luminaire components shall be protected by a surge protection device (SPD) rated for ANSI/IEEE C62.41.2-2002 Rating Category C, High Exposure Level operation to 10kV / 10kA.

The driver / power supply shall be designed to last for the life expectancy of the luminaire and have a Class A sound rating.

The driver / power supply shall have power factor of .90 or greater.

Total Harmonic Distortion shall not exceed 20% at full input power across the specified voltage range.

Radio frequency interference shall be within limits established by Industry Canada Interference-Causing Equipment Standard ICES-003 Issue 4 (5) Class A or FCC Title 47 CFR, Part 15, Class A.

Luminaires using dimming controls shall have power consumption of less than 2.5 watts in the off state.

Dimming control shall be compatible with industry standard 0 – 10V DC signal. If the luminaire is configured for dimming, any failure of the dimming control system shall result in maximum light output.

The luminaire shall be able to optionally accommodate a NEMA locking type ANSI C136.10 compliant (3 conductor) or ANSI C136.41 compliant (modified 5 conductor) photo control receptacle.

A wiring diagram shall be affixed to the interior of the housing. This diagram shall be completely visible without requiring the removal of any internal equipment.

A label showing the manufactures name and/or trademark, product model number, date of manufacture, rated voltage and rated power shall be affixed to the interior of the housing.
The exterior of the housing shall be labelled on the down-facing side with a wattage label that can easily be read from the ground. The numbering format shall follow ANSI C136.15-2011 standards for LED fixtures.

504.3.3 Optics & Photometrics

All photometric measurements shall be performed by a certified independent testing laboratory using procedures defined in IES LM-79 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

.1 The luminaire shall have a minimum luminous efficacy of 70 lumens per watt.

.2 The correlated colour temperature (CCT) shall be 4000°K +/- 300°.

.3 The minimum colour rendering index (CRI) shall be 70.

.4 The LED light source shall produce no perceptible flicker to the human eye.

.5 The luminaire shall be capable of providing Backlight-Uplight-Glare (BUG) ratings in any combination of B1/B2/B3-U0-G1/G2/G3.

.6 The refractor lens material shall be UV inhibited, high impact, and scratch resistant and be made of either plastic (acrylic or polycarbonate) or glass.

.7 Luminaires must be available in IES distribution classifications of Type II, Type III, and Type IV.

.8 Luminaires shall be provided with IES photometric data files compliant with ANSI/IESNA LM-63 Standard File Format for the Electronic Transfer of Photometric Data.

504.3.4 Temperature & Thermal

.1 All components of the luminaire shall be certified to operate in the temperature range -40°C to +40°C.

.2 The thermal management system shall consist of an integrated heat-sink, use no liquids or moving parts, and be resistant to accumulation of any debris that may degrade efficiency, including bird droppings. This system shall ensure that the LED maximum operational junction temperature is not exceeded.
504.3.5 Performance and Warranty

.1 LED lumen maintenance shall be confirmed by a certified independent laboratory using IESNA LM-80-08 Approved Method: Measuring Lumen Maintenance of LED Light Sources. Projected lumen maintenance shall be a minimum of L70 at 70,000 hours extrapolated by procedures defined in IESNA TM-21-11 Projecting Long Term Lumen Maintenance of LED Light Sources.

.2 Failure of an LED or LED module shall not cause remaining LED’s or LED modules to fail.

.3 The luminaire shall be RoHS compliant and shall not contain mercury, cadmium, or lead.

.4 Manufacturer must be ISO 9001 Quality Management System certified.

.5 Luminaires shall be warranted for a period of 10 years from the date of delivery. During the warranty period, failure of any component shall result in the replacement of the complete luminaire at no cost to the Ministry, including shipping. Any model of luminaire having a failure rate greater than 20% over the period of the warranty shall be removed from the Ministry Recognized Products List.
### 504.3.6 Compliance Checklist

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<td>CCT</td>
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<td>Accredited lab document</td>
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<td>CRI</td>
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<td>Distribution types</td>
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<td>IES data files LM-63</td>
<td>Manufacturers declaration</td>
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<td><strong>Tm</strong></td>
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<td>Operating range</td>
<td>Manufacturers declaration</td>
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<td>504.3.5.1</td>
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<td>MoT&amp;I</td>
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<tr>
<td>504.3.5.5</td>
<td>Warranty</td>
<td>Manufacturers declaration</td>
<td>MoT&amp;I</td>
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</tbody>
</table>
504.3.7 **Compliance Checklist Notes**

.1 The *Compliance Method* column states the procedure that must be followed:

   .1 *Manufacturers Declaration*: The manufacturer must provide written confirmation stating the product meets all requirements of the applicable section of the specification.

   .2 *Certified By Accredited Test Lab*: The manufacturer must provide written test results from an Accredited Testing Laboratory (ATL) confirming the product meets all requirements of the applicable section of the specification.

.2 The *Confirmation* column states the procedure and/or documentation required to confirm the specification has been met:

   .1 *MoT&I*: The manufacturer must demonstrate to the Ministry Representative that the requirements of the applicable section of the specification have been met. This may be done by one, or a combination of, drawings signed by a professional engineer of the appropriate discipline, visual inspection, field tests, or supporting technical data.

   .2 *Accredited Lab Document*: The manufacturer must provide an electronic copy of the original test results from the accredited testing laboratory. The document must include the name, address, phone number, and email address for the accredited testing laboratory and include the date of the test.

.3 All documentation must be provided electronically in an industry standard electronic format such as Adobe PDF, AutoCAD, Microsoft Excel or Microsoft Word.

.4 Final acceptance of the product is at the sole discretion of the Ministry Representative.

.5 Products meeting all of the above criteria will be listed on the Ministry Recognized Products List.
504.3.8 HPS Equivalency Requirements

LED luminaires that satisfy the above specification may also apply to be qualified as direct replacements for in-service HPS luminaires. LED luminaires meeting direct replacement criteria will be listed under a separate category on the Ministry Recognized Products List (RPL) to indicate they may be used as a direct replacement for in-service HPS luminaires. To ensure, at minimum, existing HPS lighting levels and uniformity are maintained, the following criteria must be met:

.1 Provide documentation demonstrating that the LED luminaire provides superior levels of illumination and uniformity than the HPS luminaire it is to replace.

.2 Show that the fixture will consume less power while maintaining superior levels of illumination and uniformity. Provide documentation showing the actual power consumption.

.3 Using Ministry supplied IES data files and AutoCAD layout files, provide lighting calculations based on criteria in Table 2 (below) and IESNA RP-08-05 using AGi32 software. The IES data files, AutoCAD layout files, and HPS Equivalency Declaration Form are available at:

http://www.th.gov.bc.ca/publications/eng_publications/electrical/HPS_Equivalency_Application.zip

.4 Each LED fixture must have a separate application. The application must specify the wattage (150W, 250W or 400W) and the IES distribution (Type II or Type III) of the HPS luminaire to be replaced.

.5 The model number of the replacement LED luminaire shall be of sufficient detail to designate a single LED luminaire of a specific wattage.

.6 Provide a signed declaration by a professional engineer with demonstrated experience in the field of roadway lighting stating the above criteria are met.
Table 11 – LED Roadway Luminaire Performance Criteria

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<th>250W HPS Equivalent</th>
<th>400W HPS Equivalent</th>
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<td>Light Loss Factor</td>
<td>0.81*</td>
<td>0.81*</td>
<td>0.81*</td>
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<tr>
<td>Ave./Min. Uniformity</td>
<td>3:1</td>
<td>3:1</td>
<td>3:1</td>
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<tr>
<td>Minimum Average Illuminance in Lux</td>
<td>13</td>
<td>13</td>
<td>13</td>
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<tr>
<td>Photometric Distribution for LED</td>
<td>IIIMSC or IIMSC</td>
<td>IIIMSC or IIMSC</td>
<td>IIIMSC or IIMSC</td>
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<td>Luminaire Spacing (m) (1/2 Cycle of Staggered Pattern)</td>
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<td>38</td>
<td>49</td>
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<tr>
<td>Luminaire Mounting Height (m)</td>
<td>9</td>
<td>11</td>
<td>13.5</td>
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<tr>
<td>Luminaire Location</td>
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<td>Staggered Over Edge of Lane</td>
<td>Staggered Over Edge of Lane</td>
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<tr>
<td>Orientation</td>
<td>90° or 270°</td>
<td>90° or 270°</td>
<td>90° or 270°</td>
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<tr>
<td>Arm Length (m)</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Rotation</td>
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<td>0°</td>
<td>0°</td>
</tr>
<tr>
<td>Tilt</td>
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<td>0°</td>
<td>0°</td>
</tr>
<tr>
<td>Road Width (m) (edge of lane to edge of lane)</td>
<td>12</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>Number of Lanes († Three wide lanes)</td>
<td>3†</td>
<td>5</td>
<td>6</td>
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*Based on LLD = 0.9 for L_{70} lifetime rating and LDD = 0.9.

Note 1: Average Illuminance as low as 12.5 is acceptable provided the Ave/Min uniformity is equal to or less than 3:1.
Note 2: Ave/Min uniformity as high as 3.5:1 is acceptable provided the Average Illuminance is equal to or greater than 13.
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601 SIGNAL AND PEDESTRIAN HEADS

601.1 SCOPE

.1 This specification shall apply to the supply of signal and pedestrian heads, visors and backboards.

.2 The Ministry signal and pedestrian heads, visors and backboards shall consist of the following:

1. 3-section signal head - 300 mm diameter, 300 mm diameter and 300 mm diameter sections.
2. 3-section signal head - 300 mm diameter, 200 mm diameter and 200 mm diameter sections.
3. 3-section signal head - 200 mm diameter, 200 mm diameter and 200 mm diameter sections.
4. 1-section 300 mm diameter traffic signal head.
5. 1-section 200 mm diameter traffic signal head.
6. 1 – section 300 pedestrian head configured to accept a 300 mm square combination LED WALK and DON’T WALK symbols.
7. Visors.

.3 Finials (Cap) shall be as shown in Chapter 605, Traffic Signal Mounting Hardware.

.4 All items listed above and shown on the Material Standard drawings shall be referred to as “product” in this specification. Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.
601.2 **MATERIAL STANDARDS DRAWINGS**

.1 All products shall be supplied in accordance with the Material Standard drawings listed in *Table 1.*

<table>
<thead>
<tr>
<th>DRAWING NO.</th>
<th>DRAWING TITLE</th>
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<tbody>
<tr>
<td>MS600.1</td>
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<tr>
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</tr>
<tr>
<td>MS600.4</td>
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</tr>
</tbody>
</table>

*Table 1. Material standard drawings for signal and pedestrian heads.*

601.3 **PRODUCT OPERATING CONDITIONS**

.1 Traffic signal and pedestrian heads will generally be installed on poles.

.2 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia.

601.4 **GENERAL MATERIAL AND FABRICATION REQUIREMENTS**

.1 Product shall be approved to the appropriate, nationally-recognized standards by organizations accredited by the Standards Council of Canada to do so, and bear the organizations’ label inside the enclosure.

.2 All material shall be new.

.3 Signal head sections shall have a 200 mm diameter or 300 mm diameter opening configured to accept the LED modules. Pedestrian head sections shall have a 300 mm square opening configured to accept combination walk/don’t walk LED assemblies.

.4 All signal heads shall conform to the requirements of the latest *Standard of the Institute of Transportation Engineers (ITE) "Vehicle Traffic Control Signal Heads"* and to the specific requirements of this specification.
.5 All pedestrian heads shall conform to the requirements of the latest Standard of the Institute of Transportation Engineers (ITE) "Pedestrian Traffic Control Signal Indications" and to the specific requirements of this specification.

.6 This specification defines additional requirements to those contained in the above noted ITE Standards. This specification shall be read in conjunction with these ITE Standards. Where discrepancies occur between the ITE Standards and this Ministry Specification, the Ministry Specification shall govern.

.7 All signal and pedestrian heads shall be sectional in construction.

### 601.5 ALUMINUM HOUSINGS AND DOORS

.1 Housings and doors shall conform to the ITE Standards with the following specific requirements:

1. Signal and pedestrian head sections housings and doors shall be made of die-cast aluminum or low-pressure permanent mould aluminum. The housing shall be clean, smooth and free from flaws, cracks, blowholes and other imperfections.

2. Each signal and pedestrian head housing shall have integral cast hinge lugs located on the left side. Hinge lugs shall be securely attached to the door with removable solid stainless steel pins.

3. Signal and pedestrian head doors shall move freely with no resistance when unlatched.

4. The signal and pedestrian head housing shall be powder coated green in accordance with Appendix B - Powder Coat Specification.

5. When two or more sections are ordered as a complete unit (as described above), a terminal block with a minimum of 5 input and 5 output positions shall be provided in the centre section. Three terminals shall be allocated for Red, Yellow and Green, one terminal for the neutral and one for the bond. A 5 position terminal block shall also be provided when single signal head sections are ordered. The housing and the reflector shall be bonded.

6. A synthetic gasket shall be provided between the door and the signal and pedestrian head housing, and between the lens and the door to meet the requirements of CAN/CSA Enclosure 3 Specifications. This gasket must not crack or become brittle. A suitable silicon rubber gasket is preferred.
7. The right side of the signal and pedestrian head door shall have an integral casting to accommodate dual latching bolts. Single latching systems are acceptable provided that they properly secure the door to the gasket. The latching bolt shall consist of a stainless steel wing nut and bolt assembly. The wing nut and bolt assembly shall permit fast opening for relamping.

8. The inside of the door shall have four holes located approximately 90 degrees apart to hold the lens clips on the inside of the door. The outside of the door shall have mounting tabs with holes located approximately 90 degrees apart to hold the visors in place.

9. All mounting screws shall be stainless steel type 18-8 Robertson 10-32 Pan Head. Slot head screws will be allowed for terminal block terminal screws only.

601.6 POLYCARBONATE HOUSINGS AND DOORS

.1 Housings and doors shall conform to the ITE Standards with the following specific requirements:

1. The housing of each section shall be a one piece molded ultraviolet and heat stabilized polycarbonate unit. Two integrally cast hinge/screw lugs shall be cast on each side of the housing. Through a symmetrical concept each housing shall be capable of providing either right or left hand door opening. Left hinged is standard; right hinged is special and must be specified.

2. The top and bottom of the housing shall have an opening to accommodate standard 38 mm pipe brackets. Each signal section shall be rigidly attached, one above the other. Four matching punch out locations, top and bottom of each section shall be provided to allow the sections to be bolted together. Four 10-32 stainless steel socket head (Robertson) screws shall be used to join the signal sections together. The polycarbonate signal heads shall be designed for top and bottom (dual point) mounting. Where signal heads are used for mounting, such as with a plumbizer bracket (single point), a suitable internal bracing kit shall be provided to withstand the additional load. The supplier shall provide evidence that the signal head assembly is capable of handling the loads defined in the ITE Specification when mounted from a single point.
3. The top and bottom of the signal housing shall have a Shurlock boss integrally molded into the housing. The radial angular grooves of the Shurlock boss, when used with Shurlock fittings, shall provide positive 5-degree increment positioning of the entire signal head to eliminate rotation or misalignment of the signal.

4. Each housing shall have molded bosses for two five position terminal blocks.

5. The back of each housing shall have the manufacturer's name and CSA approval clearly displayed.

6. Each housing shall have provisions for easily adding a back plate. Four stainless steel type A number 10 by 1/2" long truss style socket head screws shall be used to attach the back plate to the back of each signal section.

7. Hinge pins, door latching hardware, visor backplate, and lens clip screws shall be high quality stainless steel.

8. The housing door of each section shall be a one piece molded ultraviolet and heat stabilized polycarbonate unit. Two hinge lugs shall be cast on one side and two latch jaws shall be cast on the other side. The door shall be attached to the housing by means of two stainless steel hinge pins. Two stainless steel latch screws and wing nuts on one side of the door shall provide for opening and closing the signal door without the use of any special tools.

9. A gasket groove on the inside of the door shall accommodate a weatherproof and mildew proof resilient gasket. When the door is closed, the gasket shall seal flat against the housing, making a positive seal.

10. The outer face of the door shall have four metal threaded inserts equally spaced about the circumference of the lens opening, with four #10-32 stainless steel socket head (Robertson) screws to accommodate the signal head visors. The door and visor shall overlap 5 mm to prevent light escaping between visor and door (visor collar).

11. The signal and pedestrian head housing shall be yellow and shall match Federal Standard 595a-13538.

12. When two or more sections are ordered as a complete unit (as described above), a terminal block with a minimum of 5 input and 5 output positions shall be provided in the centre section. Three terminals shall be allocated for Red, Yellow and Green, one terminal for the neutral and one for the bond. A 5 position terminal block shall also be provided when single signal head sections are ordered. The reflector shall be bonded.
13. A synthetic gasket shall be provided between the door and the signal and pedestrian head housing, and between the lens and the door to meet the requirements of CAN/CSA Enclosure 3 Specifications. This gasket must not crack or become brittle. A suitable silicon rubber gasket is preferred.

### 601.7 VISORS

.1 Visors shall conform to ITE Standards with the following additional requirements (unless specifically stated):

1. Signal Head Visors shall be cowl or Tunnel type as detailed on the Material Standards drawing MS600.4.

2. For aluminum signal heads, visors shall be manufactured from sheet aluminum with a minimum metal thickness from 1.3 mm.

3. For polycarbonate signal heads, visors shall be manufactured from molded ultraviolet and heat stabilized polycarbonate.

4. The outside of the visors side shall be yellow to match the signal head section and the inside side shall be coated flat black. Aluminum visors shall be powder coated green in accordance with Appendix B - Powder Coat Specification.

5. The visor shall be designed to fit tightly against the door and the cast rim encircling the lens opening. The visor shall be attached on the rim of the door to the door by means of a minimum of four stainless steel Robertson 10-32 (No. 8) screws.

6. Visors shall have slotted holes in order that screws do not have to be removed to remove visor.

### 601.8 BACKBOARDS

.1 Backboards shall be designed to securely fit around signal heads. A typical 3 section backboard is detailed on Material Standards drawing MS600.4. All other backboards shall meet these requirements.

.2 When requested by the Ministry, backboards shall have a 75 mm strip of fluorescent yellow 3M™ Scotchlite™ Diamond Grade™ reflective sheeting installed around the perimeter of the backboard as shown on drawing MS600.4. The sheeting shall comply with the requirements of ASTM D4956-01 Type IX. The sheeting shall be attached in accordance with manufacturers recommendations.
.3 Backboards shall be manufactured from a single piece of aluminum with a minimum metal thickness of 1.6 mm. Under special conditions, the Ministry Representative may require a backboard that exceeds the standard dimensions. In this case, the supplier shall adjust the thickness and/or provide bracing to accommodate the increase in wind load. The Supplier shall provide shop drawings and calculations for review by the Ministry Representative.

.4 Backboards shall be powder coated in accordance with Appendix B - Powder Coat Specification. The colour shall be T31 - Federal Yellow.

.5 The fire signal backboard shall conform to TAC specifications.

.6 Backboards shall be pre-drilled with slotted holes for ease of attachment to signal heads. Backboards shall attach to the signal heads with a minimum of six zinc plated or galvanized Robertson 10-32 Pan Head screws.

.7 Backboards shall be designed so they are easily installed or removed in the field without removing the signal head from its mounting bracket. Where a slit is required to accommodate removal of backboard in the field, the supplier shall provide a mechanism for joining the slit.

.8 Standard backboard configurations are as follows:

1. 1 section 200 standard backboard.
2. 1 section 300 standard backboard.
3. 3 section 200 - 200 - 200 standard backboard.
4. Combination standard/plumbizer 3 section 300 - 200 - 200 backboard.
5. Combination standard/plumbizer 3 section 300 - 300 - 300 backboard.
6. Combination standard/plumbizer 4 section 300 - 300 - 300 - 300 backboard.
7. 4 section 300-200-200-300 standard backboard.
8. 4 section 300-P-200-P-200-300 plumbizer backboard (‘P’ indicates plumbizer location).
9. 2 section 300 - 200 fire signal backboard.
10. 2 section 300 - P - 300 fire signal plumbizer backboard.

.9 Combination standard/plumbizer backboards shall have a 32 mm breakout tab to accommodate the plumbizer bracket.
.10 The supplier shall submit shop drawings of the backboards for review prior to their supply. These shop drawings shall detail all key dimensions and slit connection detail (if required).

601.9 CONNECTING HARDWARE

.1 A stainless steel three bolt and washer assembly shall connect each signal head section together. Single section heads shall be supplied with one coupler assembly. Alternate connection assemblies must meet the approval of the Ministry prior to their supply.

601.10 IDENTIFICATION

.1 All signal and pedestrian heads, backboards and visors shall be labeled with the Manufacturer’s trademark, product identification, year and date of manufacture. These labels shall be waterproof and shall securely attach to the surface.

601.11 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 Each signal and pedestrian head shall be individually packaged in cardboard boxes to prevent damage when transporting. Visors and backboards shall be packaged in cardboard boxes to prevent damage when shipping. Each package shall contain only one type of visor or backboard. All boxes shall be neatly stacked and secured to wood pallets. The exterior of all packaging shall be identified with the supplier’s name, model number and product description.

.3 Any product damaged in shipping will be replaced at no extra cost to the Ministry.
602 LED SIGNAL MODULES

602.1 SCOPE

.1 This specification details the minimum design and operating requirements for light emitting diode (LED) traffic signal modules for the following signal displays:

1. 300mm and 200mm circular modules.
2. Square 300mm LED combination Walk/Don’t walk pedestrian head signal modules.
3. 300mm green and yellow bimodal left turn arrow modules.
4. 200mm and 300mm green arrow modules

.2 Each LED module shall consist of an assembly that utilizes LED’s as the source in lieu of an incandescent lamp for use in ITE standard traffic signal sections.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

602.2 GENERAL MATERIAL AND FABRICATION REQUIREMENTS

.1 Product shall be approved to the appropriate, nationally-recognized standards by organizations accredited by the Standards Council of Canada to do so, and bear the organizations’ label on the back of the module. Electrical Safety Branch of British Columbia, Special Inspection Services, is acceptable only for the first year after the date of product pre-approval.

.2 All material shall be new.
.3 All signal modules shall conform to the latest edition of the *Interim LED Purchase Specification of the Institute of Transportation Engineers (ITE)* and to the specific requirements of this specification.

.4 This specification defines additional requirements to those contained in the above noted *ITE Standard*. This specification shall be read in conjunction with this *ITE Standard*. Where discrepancies occur between the *ITE Standard* and this Ministry Specification, the Ministry Specification shall govern.

### 602.3 PHYSICAL AND MECHANICAL REQUIREMENTS

.1 The physical and mechanical requirements of the LED modules shall conform to Section 3 of the *ITE Standards* with the following specific requirements:

1. The supplier shall design the LED modules to fit into the doorframe of all of the current Ministry pre-approved traffic signal housings. The lamp socket, reflector, reflector holder and lens used with incandescent lamp shall not be used in a signal section with an LED signal module installed.

2. LED modules shall be sealed units with two conductors (or three conductors for bimodal units) for connecting to power, a printed circuit board, power supply, lens and gasket, and shall be weather proof after installation and connection.

3. The circuit board and power supply shall be contained inside the signal module.

4. The lens shall be integral with the unit, shall be convex with a smooth outer surface and made of ultraviolet stabilized plastic or of glass. The lens shall be capable of withstanding ultraviolet (direct sunlight) exposure for a minimum of 7 years without exhibiting evidence of deterioration.

5. The lens may be tinted or may use transparent film or materials with similar characteristics to enhance ON/OFF contrast. The use of tinting or other materials to enhance ON/OFF contrast shall not affect the chromaticity and shall be uniform across the face of the lens. If a polymeric lens is used, a surface coating or chemical surface treatment shall be used to provide front surface abrasion resistance.

6. The signal module shall be sealed to the doorframe with a one-piece EPDM (ethylene propylene rubber) gasket.
7. The yellow and green arrow bimodal module shall be sized to meet the requirements of the latest Manual of Uniform Traffic Control Devices for Canada unless otherwise indicated in the contract Special Provisions. The LED’s shall be spread evenly across the illuminated portion of the arrow area.

8. The upraised hand (outline of hand) and walking pedestrian symbols shall be sized in accordance with the latest Manual of Uniform Traffic Control Devices for Canada unless otherwise indicated in the contract Special Provisions. The upraised hand and walking pedestrian symbols shall be supplied as a bimodal unit. The module shall be designed to fit into Ministry standard 300mm square pedestrian signal head.

602.4 PHOTOMETRIC REQUIREMENTS

.1 The photometric requirements of the LED modules shall conform to Section 4 of the ITE Standards with the following specific requirements:

1. The colour of the upraised hand symbol shall conform to the requirements of the latest Standard of the Institute of Transportation Engineers (ITE) "Pedestrian Traffic Control Signal Indications" (i.e. Portland orange for the upraised hand).

2. The colour of the yellow and green bimodal arrow shall meet the chromaticity requirements of the ITE specification.

602.5 ELECTRICAL REQUIREMENTS

.1 The electrical requirements of the LED modules shall conform to Section 5 of the ITE Standards with the following specific requirements:

1. The individual LED’s shall be wired such that a failure of one LED with result in the loss of not more than 5% of the signal module light output.

2. The signal module on-board circuitry shall include voltage surge protection to withstand high-repetition noise transients as stated in Section 2.1.6 of NEMA Standard TS-2, 1992.

3. The LED signal modules shall be operationally compatible with the Ministry’s currently used controller assemblies (solid state load switches, flashers, and conflict monitors).
4. As per the ITE Standard, the total harmonic distortion (THD) (current and voltage) induced into the AC power line by all LED signal modules shall not exceed 10 percent with a .9 power factor.

5. Module dimming is not required.

6. Conductors for the modules shall be 1 meter in length No 18 type TEW stranded copper wire rated for 105 degrees C and 600 V. The connection to the modules shall be done with quick disconnect terminals or shall be fixed wired to the module. The free ends of the conductors shall be terminated with quick disconnect spade connectors suitable for termination onto a standard signal housing terminal block. All connectors shall be securely attached so they do not vibrate loose.

7. Colour coding of wiring for LED modules shall be as follows:
   .1 Red display – Red.
   .2 Green display – Brown or Black.
   .3 Yellow display – Yellow.
   .4 Green/Yellow bimodal display – Brown or Black/Yellow.
   .5 Walking pedestrian display – Brown.
   .6 Upraised hand display - Red
   .7 Neutral - White.

8. Maximum initial power requirements for LED signal modules shall be as listed in Table 2.

<table>
<thead>
<tr>
<th>LED MODULE TYPE</th>
<th>MAXIMUM WATTAGE (25°C)</th>
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<tbody>
<tr>
<td>300 mm Red</td>
<td>10 W</td>
</tr>
<tr>
<td>200 mm Red</td>
<td>7 W</td>
</tr>
<tr>
<td>300 mm Green</td>
<td>12 W</td>
</tr>
<tr>
<td>200mm Green</td>
<td>10 W</td>
</tr>
<tr>
<td>300 mm Yellow</td>
<td>16 W</td>
</tr>
<tr>
<td>200 mm Yellow</td>
<td>10 W</td>
</tr>
<tr>
<td>300 mm Green Arrow</td>
<td>7 W</td>
</tr>
<tr>
<td>300 mm Yellow Arrow</td>
<td>7 W</td>
</tr>
<tr>
<td>300 mm Ped Don’t Walk</td>
<td>7 W</td>
</tr>
<tr>
<td>300 mm Ped Walk</td>
<td>7 W</td>
</tr>
</tbody>
</table>

Table 2. Maximum wattage for LED signal modules at 25°C
602.6 PACKAGING

.1 Shipping documentation shall include a print out of a spreadsheet containing a minimum of the following information:

1. Product description (e.g. 10 watt 300mm Red LED Signal Module).
2. Model number.
3. Serial number (Bar code number).
4. Date of manufacturer.
5. Ministry purchase order number and release number.
6. Any other pertinent information.

.2 The supplier shall provide the spreadsheet in electronic format containing the above information.

.3 Each signal module shall be securely packaged in a cardboard box to prevent damage when transporting. The exterior of all packaging shall be identified with the supplier’s name and product description.

.4 Any product damaged in shipping will be replaced at no extra cost to the Ministry.
603 TRAFFIC SIGNAL LAMPS

603.1 SCOPE

.1 This specification shall apply to the supply of traffic signal lamps. Traffic signal lamps shall generally consist of the following:

1. Argon Gas filled Lamps
   .1 69 watt
   .2 100 watt
   .3 150 watt
2. Krypton Gas filled Lamps
   .1 60 watt
   .2 90 watt
   .3 135 watt
3. 50 Watt Halogen Lamps for Fiber Optic Displays

.2 All items listed above will be referred to as “product” in this specification.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

603.2 PRODUCT OPERATING CONDITIONS

.1 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia.

603.3 ARGON AND KRYPTON TRAFFIC SIGNAL LAMPS

.1 All lamps may be Argon gas or Krypton gas filled and shall meet the minimum specifications listed in Table 3 and Table 4 and the following:
1. Lamps shall be approved to the appropriate, nationally-recognized standards by organizations accredited by the Standards Council of Canada to do so, and bear the organizations’ label.

2. Lamp filament construction shall be C-9 or C-11 style with seven supports - five hook supports and two main stem supports.

3. Lamp bases shall be medium screw base style and made of brass.

4. The filament shall be made of tungsten.

5. Krypton gas filled lamps shall contain a minimum of 80% Krypton gas. Krypton lamps shall have an aluminum disc to protect the socket and wiring from heat and to reflect light.

6. All lamps shall meet all applicable ANSI standards (C81.1 and C81.62).

7. All traffic signal lamps shall conform to the requirements of the latest Standard of the Institute of Traffic Engineers (ITE) Traffic Signal Lamps.

<table>
<thead>
<tr>
<th>TRAFFIC SIGNAL LAMP DESC.</th>
<th>RATED VOLTS</th>
<th>RATED WATTS</th>
<th>MIN. RATED LIFE</th>
<th>MIN. RATED INITIAL LUMENS</th>
<th>BULB</th>
<th>LIGHT CENTER LENGTH</th>
<th>OVERALL LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear 69 Watt</td>
<td>125</td>
<td>100</td>
<td>8000</td>
<td>665</td>
<td>A-21</td>
<td>2-7/16&quot;</td>
<td>4-3/8&quot;</td>
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<td>Clear 100 Watt</td>
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<td>100</td>
<td>8000</td>
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<td>2-7/16&quot;</td>
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<td>1750</td>
<td>A-21</td>
<td>3&quot;</td>
<td>4-5/16&quot;</td>
</tr>
</tbody>
</table>

Table 3. Argon gas filled lamps
### 603.4 IDENTIFICATION

.1 All traffic signal lamps shall have the Manufacturer’s trademark, product identification and wattage labeled on each bulb.

### 603.5 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 Products shall be packaged in a cardboard box to prevent damage when transporting. The exterior of the packaging shall be identified with the lamp type and wattage.

.3 Any product damaged in shipping shall be replaced at no extra cost to the Ministry.
604 TRAFFIC SIGNAL MOUNTING HARDWARE

604.1 SCOPE

.1 This specification shall apply to the supply of traffic signal mounting hardware. Traffic signal mounting hardware shall generally consist of the following:

1. Post Top Adapters.
2. Two Way Tubular and T-Section Spreaders.
3. Three Way Tubular and T-Section Spreaders.
4. Four Way Tubular and T-Section Spreaders.
5. Small Spacers.
6. Large Spacers.
7. Pole Plates.
8. Single Arm Tubular and T-Section Brackets.
9. Side Mount Kit (includes 2 Poles Plates, one Tubular and one T-Section single arm bracket).
11. Spring Cushion End Hanger.
12. Spring Cushion End Sign Hanger.
13. Spring Cushion Mid Span Hanger.
14. Spring Cushion Mid Span Sign Hanger.
15. Span Wire Hanger and Cable Entrance.
16. Mast Arm Mount - Articulating Signal Clamping Device

.2 All items listed above and shown on the Material Standard drawings will be referred to as “product” in this specification.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.
604.2 MATERIAL STANDARDS DRAWINGS

.1 All products shall be supplied in accordance with the Material Standard drawings listed in Table 5.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware and electrical components. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.

.3 The supplier shall verify that the product shown on the drawings is fully interchangeable with current pre-approved product.

<table>
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<tr>
<th>DRAWING NO.</th>
<th>DRAWING TITLE</th>
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<td>MS620.1</td>
<td>Traffic Signal Mounting Hardware - Post Top Adapter Details</td>
</tr>
<tr>
<td>MS621.1</td>
<td>Traffic Signal Mounting Hardware - 2 Way T-Section Spreader Details</td>
</tr>
<tr>
<td>MS621.2</td>
<td>Traffic Signal Mounting Hardware - 2 Way Tubular Spreader Details</td>
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<tr>
<td>MS622.1</td>
<td>Traffic Signal Mounting Hardware - 3 Way T-Section Spreader Details</td>
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<td>MS622.2</td>
<td>Traffic Signal Mounting Hardware - 3 Way T-Section Spreader Details</td>
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<td>MS622.3</td>
<td>Traffic Signal Mounting Hardware - 3 Way Tubular Spreader Details</td>
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<td>MS622.4</td>
<td>Traffic Signal Mounting Hardware - 3 Way Tubular Spreader Details</td>
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<td>Traffic Signal Mounting Hardware - 4 Way T-Section Spreader Details</td>
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<td>Traffic Signal Mounting Hardware - 4 Way Tubular Spreader Details</td>
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<td>Traffic Signal Mounting Hardware - 4 Way Tubular Spreader Details</td>
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<td>MS624.1</td>
<td>Traffic Signal Mounting Hardware - Small Spacer Details</td>
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<td>MS624.2</td>
<td>Traffic Signal Mounting Hardware - Large Spacer Details</td>
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<td>MS624.3</td>
<td>Traffic Signal Mounting Hardware - Large Spacer Details</td>
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<td>MS625.1</td>
<td>Traffic Signal Mounting Hardware - Pole Plate (with Nipple) Details</td>
</tr>
<tr>
<td>MS625.2</td>
<td>Traffic Signal Mounting Hardware - Single Arm Tubular Bracket Details</td>
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<td>MS625.3</td>
<td>Traffic Signal Mounting Hardware - Pole Plate (with no Nipple) Details</td>
</tr>
<tr>
<td>MS625.4</td>
<td>Traffic Signal Mounting Hardware - Single Arm T-Section Bracket Details</td>
</tr>
<tr>
<td>MS626.1</td>
<td>Traffic Signal Mounting Hardware - Plumbizer Details</td>
</tr>
<tr>
<td>MS626.2</td>
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Table 5. Material standard drawings for traffic signal mounting hardware
<table>
<thead>
<tr>
<th>Material Standard</th>
<th>Description</th>
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<tbody>
<tr>
<td>MS626.3</td>
<td>Traffic Signal Mounting Hardware - Plumbizer Details</td>
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<td>MS626.4</td>
<td>Traffic Signal Mounting Hardware - Plumbizer Details</td>
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<td>MS626.5</td>
<td>Traffic Signal Mounting Hardware - Plumbizer Details</td>
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<td>Traffic Signal Mounting Hardware - Plumbizer Details</td>
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<td>MS626.8</td>
<td>Traffic Signal Mounting Hardware - Plumbizer Details</td>
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<td>MS627.1</td>
<td>Small Overhead Sign Mounting Hardware – Bracket Details</td>
</tr>
<tr>
<td>MS627.2</td>
<td>Small Overhead Sign Mounting Hardware – Bracket Details</td>
</tr>
<tr>
<td>MS628.1</td>
<td>Traffic Signal/Sign Mounting Hardware - Spring Cushion End Hanger Details</td>
</tr>
<tr>
<td>MS628.2</td>
<td>Traffic Signal/Sign Mounting Hardware - Spring Cushion End Hanger Details</td>
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<td>MS629.1</td>
<td>Traffic Signal/Sign Mounting Hardware - Spring Cushion End Sign Hanger Details</td>
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<td>MS629.2</td>
<td>Traffic Signal/Sign Mounting Hardware - Spring Cushion End Sign Hanger Details</td>
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<td>MS630.1</td>
<td>Traffic Signal/Sign Mounting Hardware - Spring Cushion Mid Hanger Details</td>
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<td>MS630.2</td>
<td>Traffic Signal/Sign Mounting Hardware - Spring Cushion Mid Hanger Elevation</td>
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<td>MS631.1</td>
<td>Traffic Signal/Sign Mounting Hardware - Spring Cushion Mid Sign Hanger Details</td>
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<td>MS631.2</td>
<td>Traffic Signal/Sign Mounting Hardware - Spring Cushion Mid Sign Hanger Details</td>
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<td>MS632.1</td>
<td>Traffic Signal Mounting Hardware - Span Wire Hanger Details</td>
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<tr>
<td>MS632.2</td>
<td>Traffic Signal Mounting Hardware - Span Wire Hanger Details</td>
</tr>
<tr>
<td>MS632.3</td>
<td>Traffic Signal Mounting Hardware - Span Wire Hanger Details</td>
</tr>
<tr>
<td>MS632.4</td>
<td>Traffic Signal Mounting Hardware - Span Wire Hanger Details</td>
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<td>MS632.5</td>
<td>Traffic Signal Mounting Hardware - Span Wire Hanger Details</td>
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<td>MS632.6</td>
<td>Traffic Signal Mounting Hardware - Span Wire Hanger Details</td>
</tr>
<tr>
<td>MS633.1</td>
<td>Traffic Signal Mounting Hardware - Finial Details</td>
</tr>
<tr>
<td>MS633.2</td>
<td>Traffic Signal Mounting Hardware - Finial Details</td>
</tr>
</tbody>
</table>

Table 5. Material standard drawings for traffic signal mounting hardware, continued
604.3 PRODUCT OPERATING CONDITIONS

.1 Traffic signal mounting hardware will generally be installed on poles and posts to support traffic signal and sign equipment.

.2 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia.

604.4 GENERAL REQUIREMENTS FOR SIGNAL MOUNTING HARDWARE

.1 Signal mounting hardware shall conform to the requirements of the latest Standard of the Institute of Transportation Engineers (ITE) “Vehicle Traffic Control Signal Heads” and the specific requirements of this specification.

.2 Unless otherwise noted, signal-mounting hardware shall be cast using aluminum alloy No 356.2 heat treated to T6.

.3 All threads shall be de-burred and cleaned so that parts join freely.

604.5 CONNECTING HARDWARE

.1 Miscellaneous hardware other than screws, nuts, bolts and washers shall be stainless steel or zinc dichromate plated. Other hardware coatings must be submitted to the Ministry for approval.

.2 Connecting hardware (i.e. screws, nuts, bolts and washers) 3/8” diameter or smaller and shall conform to the following:
   1. All hardware shall have unified national thread form (ANSI) and shall be 18-8 or 316 stainless steel.
   2. All nuts and bolts 1/4-20 and larger shall have UNC (Unified National Course) threads and hexagon heads, and shall bear suitable markings to identify their grade and origin of manufacture.
   3. All studs shall have UNC (Unified National Course) threads.
   4. All machine screws smaller than 1/4-20 (e.g. 8-32 UNC, 10-24 UNC) shall be Robertson pan-head. All screw heads shall be sized so only one screwdriver is required when working on hardware.
   5. No sheet metal or self-tapping screws shall be used.
604.6 MAST ARM MOUNT - ARTICULATING SIGNAL CLAMPING DEVICE

604.6.1 General
.1 The Articulating Signal Clamping Device shall meet the requirements of each of the following subsections.

604.6.2 Material
.1 Mast Arm Mount Articulating Signal Clamping Device shall be cast from aluminum alloy 713 or equivalent, free of voids, pits, dents, molding sand and excessive foundry grinding marks. All design radii shall be smooth and intact. Exterior surface finish shall be smooth and cosmetically acceptable, free of molding fins, cracks and other exterior blemishes. Certification shall be available upon request.

.2 Shall be fabricated from aluminum ingot with minimum requirements as follows:

<table>
<thead>
<tr>
<th>Material Property</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Alloy</td>
<td>713</td>
</tr>
<tr>
<td>Brinell Hardness</td>
<td>74</td>
</tr>
<tr>
<td>Yield Strength, KSI</td>
<td>26</td>
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<tr>
<td>Elongation (% in 2&quot;)</td>
<td>5</td>
</tr>
<tr>
<td>Tensile Strength, KSI</td>
<td>36</td>
</tr>
</tbody>
</table>

604.6.3 Design
.1 The Articulated Signal Clamping Device shall be fabricated with dimensions and design characteristics as shown in Figure 1.

.2 The device shall have the functional design characteristics as shown in Figure 1. Alternative designs will be considered for approval.

1. Mast Arm Cable Mount (Shown as A).
2. Articulating Male (Shown as B).
3. Articulating Saddle (Shown as C).
The Mast Arm Cable Clamp (A) shall be attached to the structure by means of a aircraft type stranded cable which shall be fabricated in one piece with a minimum diameter of 3/16" either galvanized or stainless steel. The cable shall be complete with 7/16" stainless steel clamp screw permanently attached to each end. Each clamp screw shall be fitted with a stainless steel hex. nut, SAE flatwasher and an aluminum-bearing washer. The clamp screw shall be flattened on two opposite sides for wrench accommodation. The stranded cable shall be of sufficient length to fasten the clamp assembly to a minimum pole diameter of 8.6". The clamp shall be designed to fit around various diameter and shaped structures. The cable shall be attached to the clamp by two mounting pads that allow the cable to be adjusted for multiple diameters. The final tightening shall be made on each clamp screw located at each end of the cable. The interior of the cable clamp shall be open to provide access for signal cable.

The Articulating Male (B) shall be hollow to provide wire access. One end shall mate to the Mast Arm Cable Fitting and be secured by a retaining ring. The other end shall have a 72 tooth serrated ring cast into the part. The Articulating Male shall be capable of being rotated 360 degrees.
.5 The Articulating Saddle (C) shall be hollow to provide wire access. One end shall be serrated to mate to the Articulating Male and have three (3) self-centering bosses extending 3/16" to allow for ease of assembly. The other end shall have a saddle to fit onto a 1.90" support tube. The saddle shall have four (4) holes to accommodate two (2) U-bolts. The U-bolts will secure the support tube to the saddle. The Articulating Male and Saddle shall be secured by a minimum 3/8"-16 stainless steel bolt, lockwasher and nut. When assembled the Male and Saddle shall rotate approximately 240 degrees.

.6 The Signal Mounting Device shall be capable of being rotated in any direction shown in Figure 1.

.7 The Articulated Signal Clamping Device shall be supplied with an extruded aluminum support tube. The tube shall have a concealed wireway and tube cap.

.8 The Articulated Signal Clamping Device shall be supplied with a cast aluminum upper and lower signal support arm. The signal support arms shall be supplied with stainless steel signal head support hardware. The support arms shall be powder coated green.

.9 All support hardware shall be grade 5 stainless steel.

.10 The supplier shall provide evidence that the Articulated Signal Clamping Device has supported a 4 section aluminum traffic signal head complete with a standard backboard under normal operating conditions for a minimum of 5 years without failure.

604.6.4 Finish

.1 All aluminum parts shall have an Alodine 1200 (or equivalent) finish.

.2 Any non-stainless parts shall have a yellow zinc di-chromate finish.

604.7 COATING

.1 With exception to the plumbizers, articulated signal clamping device and spring cushion hangers, all traffic signal hardware shall be powder coated green in accordance with Appendix B - Powder Coat Specification. The plumbizer and the spring cushion hangers shall be left unpainted.
604.8 IDENTIFICATION

.1 The supplier’s trademark and product identification shall be stamped on the outside of all product.

604.9 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 Product shall be individually packaged in cardboard boxes and the hardware packaged in sealed plastic bags to the satisfaction of the Ministry Representative. The exterior of the boxes shall be identified with the material name and Ministry stock number.

.3 Single arm brackets, top and bottom pole plates and fastening hardware shall be packaged in a cardboard box. The hardware shall be sealed in a plastic bag.

.4 Cardboard boxes shall be shipped on wood pallets for easy offloading.

.5 Any product damaged in shipping shall be replaced at no extra cost to the Ministry.
605  PUSHBUTTONS AND SIGN ASSEMBLY

605.1  SCOPE

.1 This specification shall apply to the supply of pedestrian and cycle pushbuttons, sign assembly and related components.

.2 All items listed above and shown on the Material Standards drawings will be referred to as “product” in this specification.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

605.2  MATERIAL STANDARDS DRAWINGS

.1 All products shall be supplied in accordance with the Material Standard drawings listed in Table 6.

<table>
<thead>
<tr>
<th>DRAWING NO.</th>
<th>DRAWING TITLE</th>
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</thead>
<tbody>
<tr>
<td>MS640.1</td>
<td>Push Button and Sign Assembly – Details</td>
</tr>
<tr>
<td>MS640.2</td>
<td>Push Button and Sign Assembly – Details</td>
</tr>
</tbody>
</table>

Table 6. Material standard drawings for pushbuttons

605.3  PRODUCT OPERATING CONDITIONS

.1 Pushbuttons will generally be installed on signal poles and posts.

.2 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia.
605.4 MATERIALS AND FABRICATION

605.4.1 Pedestrian Pushbutton

.1 The pushbutton shall meet the following requirements:

1. Provide a 50mm button with housing capable of mounting onto the standard integral sign assembly.
2. The round button housing assembly shall be yellow and the button shall be green coated or stainless steel.
3. Provide a switch with normally open contact.
4. Provide a flush mount white LED integral with the button housing and pre-wired to the lead terminals. The LED shall turn on when the button is pressed.
5. Provide 2 No. 14 RW90 purple conductors (2200mm in length) attached to the terminals. Wire connection to the terminals shall be made using insulated compression connectors.
6. Provide a button that is vandal resistant and that will not corrode.
7. Provide stainless steel connecting hardware for mounting the button to the sign assembly.
8. Must be of a design that driving freezing rain, snow build-up or pooling of water and ice will not cause the button to stick.
9. Provide a pushbutton approved to the appropriate, nationally-recognized standards by organizations accredited by the Standards Council of Canada to do so, and bear the organizations’ label.

605.4.2 Cast Aluminum Sign Assembly

.1 This specification defines the requirements for two styles of cast aluminum sign assemblies for pedestrian and cyclists. The first option incorporates the sign face into the casting and the second option allows for the attachment of a standard aluminum sign to the face of the casting. The style of sign to be used will be defined in the special provisions.

.2 The integral sign casting shall meet the following requirements:

1. Provide sign messaging with raised figures that comply with the Transportation Association of Canada symbols for pedestrian and cyclist crossings as shown on the drawings.
2. Sign assembly shall be cast using aluminum alloy No 356.2 heat treated to T6.
3. Ensure that the threads are compatible with the screws provided with the pushbutton. All threads shall be de-burred and cleaned.
4. Provide stainless steel hardware to fasten the casting to the pole.

.3 Aluminum sign mounted to the face of the casting
   1. The pushbutton and sign assembly shall be as shown on the drawings except that the sign assembly shall be designed to accept standard 200mm X 130mm SP-10L, 10D and 10R signs.
   2. Sign assembly shall be cast using aluminum alloy No 356.2 heat treated to T6.
   3. Ensure that the threads are compatible with the screws provided with the pushbutton. All threads shall be de-burred and cleaned.
   4. Provide stainless steel hardware to fasten the casting to the pole.
   5. Provide stainless steel hardware to attach the aluminum sign to the casting.

.4 Aluminum signs:
   1. Aluminum SP-10L, 10D and 10R signs messaging shall comply with the TAC Manual and shall be manufactured in compliance with the Ministry of Transportation Specifications for Standard Highway Sign Materials, Fabrication and Supply.

605.4.3 Connecting Hardware
   .1 Miscellaneous hardware other than screws, nuts, bolts and washers shall be stainless steel or zinc dichromate plated. Other hardware coatings must be submitted to the Ministry for approval.
   .2 Connecting hardware (i.e. screws, nuts, bolts and washers) 3/8” diameter or smaller and shall conform to the following:
      1. All hardware shall have unified national thread form (ANSI) and shall be 18-8 or 316 stainless steel.
      2. All nuts and bolts 1/4-20 and larger shall have UNC (Unified National Course) threads and hexagon heads, and shall bear suitable markings to identify their grade and origin of manufacture.
      3. All machine screws smaller than 1/4-20 (e.g. 8-32 UNC, 10-24 UNC) shall be Robertson pan-head.
4. All screw heads shall be sized so only one screwdriver is required when working on hardware.

605.5 COATING

.1 The sign casting shall be powder coated yellow in accordance with Appendix B - Powder Coat Specification. The raised figures shall be painted black with a paint designed to adhere to the powder-coated surface.

.2 Pushbuttons shall be powder coated yellow in accordance with Appendix B - Powder Coat Specification.

605.6 IDENTIFICATION

.1 The supplier’s trademark and product identification shall be stamped on the outside of all product. The supplier shall also uniquely identify all pushbuttons with a serial number.

605.7 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 Product shall be individually packaged in cardboard boxes and the hardware packaged in sealed plastic bags to the satisfaction of the Ministry Representative. The exterior of the boxes shall be identified with the material name and Ministry stock number.

.3 Any product damaged in shipping shall be replaced at no extra cost to the Ministry.
606 POST MOUNTED FLASHER LUMINAIRES

606.1 SCOPE

.1 This specification shall apply to the supply for post-mounted flasher luminaires and related components.

.2 All items listed above and shown on the Material Standard drawings will be referred to as “product” in this specification.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

606.2 MATERIAL STANDARDS DRAWINGS

.1 All products shall be supplied in accordance with the Material Standard drawings listed in Table 7.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware and electrical components. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.

.3 The supplier shall verify that the product shown on the drawings is fully interchangeable with current pre-approved product.
### PRODUCT OPERATING CONDITIONS

.1 Flasher luminaires will generally be installed on poles or posts and shall be exposed to vehicular impacts.

.2 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia.

### MATERIALS AND FABRICATION

.1 Materials shall be new.

.2 Flasher luminaires shall be approved to the appropriate nationally recognized standards by organizations accredited by the Standards Council of Canada to do so, and bear the organizations’ label inside the housing.

.3 Flasher luminaires shall be cast using aluminum alloy heat treated to T6.

.4 Miscellaneous hardware other than screws, nuts, bolts and washers shall be stainless steel or zinc dichromate plated. Other hardware coatings must be submitted to the Ministry for approval.

.5 Connecting hardware (i.e. screws, nuts, bolts and washers) 3/8” diameter or smaller and shall conform to the following:

1. All hardware shall have unified national thread form (ANSI) and shall be 18-8 or 316 stainless steel.
2. All nuts and bolts 1/4-20 and larger shall have UNC (Unified National Course) threads and hexagon heads, and shall bear suitable markings to identify their grade and origin of manufacture.

3. All machine screws smaller than 1/4-20 (e.g. 8-32 UNC, 10-24 UNC) shall be Robertson pan-head. All screw heads shall be sized so only one screwdriver is required when working on the flasher.

4. No sheet metal or self-tapping screws shall be used.

606.5 ELECTRICAL

.1 Lamp holder shall be glazed porcelain, corrosion resistant metal socket sized for a medium base lamp complete with anti-vibration lamp grips and spring-loaded centre contact.

.2 Lamp sockets shall be pre-wired with No. 18 type TEW stranded copper wire rated for 105 degrees C and 600 V. The wire leads shall be 300mm long and coiled behind the barrier plate. The wires shall be connected to the lamp socket using nylon insulated ring terminals (Sta-Kon style). A 300mm long bond wire shall also be supplied. The bond wire shall be connected to the bond stud using a nylon insulated ring terminal (Sta-Kon style).

.3 Colour coding of wiring shall be as follows:
   1. Hot - Black.

606.6 LENS

.1 The lens shall be yellow and shall be manufactured from 5 mm thick, high impact, prismatic polycarbonate material. The lens material shall be ultraviolet stabilized for colour retention. The lens shall withstand the high ambient temperatures generated by continuous lamp operation. The colour of the yellow lens shall meet ITE Standards for chromaticity.

606.7 COATING

.1 The post mounted flasher luminaire housing and lens guard shall be powder coated green in accordance with Appendix B - Powder Coat Specification.
606.8 IDENTIFICATION
.1 The supplier’s trademark and product identification shall be stamped on the outside of all product.

606.9 PACKAGING
.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 Product shall be individually packaged in cardboard boxes. The exterior of the boxes shall be identified with the material name and Ministry stock number.

.3 Cardboard boxes shall be shipped on wood pallets for easy offloading.

.4 Any product damaged in shipping shall be replaced at no extra cost to the Ministry.
607 AUDIBLE SIGNALS

607.1 SCOPE

.1 This specification shall apply to the supply of Audible Signals and related components.

.2 All items listed above and shown on the Material Standard drawings will be referred to as “product” in this specification.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

607.2 MATERIAL STANDARDS DRAWING

.1 The audible signal mounting assembly shall be as shown on Material Standard Drawing MS660.1 and MS660.2 and MS660.2.

607.3 PRODUCT OPERATING CONDITIONS

.1 The product will generally be installed on top of pedestrian heads.

.2 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia. The product shall operate in temperatures from -37 degrees C to +74 degrees C.

607.4 MATERIALS AND FABRICATION

.1 Audible Signals shall be supplied with all mounting hardware as detailed on the applicable Material Standard drawings.

.2 The enclosure shall be made of aluminum and shall be weatherproof. Approximate dimensions are 125 x 95 x 125 mm (L x W x H).
AUDIBLE SIGNALS

.3 The mounting shall be a positive locking heavy-duty swivel as shown on the Material Standard drawings.

.4 All mounting screws shall be 18-8 stainless steel, Robertson 10-32 pan-head machine screws. All screw heads shall be sized so only one screwdriver is required when working on the unit.

.5 All other fastening hardware shall be stainless steel.

607.5 COATING

.1 The housing shall be powder coated grey in accordance with Appendix B - Powder Coat Specification.

607.6 OUTPUT

.1 The unit shall be capable of emitting audible signals set by the Transportation Association of Canada (TAC) Sub-Committee, Project No. 122.

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SOUND #1</th>
<th>SOUND #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound Type</td>
<td>Bird Call “Chirp-Chirp”</td>
<td>Bird Call “Cuckoo”</td>
</tr>
<tr>
<td>Walk Direction</td>
<td>East-West</td>
<td>North-South</td>
</tr>
<tr>
<td>Method</td>
<td>Varying frequency tone</td>
<td>Alternating high and low tones</td>
</tr>
<tr>
<td>Period</td>
<td>1.0 second (± 20%)</td>
<td>1.5 second (± 20%)</td>
</tr>
<tr>
<td>Duration</td>
<td>0.2 seconds (± 20%)</td>
<td>0.6 seconds (± 20%)</td>
</tr>
<tr>
<td>Frequency Base</td>
<td>2,800 Hz (± 20%)</td>
<td>1,100 Hz (± 20%)</td>
</tr>
<tr>
<td>Frequency Deviation</td>
<td>-800 Hz (± 20%)</td>
<td>+120 Hz (± 20%)</td>
</tr>
</tbody>
</table>

Table 8. Audible signal output parameters
.2 The selection of sounds shall be made through a switch mounted on the PC board. Should the switch go open circuit, the unit shall have a fail-safe feature that will also allow no sound to be emitted.

.3 The volume shall be factory adjusted to provide approximately 66 dB sound output at 1 meter to reflect minimal street activity. During higher levels of ambient street noise, the sound output shall increase proportionately up to a maximum of approximately 90 dB at 1m. The sound output shall reflect the relative level of ambient noise during the Walk indication. The response time of the automatic volume control is between 150 to 200 milliseconds. The unit shall have a potentiometer to adjust the minimum volume level (i.e. to set volume during minimal street activity).

.4 The unit shall have a sound inhibit input by applying either 24V DC or 120 VAC to disable the sound at certain times of day.

607.7 ELECTRICAL

.1 Audible signals shall be approved to the appropriate, nationally recognized standards by organizations accredited by the Standards Council of Canada to do so, and bear the organizations’ label inside the housing.

.2 The unit shall be powered from 115 VAC (±20 VAC), 60 Hz. The power requirements shall not exceed 3 watts. The unit shall have a replaceable fuse mounted inside the housing.

.3 The printed circuit board shall be protected with an Acrylic conformal coating.

.4 Movisters shall be used to protect the unit from high voltage transients. Movisters shall be installed between AC+ and neutral, AC+ and ground; and neutral and ground.

.5 The speaker steel basket shall have a zinc dichromate finish. The voice coil shall be solid aluminum. Speaker cones shall be constructed of vinyl impregnated cloth to withstand immersion in water, direct sunlight and extreme temperatures (ambient operating -37ºC to +74ºC). Speakers shall withstand a total immersion in water for 96 hours without deterioration of sound quality. Speaker voice coil area shall be protected from ferrous and non-ferrous particles. Speakers shall be rated for 4 watts RMS and have a frequency response of 250 Hz to 7 kHz.
.6 Each unit shall be supplied with a 1.5 meter long six conductor No.20 AWG control cable for field installation. Conductor identification shall be as follows:

1. Walk Signal (120 V AC). - Blue
2. Don’t Walk Signal (120 V AC) - Orange
5. Inhibit Input - Black.
6. Inhibit Common - White/Purple.

.7 Each unit shall be supplied with a complete set of installation instructions.

607.8 IDENTIFICATION

.1 The Manufacturer’s trademark and product identification shall be labeled on the outside of the unit in an easily identifiable location.

607.9 PACKAGING

.1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.

.2 Product shall be individually packaged in cardboard boxes. The exterior of the boxes shall be identified with the material name and Ministry stock number.

.3 Any product damaged in shipping shall be replaced at no extra cost to the Ministry.
608 SHIELDED CABLES

608.1 SCOPE

.1 This specification shall apply to the supply of shielded cable. Shielded cable will be referred to as “product” in this specification.

.2 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

608.2 PRODUCT OPERATING CONDITIONS

.1 Shielded Cables will generally be installed in an underground conduit system.

.2 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia.

608.3 MATERIALS AND FABRICATION

.1 Cable shall be approved to the appropriate, nationally-recognized standards by organizations accredited by the Standards Council of Canada to do so, and bear the organizations’ label on the outside of the cable.

.2 Shielded Cables shall be supplied in accordance with Table 9 and Table 10.

.3 The electrical and physical requirements of the cable shall fall within 5% of the specified values shown in Table 9 and Table 10.

.4 Each length of shielded cable shall be supplied in complete lengths with no splices.
608.4 IDENTIFICATION
   .1 The supplier’s trademark, product identification and cable specification shall be stamped on the cable at every 1200 mm.

608.5 PACKAGING
   .1 Shipping documentation shall include an itemized bill of materials, purchase order number and Ministry release number.
   .2 The Shielded Cable shall be supplied on reels and packaged in a cardboard box to prevent damage when transporting.
   .3 Shielded Cable shall be supplied in lengths as specified.
   .4 The exterior of the packaging shall be identified with the material name and Ministry stock number.
   .5 Any product damaged in shipping shall be replaced at no extra cost to the Ministry.
### SHIELDED CABLES

<table>
<thead>
<tr>
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<th>REQUIREMENTS</th>
</tr>
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</table>
| **DESCRIPTION** | • Belden 9318 or approved alternate.  
• Two No. 18 stranded AWG (19-thirty gauge strands) tinned copper drain wire with 0.41 mm thick PVC insulated twisted pair conductors.  
• Colour code: Black, Red.  
• Cable shall have a 5 year warranty from defects. |
| **ELECTRICAL** | • Maximum operating voltage.  
• Maximum continuous current per conductor @ 25°C.  
• Nominal capacitance between conductors of pair @ 1 KHz.  
• Nominal capacitance from conductor to shield @ 1 KHz with the other conductor tied to the shield.  
• Nominal inductance of pairs.  
• Nominal conductor DC resistance @ 20°C.  
• Nominal shield DC resistance @ 20°C.  |
| **PHYSICAL** | • Temperature rating.  
• Insulation material.  
• Jacket material.  
• Nominal cable outside diameter.  
• Type of shield and % of coverage.  
• Twisted pair lay length.  
• Maximum pulling tension.  
• Minimum bend radius.  
• Nominal weight/300 m  
• Applicable specification.  
• Colour code.  
• Flame resistance.  |

<p>| | |</p>
<table>
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</thead>
<tbody>
<tr>
<td>• Maximum operating voltage.</td>
<td>300 V rms.</td>
</tr>
<tr>
<td>• Maximum continuous current per conductor @ 25°C.</td>
<td>5.5 A.</td>
</tr>
<tr>
<td>• Nominal capacitance between conductors of pair @ 1 KHz.</td>
<td>177 pF/m (54 pF/ft.).</td>
</tr>
<tr>
<td>• Nominal capacitance from conductor to shield @ 1 KHz with the other conductor tied to the shield.</td>
<td>328 pF/m (100 pF/ft.).</td>
</tr>
<tr>
<td>• Nominal inductance of pairs.</td>
<td>0.56 µH/m. (0.17 µH/ft.).</td>
</tr>
<tr>
<td>• Nominal conductor DC resistance @ 20°C.</td>
<td>5.87 ohms/300 m (5.96 ohms/1000 ft.).</td>
</tr>
<tr>
<td>• Nominal shield DC resistance @ 20°C.</td>
<td>8.86 ohms/300 m (9.0 ohms/1000 ft.).</td>
</tr>
<tr>
<td>• Temperature rating.</td>
<td>-30°C to +80°C.</td>
</tr>
<tr>
<td>• Insulation material.</td>
<td>PVC (polyvinyl chloride).</td>
</tr>
<tr>
<td>• Jacket material.</td>
<td>0.94 mm thick, sunlight resistant chrome - coloured PVC.</td>
</tr>
<tr>
<td>• Nominal cable outside diameter.</td>
<td>5.92 mm.</td>
</tr>
<tr>
<td>• Type of shield and % of coverage.</td>
<td>Polyester aluminum tape with 100% coverage.</td>
</tr>
<tr>
<td>• Twisted pair lay length.</td>
<td>4.11 cm - 24.3 twists/m (1.62” - 7.4 twists/ft.).</td>
</tr>
<tr>
<td>• Maximum pulling tension.</td>
<td>27.2 kg. (60 lbs.).</td>
</tr>
<tr>
<td>• Minimum bend radius.</td>
<td>6.1 cm (2.4”).</td>
</tr>
<tr>
<td>• Nominal weight/300 m</td>
<td>14.35 kg. (31.57 lbs.).</td>
</tr>
<tr>
<td>• Applicable specification.</td>
<td>CSA FAS90.</td>
</tr>
<tr>
<td>• Colour code.</td>
<td>Black and Red.</td>
</tr>
<tr>
<td>• Flame resistance.</td>
<td>CSA FT4 flame test.</td>
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Table 9. Specifications - Shielded cable for loops and telephone communications
### CATEGORY REQUIREMENTS

#### DESCRIPTION

- Belden 9773 or approved alternate.
- No. 18 stranded AWG (19-thirty gauge strands) - 3 individually shielded pairs, each with tinned copper drain wire.
- Colour code: Black and Red; Black and White; Black and Green.
- Cable shall have a 5 year warranty from defects.

#### ELECTRICAL

- Maximum operating voltage. 300 V rms.
- Maximum continuous current per conductor @ 25° C. 3.64 A.
- Nominal capacitance between conductors of pair @ 1 KHz. 98 pF/m (30 pF/ft.)
- Nominal capacitance from conductor to shield @ 1 KHz with the other conductor tied to the shield. 180 pF/m (55 pF/ft.)
- Nominal impedance 50 ohms
- Nominal inductance of pairs. 0.59 µH/m. (0.18 µH/ft.)
- Nominal conductor DC resistance @ 20° C. 6.3 ohms/300 m (6.4 ohms/1000 ft.)
- Nominal shield DC resistance @ 20° C. 8.2 ohms/300 m (8.3 ohms/1000 ft.)

#### PHYSICAL

- Temperature rating. -30° C to +80° C.
- Insulation material. Polyethylene
- Jacket material. Chrome coloured PVC.
- Nominal cable outside diameter. 10.21 mm. (.402 in)
- Type of shield and % of coverage. Polyester aluminum tape with 100% coverage
- Twisted pair lay length. 4.11 cm - 24.3 twists/m (1.62” - 7.4 twists/ft.)
- Maximum pulling tension. 80.5 kg. (177 lbs.)
- Minimum bend radius. 9.5 cm (3.75”)
- Nominal weight/300 m 37.1 kg. (81.7 lbs.)
- Applicable specification. CSA Certified.
- Colour code. Black (Rx1) and red (Tx1), Black (Rx2) and White (Tx2), Black (Spare) and Green (Spare).
- Flame resistance. CSA FT1 flame test.

Table 10. Specifications - Shielded cable for traffic signal intertie.
Section 700
Internally Illuminated Signs

Engineering Branch

December 2003
# 700 INTERNALLY ILLUMINATED SIGNS

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701 LED LANE CONTROL SIGNALS

701.1 SCOPE

.1 This specification shall apply to the supply, testing and delivery of LED lane control signs complete with visor, backboard and mounting hardware, herein referred to as product.

.2 Signs shall be manufactured in various display configurations as required in the contract Special Provisions.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

701.2 MATERIAL STANDARDS DRAWINGS

.1 All products shall be supplied in accordance with the drawings listed in Table 1. The supplier shall note that all drawings are in imperial units and that they are printed approximately to half size. The Ministry will provide full size drawings to the successful bidder. Should the size and shape of the enclosure be modified by Special Provisions, then the Supplier shall submit detailed manufacturing drawings in Autocad format to the Ministry Representative for approval.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware and electrical components. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.
701.3 QUALIFICATIONS

.1 The supplier shall produce evidence of satisfactory aluminum welding experience as well as evidence that the manufacturing plant has been performing the type of manufacturing required by this specification for a continuous period of not less than five years. Acceptance of the supplier will be at the discretion of the Ministry’s assessment of the supplier’s organization, personnel, equipment and past performance.

701.4 PRODUCT OPERATING REQUIREMENTS

.1 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia. The product will be exposed to temperatures ranging from minus 40 degrees C to plus 74 degrees C.

701.5 MATERIALS

.1 All materials shall be new.

.2 All electrical materials shall be CSA approved.
.3 All stainless steel plate shall be grade 304-4.

.4 Unless otherwise noted, the enclosure shall be fabricated from 1/8” thick - 5052-H32 sheet aluminum.

701.6 CONNECTING HARDWARE

.1 Miscellaneous hardware other than screws, nuts, bolts and washers shall be stainless steel or zinc dichromate plated. Other hardware coatings must be submitted to the Ministry for approval.

.2 Connecting hardware (i.e. screws, nuts, bolts and washers) shall conform to the following:

1. All hardware shall have unified national thread form (ANSI) and shall be 18-8 or 316 stainless steel.

2. All nuts and bolts 1/4-20 and larger shall have UNC (Unified National Course) threads and hexagon heads, and shall bear suitable markings to identify their grade and origin of manufacture.

3. All studs shall have UNC (Unified National Course) threads.

4. All machine screws smaller than 1/4-20 (e.g. 8-32 UNC, 10-24 UNC) shall be Robertson pan-head. All screw heads shall be sized so only one screwdriver is required when working on display.

5. No sheet metal or self-tapping screws shall be used.

701.7 FABRICATION

701.7.1 General

.1 The enclosure is designed to meet CSA enclosure 4X designation.

.2 The cabinet enclosure shall be CNC manufactured. The Ministry will supply Autocad drawings of the enclosure for use in the CNC manufacturing.
The hardware and equipment lists shown on the drawings describe the required components to fabricate the product. No substitutes are permitted without Ministry approval. The supplier shall confirm that all components fit into the unit and shall produce a complete working product as specified. The supplier shall contact the Ministry Representative, if minor adjustments to component locations are required.

### 701.7.2 Welding

1. All welds shall be in accordance with CAN/CSA W59.2 - Welded Aluminum Construction.
2. All exterior seams shall be of continuously welded construction. All exterior welds shall be ground smooth.
3. All welds shall be free of slag and spatter.

### 701.7.3 Door and removable Cover Gaskets

1. The gasket shall be of one continuous piece per side (i.e. four strips per opening) and shall be permanently bonded to the metal.
2. The gasket shall be of an appropriate length so as not to have gaps at gasket joints or to shrink over time. The surface of the gasket shall be covered with a silicon lubricant to prevent sticking to the mating surface.

### 701.7.4 Tolerances

1. The cabinet shall be manufactured to the tolerances shown on the drawings.

### 701.8 DISPLAY FACE

1. The display face shall be formed into the door as shown on the drawings. The pixel pattern on the display face may vary and will be as defined in the special provisions.
2. The face shall be punched to accommodate the display pattern shown on the drawings.
3. LED pixels shall be securely mounted into the aluminum face.
The LED intensity and chromaticity shall comply with the latest edition of the *Interim LED Purchase Specification of the Institute of Transportation Engineers (ITE)* for LED Signal Modules.

### 701.9 ELECTRICAL REQUIREMENTS

.1 The electrical requirements of the LED sign shall conform to Section 5 of the *ITE Standards* with the following specific requirements:

1. The individual LED’s shall be wired such that a failure of one LED with result in the loss of not more than 5% of the signal module light output.

2. The signal module on-board circuitry shall include voltage surge protection to withstand high-repetition noise transients as stated in Section 2.1.6 of NEMA Standard TS-2, 1992.

3. The LED signal modules shall be operationally compatible with the Ministry’s currently used controller assemblies (solid state load switches, flashers, and conflict monitors).

4. As per the ITE Standard, the total harmonic distortion (THD) (current and voltage) induced into the AC power line by all LED signal modules shall not exceed 10 percent with a .9 power factor.

5. Module dimming is not required.

6. Conductors for the modules shall be 1 meter in length No 18 type TEW stranded copper wire rated for 105 degrees C and 600 V. The connection to the modules shall be done with quick disconnect terminals or shall be fixed wired to the module. The free ends of the conductors shall be terminated with quick disconnect spade connectors suitable for termination onto a standard signal housing terminal block. All connectors shall be securely attached so they do not vibrate loose.

7. Colour coding of wiring for LED modules shall be as follows:
   
   .1 Red display – Red.
   
   .2 Green display – Brown or Black.
   
   .3 Yellow display – Yellow.
   
   .4 Neutral - White.
701.10 ENCLOSURE MOUNTING HARDWARE

.1 The enclosure mounting hardware shall be supplied as shown on the drawings.

701.11 CABINET FINISH

.1 The cabinet shall be finished as follows:

1. Cabinet with exception to the electrical panel (part M04) and the door (part M06A, M06B and M06C) shall be powder coated black in accordance with Appendix B - Powder Coat Specification. The electrical panels shall be finished with clear chromate and the doors shall be finished with black anodizing. Any stainless steel parts shall be left unfinished.

2. The final product shall be free of dents, scratches, weld burns and abrasions harmful to its strength and general appearance.

3. All exterior corners shall be rounded to a minimum radius of 1/8”.

4. All sharp edges shall be de-burred to a minimum radius of 1/64” in order to reduce hazards to service personnel.

701.12 TESTING

701.12.1 General Testing

.1 The supplier shall test all product at the factory prior to shipment. The tests shall consist of powering each lamp and verifying the proper illumination of all pixels for the applicable display.

701.12.2 Testing of Welds

.1 Prior to start of manufacturing, the supplier shall submit a sample weld prepared by each weld procedure for testing in accordance with CAN/CSA W59.2.

.2 After approval of the weld samples and procedures, the welds on 10% of all displays shall undergo visual and non-destructive testing in accordance with CAN/CSA W59.2. This testing shall be performed prior to coating all product.
.3 All testing shall be performed by an independent agency certified to CAN/CSA-W178.1.

.4 The cost for product testing shall be borne by the supplier including re-testing as determined by the Ministry Representative and the Testing Agency. Should the supplier fail testing, the supplier shall repair or replace all defective product to the satisfaction of the Ministry Representative. Should the test results indicate that the failure is related to the production run, the supplier must have all product tested within the production run at no cost to the Ministry.

701.13 ACCEPTANCE.

.1 The Ministry shall require the following conditions to be met prior to accepting product. Failure to do so will be cause for rejection:

1. The product shall meet all Ministry specifications.
2. The product shall be complete and operational.
3. The product shall be tested to the satisfaction of the Ministry Representative.
4. Any product which has been rejected shall be repaired or replaced within a time period acceptable to the Ministry Representative. All costs associated with repairs and for the testing of a failed product shall be borne by the supplier.

701.14 IDENTIFICATION

701.14.1 Manufacturers Identification

.1 An aluminum or stainless steel nameplate shall be attached to the rear exterior surface of the product (upper left hand corner when viewed from the back). The nameplate shall include the Manufacturer’s trademark, product identification, and the year and date of manufacture. The size of the nameplate shall meet the approval of the Ministry Representative.

.2 The nameplate shall be secured to the enclosure using blind pems as shown on the drawings. The pem locations shown may be adjusted slightly to suit the manufactures ID label.
LED LANE CONTROL SIGNAL HEADS

701.14.2 LED Sign Identification

.1 The product shall have a lamicoid style ID label secured to the exterior on the underside of the enclosure using the pem locations shown on the drawings. The character height shall be the same as the character height used for the NEMA wattage label for luminaires (i.e. designed to be viewed from the ground). The label shall have black characters on a white background.

.2 The ID label shall have 7 characters. The estimated size of the lamicoid label is 10” wide by 3” high (i.e. 2” high by ¾” wide characters with ¼” space between characters). The Ministry will provide the characters for each unit to the Supplier.

701.14.3 Component Labelling

.1 Internal components shall be labeled using vinyl adhesive labels with 10 mm high black characters on a white background. The lamps, transformers and terminal blocks shall be labeled as shown on the drawings.

701.15 PACKAGING

.1 Shipping documentation shall consist of an itemized bill of materials and purchase order number.

.2 Prior to shipping, the supplier must provide the Ministry Representative with a listing of how they plan to bundle, package, and ship the product. The list shall contain the maximum quantity in each bundle or on each pallet and the weight of the bundle or pallet. All hardware shall be attached to its parent component.

.3 As a minimum, LED signs shall be packaged on wood pallets. The backboards and visors shall be shipped separately on wood pallets. The mounting brackets and hardware for each display shall be packaged in a cardboard box (i.e. one box per display).

.4 All products damaged in shipping shall be replaced by the supplier without delay at no extra cost to the Ministry (i.e. delays caused by disputes between the supplier and the shipper are of no concern to the Ministry).
702 LED REGULATORY SIGNS

702.1 SCOPE

.1 This specification shall apply to the supply, testing and delivery of fibre optic regulatory signs (e.g. restricted left turn sign and restricted right turn sign) complete with visor, backboard and mounting hardware, herein referred to as product.

.2 Signs shall be manufactured in various display configurations as required in the contract Special Provisions. Some signs may require two display states. The safety cable, mounting bracket assembly, shaft mounting plate and 1” liquid tight flex connector are optional depending on the application. The requirement for optional components will be identified in the contract special provisions.

.3 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

702.2 MATERIAL STANDARDS DRAWINGS

.1 All products shall be supplied in accordance with the drawings listed in Table 2. The supplier shall note that all drawings are in imperial units and that they are printed approximately to half size.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware and electrical components. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.
### LED REGULATORY SIGNS

#### DRAWING NO. | DRAWING TITLE
--- | ---
MS710.1 | LED Regulatory Sign - Main Assembly
MS710.2 | LED Regulatory Sign - Enclosure
MS710.3 | LED Regulatory Sign - Door
MS710.4 | LED Regulatory Sign - Visor
MS710.5 | LED Regulatory Sign – Electrical Panel
MS710.6 | LED Regulatory Sign – Shaft Mounting Plate
MS710.7 | LED Regulatory Sign – Typical Sign Face - Pixel Layout

Table 2. Drawings for LED regulatory signs

#### 702.3 QUALIFICATIONS

1. The supplier shall produce evidence of satisfactory aluminum welding experience as well as evidence that the manufacturing plant has been performing the type of manufacturing required by this specification for a continuous period of not less than five years. Acceptance of the supplier will be at the discretion of the Ministry’s assessment of the supplier’s organization, personnel, equipment and past performance.

#### 702.4 PRODUCT OPERATING REQUIREMENTS

1. The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia. The product will be exposed to temperatures ranging from minus 40 degrees C to plus 74 degrees C.

#### 702.5 MATERIALS

1. All materials shall be new.

2. All electrical materials shall be CSA approved.

3. All stainless steel plate shall be grade 304-4.
.4 Unless otherwise noted, the enclosure shall be fabricated from 1/8” thick 5052-H32 sheet aluminum.

702.6 CONNECTING HARDWARE

.1 Miscellaneous hardware other than screws, nuts, bolts and washers shall be stainless steel or zinc dichromate plated. Other hardware coatings must be submitted to the Ministry for approval.

.2 Connecting hardware (i.e. screws, nuts, bolts and washers) shall conform to the following:

1. All hardware shall have unified national thread form (ANSI) and shall be 18-8 or 316 stainless steel.

2. All nuts and bolts 1/4-20 and larger shall have UNC (Unified National Course) threads and hexagon heads, and shall bear suitable markings to identify their grade and origin of manufacture.

3. All studs shall have UNC (Unified National Course) threads.

4. All machine screws smaller than 1/4-20 (e.g. 8-32 UNC, 10-24 UNC) shall be Robertson pan-head. All screw heads shall be sized so only one screwdriver is required when working on display.

5. No sheet metal or self-tapping screws shall be used.

702.7 FABRICATION

702.7.1 General

.1 The enclosure is designed to meet CSA enclosure 4X designation.

.2 The cabinet enclosure shall be CNC manufactured.

.3 The hardware and equipment lists shown on the drawings describe the required components to fabricate the product. No substitutes are permitted without Ministry approval. The supplier shall confirm that all components fit into the unit and shall produce detailed shop drawings and a complete working product as specified herein.

.4 The general appearance of a typical LED sign without visor is shown in Figure 1.
702.7.2 Welding

.1 All welds shall be in accordance with CAN/CSA W59.2 - Welded Aluminum Construction.

.2 All exterior seams shall be of continuously welded construction. All exterior welds shall be ground smooth.

.3 All welds shall be free of slag and spatter.

702.7.3 Door Gaskets

.1 The gasket shall be of one continuous piece per side (i.e. four strips per opening) and shall be permanently bonded to the metal.
.2 The gasket shall be of an appropriate length so as not to have gaps at gasket joints or to shrink over time. The surface of the gasket shall be covered with a silicon lubricant to prevent sticking to the mating surface.

702.7.4 Tolerances

.1 The cabinet shall be manufactured to the tolerances shown on the drawings.

702.8 DISPLAY FACE

.1 The display face shall be formed into the door as shown on the drawings. The pixel pattern on the display face may vary and will be as defined in the special provisions.

.2 The face shall be punched to accommodate the display pattern shown on the drawings.

.3 LED pixels shall be securely mounted into the aluminum face.

.4 The LED intensity and chromaticity shall comply with the latest edition of the Interim LED Purchase Specification of the Institute of Transportation Engineers (ITE) for LED Signal Modules.

702.9 ELECTRICAL REQUIREMENTS

.1 The electrical requirements of the LED sign shall conform to Section 5 of the ITE Standards with the following specific requirements:

1. The individual LED’s shall be wired such that a failure of one LED with result in the loss of not more than 5% of the signal module light output.

2. The signal module on-board circuitry shall include voltage surge protection to withstand high-repetition noise transients as stated in Section 2.1.6 of NEMA Standard TS-2, 1992.

3. The LED signal modules shall be operationally compatible with the Ministry’s currently used controller assemblies (solid state load switches, flashers, and conflict monitors).
4. As per the ITE Standard, the total harmonic distortion (THD) (current and voltage) induced into the AC power line by all LED signal modules shall not exceed 20 percent with a .9 power factor.

5. Module dimming is not required.

6. Conductors for the modules shall be 1 meter in length No 18 type TEW stranded copper wire rated for 105 degrees C and 600 V. The connection to the modules shall be done with quick disconnect terminals or shall be fixed wired to the module. The free ends of the conductors shall be terminated with quick disconnect spade connectors suitable for termination onto a standard signal housing terminal block. All connectors shall be securely attached so they do not vibrate loose.

7. Colour coding of wiring for LED modules shall be as follows:
   .1 Red display – Red.
   .2 Green display – Brown or Black.
   .3 Yellow display – Yellow.
   .4 Neutral - White.

   .2 The display face shall be formed into the door as shown on the drawings. The pixel pattern on the display face may vary and will be as defined in the special provisions.

   .3 The face shall be punched to accommodate the display pattern shown on the drawings.

   .4 LEDs shall be securely mounted into the aluminum face.

702.10 ENCLOSURE MOUNTING HARDWARE
   .1 The enclosure shall be supplied with two articulated serrated bracket assemblies for mounting the display to the pole as shown the drawings. The unit shall also be supplied with a stainless steel support cable.

702.11 CABINET FINISH
   .1 The cabinet shall be finished as follows:
1. Cabinet with exception to the electrical panel (part M03) and the door (part M04) shall be powder coated black in accordance with Appendix B - Powder Coat Specification. The electrical panels shall be finished with clear chromate and the door shall be finished with black anodizing. Any stainless steel parts shall be left unfinished.

2. The final product shall be free of dents, scratches, weld burns and abrasions harmful to its strength and general appearance.

3. All exterior corners shall be rounded to a minimum radius of 1/8”.

4. All sharp edges shall be de-burred to a minimum radius of 1/64” in order to reduce hazards to service personnel.

702.12 TESTING

702.12.1 General Testing

.1 The supplier shall test all product at the factory prior to shipment. The tests shall consist of applying power to simulate the output signal(s) from the traffic controller and verifying the proper illumination of all pixels for the applicable display.

702.12.2 Testing of Welds

.1 Prior to start of manufacturing, the supplier shall submit a sample weld prepared by each weld procedure for testing in accordance with CAN/CSA W59.2.

.2 After approval of the weld samples and procedures, the welds on 10% of all displays shall undergo visual and non-destructive testing in accordance with CAN/CSA W59.2. This testing shall be performed prior to coating all product.

.3 All testing shall be performed by an independent agency certified to CAN/CSA-W178.1.
The cost for product testing shall be borne by the supplier including re-testing as determined by the Ministry Representative and the Testing Agency. Should the supplier fail testing, the supplier shall repair or replace all defective product to the satisfaction of the Ministry Representative. Should the test results indicate that the failure is related to the production run, the supplier must have all product tested within the production run at no cost to the Ministry.

**702.13 ACCEPTANCE.**

.1 The Ministry shall require the following conditions to be met prior to accepting product. Failure to do so will be cause for rejection:

1. The product shall meet all Ministry specifications.
2. The product shall be complete and operational.
3. The product shall be tested to the satisfaction of the Ministry Representative.
4. Any product which has been rejected shall be repaired or replaced within a time period acceptable to the Ministry Representative. All costs associated with repairs and for the testing of a failed product shall be borne by the supplier.

**702.14 IDENTIFICATION**

**702.14.1 Manufacturers Identification**

.1 An aluminum or stainless steel nameplate shall be attached to the rear exterior surface of the product (upper left-hand corner when viewed from the back). The nameplate shall include the Manufacturer’s trademark, product identification, and the year and date of manufacture. The size of the nameplate shall meet the approval of the Ministry Representative.

.2 The nameplate shall be secured to the enclosure using blind pems as shown on the drawings. The pem locations shown may be adjusted slightly to suit the manufactures ID label.
702.14.2 Component Labelling

.1 Internal components shall be labeled using vinyl adhesive labels with 10mm high black characters on a white background. The lamps, transformers and terminal blocks shall be labeled as shown on the drawings.

702.15 SHOP DRAWINGS

702.15.1 Submission

.1 The supplier shall provide detailed shop drawings (in electronic format) for review by the Ministry Representative. The supplier shall submit four copies of the following information prior to production:

1. Detailed dimensioned layout shop drawings (i.e. manufacturing drawings) including plans, elevations, sections, equipment layout and wiring diagrams.
2. OEM information for materials and equipment.

702.15.2 Drawing Format

.1 The drawing format shall be as follows:

1. In Autocad format (most current release.)
2. Produced on ISO A1 size paper (other sizes shall meet the approval of the Ministry Representative).
3. In metric units only.
4. Legible when reduced to 1/2 size.

702.15.3 Ministry Review

.1 The Ministry Review of the shop drawings will be as follows:

1. Drawings will be reviewed by the Ministry Representative solely to ascertain conformance with the general design concept. Responsibility for approval of detail design inherent in the drawings rests solely with the supplier. The review by the Ministry Representative shall not constitute approval.
2. Review by the Ministry Representative shall not relieve the supplier of its responsibility for errors or omissions in the drawings or for proper completion of the work in accordance with the contract documents. The Ministry Representative may review all design drawings and return any comments to the supplier seven days after receipt.

3. The supplier is responsible for verification and correlation of field dimensions, fabrication processes, techniques of construction, installation and co-ordination of all parts of the work.

4. After the Ministry Review, the drawings will be returned to the supplier. The supplier shall revise the drawings to the satisfaction of the Ministry Representative prior to fabrication.

702.16 PACKAGING

.1 Shipping documentation shall consist of an itemized bill of materials and purchase order number.

.2 Prior to shipping, the supplier must provide the Ministry Representative with a listing of how they plan to bundle, package, and ship the product. The list shall contain the maximum quantity in each bundle or on each pallet and the weight of the bundle or pallet. All hardware shall be attached to its parent component.

.3 As a minimum, signs shall be packaged on wood pallets. The visors shall be shipped separately on wood pallets. The mounting brackets and hardware for each display shall be packaged in a cardboard box (i.e. one box per display).

.4 All products damaged in shipping shall be replaced by the supplier without delay at no extra cost to the Ministry (i.e. delays caused by disputes between the supplier and the shipper are of no concern to the Ministry).
703 INTERNALLY ILLUMINATED CROSSWALK SIGN

703.1 SCOPE

.1 This specification shall apply to the supply, testing and delivery of internally illuminated crosswalk signs, herein referred to as product. The 300mm yellow LED traffic signal heads complete with wiring to a terminal block an optional feature. The requirement for the traffic signal heads will be defined in the contract special provisions. The spring hangers, 150 watt HPS lamp and 175W watt MV lamps are not supplied with the sign.

.2 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

703.2 MATERIAL STANDARDS DRAWINGS

.1 All products shall be supplied in accordance with the drawings listed in Table 3. The supplier shall note that all drawings are in imperial units and that they are printed approximately to half size.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware and electrical components. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.

<table>
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<tr>
<th>DRAWING NO.</th>
<th>DRAWING TITLE</th>
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<tr>
<td>MS720.1</td>
<td>Internally Illuminated Crosswalk Sign - Main Assembly</td>
</tr>
<tr>
<td>MS720.2</td>
<td>Internally Illuminated Crosswalk Sign – Electrical Equipment Placement</td>
</tr>
</tbody>
</table>

Table 3. Drawings for internally illuminated crosswalk sign
703.3 PRODUCT OPERATING REQUIREMENTS

.1 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia. The product will be exposed to temperatures ranging from minus 40 degrees C to plus 74 degrees C.

703.4 MATERIALS

.1 All materials shall be new.

.2 All electrical materials shall be CSA approved.

.3 Unless otherwise noted, the enclosure shall be fabricated from 1/8” thick - 5052-H32 sheet aluminum.

703.5 CONNECTING HARDWARE

.1 Miscellaneous hardware other than screws, nuts, bolts and washers shall be stainless steel or zinc dichromate plated. Other hardware coatings must be submitted to the Ministry for approval.

.2 Connecting hardware (i.e. screws, nuts, bolts and washers) shall conform to the following:

1. All hardware shall have unified national thread form (ANSI) and shall be 18-8 or 316 stainless steel.

2. All nuts and bolts 1/4-20 and larger shall have UNC (Unified National Course) threads and hexagon heads, and shall bear suitable markings to identify their grade and origin of manufacture.

3. All studs shall have UNC (Unified National Course) threads.

4. All machine screws smaller than 1/4-20 (e.g. 8-32 UNC, 10-24 UNC) shall be Robertson pan-head. All screw heads shall be sized so only one screwdriver is required when working on display.

5. No sheet metal or self-tapping screws shall be used.
703.6 FABRICATION

703.6.1 General

.1 The enclosure is designed to meet CSA enclosure 4X designation.

.2 The hardware and equipment lists shown on the drawings describe the required components to fabricate the product. No substitutes are permitted without Ministry approval. The supplier shall confirm that all components fit into the unit and shall produce detailed shop drawings and a complete working product as specified herein.

.3 The general appearance of a typical fibre sign without visor is shown in Figure 1.

703.6.2 Welding

.1 All welds shall be in accordance with CAN/CSA W59.2 - Welded Aluminum Construction.

.2 All exterior seams shall be of continuously welded construction. All exterior welds shall be ground smooth.

.3 All welds shall be free of slag and spatter.

703.6.3 Door Gaskets

.1 The gasket shall be of one continuous piece per side (i.e. four strips per opening) and shall be permanently bonded to the metal.

.2 The gasket shall be of an appropriate length so as not to have gaps at gasket joints or to shrink over time. The surface of the gasket shall be covered with a silicon lubricant to prevent sticking to the mating surface.

703.6.4 Tolerances

.1 The cabinet shall be square and true. All doors shall not bind and shall be easily removable.
703.7 DISPLAY FACE
.1 The display face shall be made of lexan and shall be masked to form the Ministry standard crosswalk symbol (SP-005R and SP-005L).

703.8 CABINET DESIGN
.1 The cabinet shall conform the functional requirements of the standard drawings. The general appearance and features of sign are illustrated in Figures 2, 3, 4 and 5.
Figure 2. Front view

Figure 3. Front view with doors removed
Figure 4. Down light (bottom view)

Figure 5. Leveling bracket
703.9 BALLASTS AND LAMPS
.1 HPS and MV ballast and lamps shall meet the requirements of Chapter 500, Lighting Equipment.

703.10 TRAFFIC SIGNAL HEADS
.1 The traffic signal heads shall meet the requirements of Chapter 601, Signal and Pedestrian Heads and the LED modules shall meet the requirements of Chapter 602, LED Signal Modules. The requirement for the optional signal heads complete with wiring to a terminal block will be indicated in the special provisions.

703.11 ELECTRICAL
.1 All wiring, wire labeling and component labeling shall meet the requirements of Chapter 402 Electrical Kiosks.

.2 All wiring shall be No. 18 type TEW stranded copper wire rated for 105 degrees C and 300 V.

.3 Wiring methods shall be as follows:
   1. All wire bundles shall be formed by using a single ty-wrap.
   2. No ty-wraps or any other wire bundling device shall be found inside or partly inside any wire bundles.
   3. Wire harnesses shall be ty-wrapped every 40mm.
   4. All wiring on the standoff plate shall take the neatest route to its termination point.
   5. All wires shall be free of splices or through connections in their entirety (except for connections to the lamp sockets).

703.12 ENCLOSURE MOUNTING HARDWARE
.1 The enclosure shall be supplied with one leveling bracket complete with stainless steel mounting hardware as shown on the drawing.
703.13 CABINET FINISH

.1 The cabinet shall be finished as follows:

1. The enclosure shall be powder coated green in accordance with Appendix B - Powder Coat Specification. Any stainless steel parts shall be left unfinished.
2. The final product shall be free of dents, scratches, weld burns and abrasions harmful to its strength and general appearance.
3. All exterior corners shall be rounded to a minimum radius of 1/8”.
4. All sharp edges shall be de-burred to a minimum radius of 1/64” in order to reduce hazards to service personnel.

703.14 TESTING

703.14.1 General Testing

.1 The supplier shall test all product at the factory prior to shipment. The tests shall consist of applying power to ensure the HID lamps turn on.

703.15 ACCEPTANCE.

.1 The Ministry shall require the following conditions to be met prior to accepting product. Failure to do so will be cause for rejection:

1. The product shall meet all Ministry specifications.
2. The product shall be complete and operational.
3. The product shall be tested to the satisfaction of the Ministry Representative.
4. Any product which has been rejected shall be repaired or replaced within a time period acceptable to the Ministry Representative. All costs associated with repairs and for the testing of a failed product shall be borne by the supplier.
703.16 IDENTIFICATION

703.16.1 Manufacturers Identification

.1 An aluminum or stainless steel nameplate shall be attached to the exterior surface of the product. The nameplate shall include the Manufacturer’s trademark, product identification, and the year and date of manufacture. The size of the nameplate shall meet the approval of the Ministry Representative.

.2 The nameplate shall be secured to the enclosure using blind pems. The pem locations shown may be adjusted slightly to suit the manufactures ID label.

703.16.2 Component Labelling

.1 Internal components shall be labeled using vinyl adhesive labels with 10mm high black characters on a white background. The lamps, transformers and terminal blocks shall be labeled as shown on the drawings.

703.17 SHOP DRAWINGS

703.17.1 Submission

.1 The supplier shall provide detailed shop drawings (in electronic format) for review by the Ministry Representative. The supplier shall submit four copies of the following information prior to production:

1. Detailed dimensioned layout shop drawings (i.e. manufacturing drawings) including plans, elevations, sections, equipment layout and wiring diagrams.

2. OEM information for materials and equipment.

703.17.2 Drawing Format

.1 The drawing format shall be as follows:

1. In Autocad format (most current release.)

2. Produced on ISO A1 size paper (other sizes shall meet the approval of the Ministry Representative).

3. In metric units only.
4. Legible when reduced to 1/2 size.

703.17.3 Ministry Review

.1 The Ministry Review of the shop drawings will be as follows:

1. Drawings will be reviewed by the Ministry Representative solely to ascertain conformance with the general design concept. Responsibility for approval of detail design inherent in the drawings rests solely with the supplier. The review by the Ministry Representative shall not constitute approval.

2. Review by the Ministry Representative shall not relieve the supplier of its responsibility for errors or omissions in the drawings or for proper completion of the work in accordance with the contract documents. The Ministry Representative may review all design drawings and return any comments to the supplier seven days after receipt.

3. The supplier is responsible for verification and correlation of field dimensions, fabrication processes, techniques of construction, installation and co-ordination of all parts of the work.

4. After the Ministry Review, the drawings will be returned to the supplier. The supplier shall revise the drawings to the satisfaction of the Ministry Representative prior to fabrication.

703.18 PACKAGING

.1 Shipping documentation shall consist of an itemized bill of materials and purchase order number.

.2 Prior to shipping, the supplier must provide the Ministry Representative with a listing of how they plan to bundle, package, and ship the product. The list shall contain the maximum quantity in each bundle or on each pallet and the weight of the bundle or pallet. All hardware shall be attached to its parent component.

.3 All products damaged in shipping shall be replaced by the supplier without delay at no extra cost to the Ministry (i.e. delays caused by disputes between the supplier and the shipper are of no concern to the Ministry).
704 SIX CHARACTER CHANGEABLE MESSAGE SIGN

704.1 SCOPE

.1 This specification shall apply to the supply, testing and delivery of six character changeable message signs.

.2 Supplier shall refer to section 100 for the Product Approval Process, Warranty, Supplier Quality Management System, Ministry Audit Process and Alternative Product Submissions.

704.2 MATERIAL STANDARDS DRAWINGS

.1 All products shall be supplied in accordance with the drawings listed in Table 4.

.2 The supplier shall verify all dimensions and sizes of manufactured parts for proper fit prior to fabrication. The supplier shall also verify hardware and electrical components. The supplier shall report any drawing errors to the Ministry prior to fabrication. Errors or omissions on the drawings shall not relieve the supplier of its responsibility of delivering a complete working product.

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<th>DRAWING NO.</th>
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<tr>
<td>MS730.1</td>
<td>Assembled Cabinet (Isometric View)</td>
</tr>
<tr>
<td>MS730.2</td>
<td>Assembly View</td>
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<tr>
<td>MS730.3</td>
<td>Internal Frame Details</td>
</tr>
<tr>
<td>MS730.4</td>
<td>Details - Front Face and Frame</td>
</tr>
<tr>
<td>MS730.5</td>
<td>Rear Door Details</td>
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</tbody>
</table>

Table 4. Drawings for six character changeable message sign.
**704.3 QUALIFICATIONS**

.1 The supplier shall produce evidence of satisfactory aluminum welding experience as well as evidence that the manufacturing plant has been performing the type of manufacturing required by this specification for a continuous period of not less than five years. Acceptance of the supplier will be at the discretion of the Ministry’s assessment of the supplier’s organization, personnel, equipment and past performance.

**704.4 PRODUCT OPERATING REQUIREMENTS**

.1 The product will be exposed to all prevailing climatic conditions throughout the Province of British Columbia. The product will be exposed to temperatures ranging from minus 40 degrees C to plus 74 degrees C.

**704.5 MATERIALS**

.1 All materials shall be new.

.2 All electrical materials shall be CSA approved.

.3 All stainless steel plate shall be grade 304-4.
.4 Unless otherwise noted, the enclosure shall be fabricated from 1/8" thick - 5052-H32 sheet aluminum.

**704.6 CONNECTING HARDWARE**

.1 Miscellaneous hardware other than screws, nuts, bolts and washers shall be stainless steel or zinc dichromate plated. Other hardware coatings must be submitted to the Ministry for approval.

.2 Connecting hardware (i.e. screws, nuts, bolts and washers) shall conform to the following:

1. All hardware shall have unified national thread form (ANSI) and shall be 18-8 or 316 stainless steel.

2. All nuts and bolts 1/4-20 and larger shall have UNC (Unified National Course) threads and hexagon heads, and shall bear suitable markings to identify their grade and origin of manufacture.

3. All studs shall have UNC (Unified National Course) threads.

4. All machine screws smaller than 1/4-20 (e.g. 8-32 UNC, 10-24 UNC) shall be Robertson pan-head. All screw heads shall be sized so only one screwdriver is required when working on display.

5. No sheet metal or self-tapping screws shall be used.

**704.7 FABRICATION**

**704.7.1 General**

.1 The enclosure is designed to meet CSA enclosure 4X designation.

.2 The cabinet enclosure shall be CNC manufactured.

.3 The hardware and equipment lists shown on the drawings describe the required components to fabricate the product. No substitutes are permitted without Ministry approval. The supplier shall confirm that all components fit into the unit and shall produce a complete working product as specified. The supplier shall contact the Ministry Representative, if minor adjustments to component locations are required.
704.7.2 Welding

.1 All welds shall be in accordance with CAN/CSA W59.2 - Welded Aluminum Construction.

.2 All exterior seams shall be of continuously welded construction. All exterior welds shall be ground smooth.

.3 All welds shall be free of slag and spatter.

704.7.3 Tolerances

.1 The cabinet shall be manufactured to the tolerances shown on the drawings.

704.8 LED TECHNOLOGY

.1 High output Light Emitting Diode (LED) source, amber colour, intensity of 1000mcd (minimum) per LED and drive current of 20mA.

.2 Modular display format, allowing easy installation, replacement and maintenance of individual modules.

.3 Four (4) LEDs per pixel (minimum).

.4 Text character size shall be 300mm.

.5 Capable of control via serial/IP and manual connection.

.6 Seventy (70) degree viewing angle.

704.9 SIGN CONTROLLER

.1 Shall be an integrated sign controller to allow for the remote control using a two-position switch.

704.10 ELECTRICAL

.1 All wiring shall be as shown on the drawings.
.2 All wiring shall be No. 18 type TEW stranded copper wire rated for 105 degrees C and 300 V unless otherwise noted. The sign shall be supplied with 10 meters of 7 conductor No. 14 type SOW cable pre-attached to the sign as shown on the drawings.

.3 Wiring methods shall be as follows:
1. All wire bundles shall be formed by using a single ty-wrap.
2. No ty-wraps or any other wire bundling device shall be found inside or partly inside any wire bundles.
3. Wire harnesses shall be ty-wrapped every 40mm.
4. All wiring on the back panel shall take the neatest route to its termination point.
5. All wires shall be free of splices or through connections in their entirety.

704.11 CABINET FINISH
.1 The cabinet shall be finished as follows:
1. Cabinet shall be powder coated black in accordance with Appendix B - Powder Coat Specification. The electrical panels shall be finished with clear chromate and the doors shall be finished with black anodizing. Any stainless steel parts shall be left unfinished.
2. The final product shall be free of dents, scratches, weld burns and abrasions harmful to its strength and general appearance.
3. All exterior corners shall be rounded to a minimum radius of 1/8”.
4. All sharp edges shall be de-burred to a minimum radius of 1/64” in order to reduce hazards to service personnel.

704.12 TESTING

704.12.1 General Testing
.1 The supplier shall test all products at the factory prior to shipment. The tests shall consist of powering the sign and testing the operation of the sign controller, modules and open/closed switch.
SIX CHARACTER CHANGEABLE MESSAGE SIGN

704.13 ACCEPTANCE.
.1 The Ministry shall require the following conditions to be met prior to accepting product. Failure to do so will be cause for rejection:

1. The product shall meet all Ministry specifications.
2. The product shall be complete and operational.
3. The product shall be tested to the satisfaction of the Ministry Representative.
4. Any product which has been rejected shall be repaired or replaced within a time period acceptable to the Ministry Representative. All costs associated with repairs and for the testing of a failed product shall be borne by the supplier.

704.14 IDENTIFICATION

704.14.1 Manufacturers Identification
.1 An aluminum or stainless steel nameplate shall be attached to the rear exterior surface of the product (upper left hand corner when viewed from the back). The nameplate shall include the Manufacturer’s trademark, product identification, and the year and date of manufacture. The size of the nameplate shall meet the approval of the Ministry Representative.

.2 The nameplate shall be secured to the enclosure using blind pems as shown on the drawings. The pem locations shown may be adjusted slightly to suit the manufactures ID label.

704.14.2 Sign Identification
.1 The product shall have a lamicoid style ID label secured to the exterior on the underside of the enclosure using the pem locations shown on the drawings. The character height shall be the same as the character height used for the NEMA wattage label for luminaires (i.e. designed to be viewed from the ground). The label shall have black characters on a white background.

.2 The ID label shall have 7 characters. The estimated size of the lamicoid label is 10” wide by 3” high (i.e. 2” high by ¾” wide characters with ¼” space between characters). The Ministry will provide the characters for each unit to the Supplier.
704.14.3 **Component Labelling**

.1 Internal components shall be labeled using vinyl adhesive labels with 10mm high black characters on a white background. The lamps, transformers and terminal blocks shall labeled as shown on the drawings.

704.15 **PACKAGING**

.1 Shipping documentation shall consist of an itemized bill of materials and purchase order number.

.2 Prior to shipping, the supplier must provide the Ministry Representative with a listing of how they plan to bundle, package, and ship the product. The list shall contain the maximum quantity in each bundle or on each pallet and the weight of the bundle or pallet. All hardware shall be attached to its parent component.

.3 As a minimum, signs shall be packaged on wood pallets.

.4 All products damaged in shipping shall be replaced by the supplier without delay at no extra cost to the Ministry (i.e. delays caused by disputes between the supplier and the shipper are of no concern to the Ministry).
## 800 GENERAL MATERIALS

### 801 GENERAL MATERIALS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>801.1</td>
<td>GENERAL EQUIPMENT</td>
<td>1</td>
</tr>
</tbody>
</table>

---

Engineering Branch  
Electrical and Signing Material Standards  
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December 2003  
Page i
801 GENERAL MATERIALS

801.1 GENERAL EQUIPMENT

.1 The following is a list of equipment which are approved for use on Ministry Projects. For the purposes of standardization, alternate equipment will not be accepted unless written approval is received by the Ministry.

.1 Circuit Breakers \((120/240\text{V})\). Circuit breakers shall be Square ‘D’. Size and number of poles are as specified.

.2 Contactors. 30 amp 4 pole lighting contactor with 120 volt coil - Cutler-Hammer (Westinghouse) No. A202K1DA.

.3 Flasher Units. Flasher units shall be Electro Systems TFF-12.

.4 Padlocks. Padlocks shall be Associated Lock No. AS-HWY-1 with a removable cylinder keyed to system AS-58-2. Body shall be engraved with “MOTH-ELEC”.

.5 Pedestrian Underpass Luminaires. Pedestrian underpass luminaires shall be 35W Low Pressure Sodium type as manufactured by Valid Manufacturing.

.6 Banner Hangers. Banner hangers shall be Globe Foundry Ltd BB100.

.7 End Mount Plumbizer. End mount plumbizers shall be Econolite Canada No. C00641P001 including mounting hardware kit No. SE-3045.
Appendix A
Comments and Product Submission Form

Engineering Branch
December 2003
Comments / Suggestions to Electrical and Signing Material Standards
(Specify Section, Clause, Paragraph, etc. to which these comments apply)

Name: ___________________________ Date: ___________________________
Company: _________________________ Tel: ___________________________
                                          Fax: ___________________________

Comments:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Send to:
Ross Casey, Senior Electrical Standards Technologist
Engineering Branch
Ministry of Transportation
4B - 940 Blanshard Street
Victoria, BC V8W 3E6

Fax Number: 250-356-8143
Suggestions and comments will not be considered unless they are in writing.

Send to:
Ross Casey, Senior Electrical Standards Technologist
Engineering Branch
Ministry of Transportation
4B - 940 Blanshard Street
Victoria, BC V8W 3E6

Fax Number: 250-356-8143
Product Submission Form
To be completed by Suppliers

New Products Evaluation Standing Committee
PRODUCT SUBMISSION FORM

This form must accompany all new product submissions to the Ministry of Transportation. Applicants should make every effort to provide the requested information as this data will be used by the New Products Evaluation Committee to assist in the initial review of the product. A letter of receipt will be issued as well as a status report following the initial appraisal.

1) Supplier Name: ___________________________________________________________
Address: __________________________________________________________________
City: _______________________________ Prov/State: __________________________ Postal/Zip: ______________
Contact: ___________________________ Telephone No.: (______) __________________ Facsimile No.: (____) ________

2) Manufacturer Name (if different supplier) : __________________________________________
Address: __________________________________________________________________
City: ________________________________________________________________________

3) Product Name: ________________________________________________________________

4) Briefly state the intended purpose of use of this product: _________________________________

5) Is this product currently being used or under review by any other transportation agency?
If Yes, explain: _____________________________________________________________________

6) Has this product been evaluated for environmental impact?  Yes ☐ No ☐ If yes, attach environmental studies.

7) Is this product WHMIS controlled?  Yes ☐ No ☐
If yes, attach MSDS (note: MSDS must conform to WHMIS standards).

8) Does this product meet the requirements of a recognized specification agency (i.e., CSA, ASTM, CGSB, AASHTO)?
Yes ☐ No ☐
If so, state agency and specification number.

9) Have you attached all other information that you feel is relevant and will assist the Committee to appraise this product?

______________________________________________________________________________

Signature ___________________________ Date __________

INTERNET ADDRESS: http://www.gov.bc.ca/tran/
# APPENDIX B

## 1 POWDER COAT SUPPLIER PRE-APPROVAL

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1.2 POWDER COAT SELECTION CRITERIA .......... 1

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1 POWDER COAT SUPPLIER PRE-APPROVAL

1.1 SCOPE

.1 This specification shall apply to the criteria for selecting powder coat products used on aluminum components and to the pre-approval of powder coat suppliers and products.

1.2 POWDER COAT SELECTION CRITERIA

.1 Powder coat shall be of type Polyester-TGIC.

.2 Powder coating products used for coating aluminum components shall meet the following requirements:

<table>
<thead>
<tr>
<th>TEST</th>
<th>TEST METHOD</th>
<th>REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoor durability</td>
<td>Florida 45° South test</td>
<td>shall withstand 12 months with 90% gloss retention and no significant color change.</td>
</tr>
<tr>
<td>U.V. Resistance</td>
<td>QUV 340 lamp</td>
<td>shall withstand 600 hours with less than 1 Macadam unit variation in surface color.</td>
</tr>
<tr>
<td>Saltspray resistance</td>
<td>ASTM B 117-90</td>
<td>shall withstand 1000 hours with less than 1 mm (1/16 in.) creepage.</td>
</tr>
<tr>
<td>Humidity resistance</td>
<td>ASTM D 2247-87</td>
<td>shall withstand 1000 hours with no change.</td>
</tr>
</tbody>
</table>

Table 1. Requirements for approval of powder coat products

1 Results shall be based on tests performed on a chromated aluminum or steel test panel with a thickness between 0.5 and 0.8 mm.

2 In the case that the Florida 45° South test has not been performed, temporary approval may be granted based on the results of the U.V. resistance test. Plans to proceed with the Florida 45° South test must be specified.

3 Required for temporary approval only if Florida 45° South test has not been performed.
Gloss test (Gardner 60°) | ASTM D 523 | gloss shall not vary more than +/- 10 units from the specification.
--- | --- | ---
Mandrel bending test | ASTM D 522 | shall be 3 mm (1/8 in) or better.
Hardness | ASTM D 3363 | shall be H-2H
Impact (1/10 in Distortion) | ASTM D 2794-90 | shall be 80 in/lbs or better.

Table 1. Requirements for approval of powder coat products, continued

### 1.3 PRE-APPROVAL FOR POWDER COAT SUPPLIERS

.1 In addition to the requirements of Chapter 102, the supplier shall provide the following information:

.1 A letter requesting pre-approval.
.2 Printed verification of ISO 9002 certification.
.3 A completed Powder Coat Supplier Pre-approval Form for each color with its unique product code. Use the form provided in Figure 1.

.2 When a supplier obtains product pre-approval the supplier will be added to the Ministry’s Approved Product List.

.3 All documentation will be retained by the Ministry. This documentation will be used to ensure the product meets the minimum quality benchmark as stated by the supplier.

.4 Where material standards are revised, pre-approved suppliers shall modify their products to conform to the revision. Suppliers shall demonstrate to the Ministry Representative that the modified product conforms to the revision.

.5 The Ministry may terminate a supplier’s product pre-approval for any just reason including the following:

.1 Repeated failure of the supplier to comply with the requirement of this specification and any special provisions issued with the contract.
.2 Failure of the supplier to allow product inspections.
.3 Repeated defects in product.
.4 Failure to modify product to suit the most current material standard.

---

If currently seeking ISO-9002 status, then provide information to indicate what stage the approval process is at and when approval should be completed.
Should the Ministry terminate a supplier’s product pre-approval, the supplier’s product will be removed from the Ministry’s Approved Supplier and Product List. The supplier will not be eligible to reapply for product pre-approval until all deficiencies have been corrected to the satisfaction of the Ministry.
Powder Coat Supplier Pre-approval Form

<table>
<thead>
<tr>
<th>Company</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product Color</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

Provide performance details for the above product in the following tests:
(Refer to the Supplier Pre-approval section)

<table>
<thead>
<tr>
<th>TEST</th>
<th>TEST METHOD</th>
<th>TEST DATE</th>
<th>TEST PERFORMANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Outdoor durability</td>
<td>Florida 45° South</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>U.V. resistance</td>
<td>QUV 340 lamp</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Saltspray resistance</td>
<td>ASTM B 117-90</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Humidity resistance</td>
<td>ASTM D 2247-87</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Gloss test</td>
<td>ASTM D 523</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Mandrel bending</td>
<td>ASTM D 522</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Hardness</td>
<td>ASTM D 3363</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Impact</td>
<td>ASTM D 2794-90</td>
<td></td>
</tr>
</tbody>
</table>

Provide instructions for application of the powder coat such that compliance with the instructions will ensure the powder coat will perform as indicated in the test results above. (Attachments may be used)

I, ________________________________ , the company representative certify that the above information is accurate.

Signature ________________________________ Date ________________

Figure 1: Powder coat supplier pre-approval form
2  POWDER COAT APPLICATOR PRE-APPROVAL

2.1 SCOPE

.1 This specification shall apply to the pre-approval of powder coat applicators.

2.2 PRE-APPROVAL FOR POWDER COAT APPLICATORS

.1 In addition to the requirements of Chapter 102, the supplier shall provide the following information:

   .1 A letter requesting pre-approval.
   .2 A completed *Powder Coat Applicator Pre-approval Form*. Use the form provided in Figure 2.

.2 The Ministry reserves the right to enter the Applicators premises before and/or after pre-approval to conduct quality assurance inspections. The Applicator agrees to allow reasonable access to the Ministry representative(s).

.3 The Ministry may at any time request a sample from a given batch of powder coated product to conduct quality assurance testing. The Applicator agrees to provide a sample of powder coated product when requested by a Ministry representative(s).

.4 When a powder coat applicator obtains pre-approval the applicator will be added to the Ministry’s *Approved Powder Coat Applicators List*.

.5 All documentation will be retained by the Ministry. This documentation will be used to ensure the application facility meets the current application specification.

.6 Where the application specification is revised, pre-approved applicators shall modify their process as required to conform to the revision. Applicators shall demonstrate to the Ministry Representative that the modified process conforms to the revision.

.7 The Ministry may terminate an applicator’s pre-approval for any just reason including the following:
.1 Repeated failure of the applicator to comply with the requirement of this specification and any special provisions issued with the contract.

.2 Failure of the applicator to allow process and finished product inspections.

.3 Repeated deficiencies in the application process or finished products.

.4 Failure to modify the application process to suit the most current application specification.

.8 Should the Ministry terminate a supplier’s product pre-approval, the supplier’s product will be removed from the Approved Powder Coat Applicators List. The supplier will not be eligible to reapply for product pre-approval until all deficiencies have been corrected to the satisfaction of the Ministry.
## Powder Coat Applicator Pre-approval Form

<table>
<thead>
<tr>
<th>Company</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### FACILITY ADDRESS

<table>
<thead>
<tr>
<th>Street</th>
<th>City</th>
<th>Postal Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phone</th>
<th>Fax</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Provide a brief description of your application facility confirming that the facility is able to comply with the powder coat application specification.

__________

Provide a detailed outline of the steps that will be performed during the complete powder coat application process. (Use attachments if required)

__________

I, ________________________, the company representative certify that the above information is accurate.

<table>
<thead>
<tr>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Figure 2: Powder coat applicator pre-approval form
3  POWDER COAT APPLICATION SPECIFICATION

3.1  SCOPE

.1  This specification shall apply to the application of powder coating products on aluminum components.

3.2  GENERAL REQUIREMENTS

.1  The powder coating process, as specified below, shall be tested on at least one piece from a given batch of aluminum components to ensure a high quality coating for that type of component before the complete batch is powder coated. If there is uncertainty about the quality or appearance of the powder coating, Ministry approval shall be acquired.

.2  Where possible, items to be powder coated shall be free of dents, scratches, weld burns, ripples, pits, and abrasions before powder coating.

.3  Removable components which may be damaged by the powder coating process shall be removed before powder coating and reassembled after powder coating.

.4  Mask all threaded hardware and tapped holes as required.

3.3  PRE-TREATMENT

.1  The powder coating pre-treatment shall include the following steps:

.1  Alkaline cleaning, (or equivalent) as required, to remove process oil, grease, and dirt.

.2  Rinsing as required.

---

5  If Dried in Place pre-treatment method is used in step 3, steps 4 and 5 are not required.
.3 Multi-metal Iron Phosphate coating or Dried in Place pre-treatment to increase corrosion resistance and improve paint adhesion. Follow chemical supplier’s specifications. Chemical concentration, temperature, and timing specifications must be followed precisely.

.4 Rinsing as required.

.5 Non-Chrome (or equivalent) sealer coating to provide additional corrosion protection. Follow chemical supplier’s specifications. Chemical concentration, temperature, and timing specifications must be followed precisely.

3.4 DRYING / PRE-HEATING

.1 All items to be powder coated must be completely dry and pre-heated as required to help prevent out-gassing before powder coat application.

3.5 APPLICATION

.1 Powder coat shall be of type Polyester-TGIC.

.2 For porous castings, a powder coat type shall be selected to help prevent out-gassing.

.3 Powder coat must be applied to meet the powder coat manufacturer’s specifications.

.4 Powder coat thickness shall be no less than 2.5 mils at any location.

.5 Full-coverage of interior and exterior surfaces is required, unless otherwise specified in the contract, with no light spots allowed on exterior surfaces.

3.6 FINAL APPEARANCE

.1 All powder coatings shall be smooth, substantially free of contamination, flow lines, light spots, powder build-up, powder washout, streaks, sagging, runs, blisters and other defects that would in any way impair serviceability or detract from the general appearance.

.2 Orange peel appearance shall be reduced as much as possible, however, where unavoidable, orange peel appearance shall be consistent and visible only at short ranges.