

TENDER DOCUMENTS

SUBSECTION 6.55 LIGHTING

TABLE OF CONTENTS

| | PAGE |
|---------------------------------------|-------------|
| SUBSECTION 6.55 LIGHTING | 1 |
| 6.55.1 GENERAL | 1 |
| 6.55.2 REFERENCE STANDARDS | 1 |
| 6.55.3 MATERIALS | 3 |
| 6.55.4 DESIGN | 5 |
| 6.55.5 EXECUTION OF WORK | 6 |
| 6.55.6 QUALITY CONTROL | 8 |

SUBSECTION 6.55 LIGHTING

6.55.1 GENERAL

- 6.55.1.1 This subsection sets out the requirements related to the supply and installation of the lighting system provided for in this Contract.
- 6.55.1.2 Any specific requirements related to the supply and installation of the lighting system provided for in this Contract are set out in Section 4 *Special Technical Conditions* and on the drawings.
- 6.55.1.3 The requirements related to the supply and installation of electrical cables are set out in subsection 6.52 *Electrical Cables*.
- 6.55.1.4 The requirements related to electrical distribution are set out in subsection 6.54 *Electrical Power Distribution*.

6.55.2 REFERENCE STANDARDS

- 6.55.2.1 The **Contractor** shall perform all work related to the supply and installation of lighting equipment in accordance with the requirements of the following standards and documents to which the provisions of the Contract are added:

6.55.2.1.1 (ANSI) American National Standards Institute

- ANSI C82.4:2002 *Ballasts for High-Intensity-Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type)*;
- ANSI C136.15-1997 *American National Standard for Roadway Lighting Equipment High-Intensity-Discharge and Low-Pressure-Sodium Lamps in Luminaires Field Identification*.

6.55.2.1.2 (ACNOR(CSA))Canadian Standards Association

- CAN/CSA C22.2 NO. 0-M91 (R2006) *General Requirements – Canadian Electrical Code, Part II*;
- CAN/CSA C22.2 NO. 9.0-96 (R2006) *General Requirements for Luminaires*;
- CAN/CSA C22.2 NO. 9.0S1-97 (R2004) *Supplement No. 1 to C22.2 No. 9.0-96, General Requirements for Luminaires*;
- CAN/CSA C22.2 NO. 39-M1987 (R2007) *Fuseholders*;
- CAN/CSA C22.2 NO. 43-08 *Lampholders (Bi-national standard with UL 496)*;

- CAN/CSA C22.2 NO. 74-96 (R2005) *Equipment for Use with Electric Discharge Lamps*;
- CAN/CSA C22.2 NO. 106-05 *HRC-Miscellaneous Fuses*;
- CAN/CSA C22.2 NO. 141-02 (R2007) *Unit Equipment for Emergency Lighting*;
- CAN/CSA C22.10-07 *Quebec Construction Code - Chapter V, Electricity - Canadian Electrical Code, Part I (Twentieth Edition) with Quebec Amendments*;
- CAN/CSA E598-2-1-98 (R2007) *Luminaires - Part 2: Particular Requirements - Section 1: Fixed General-Purpose Luminaires (Adopted IEC 598-2-1:1979, first edition, including Amendment 1:1987, with Canadian deviations)*;
- CAN/CSA-G164-M92 (R2003) *Hot Dip Galvanizing of Irregularly Shaped Articles*;
- CAN/CSA S6-06 *Canadian Highway Bridge Design Code*;
- CAN/CSA S136-01 (C2007) *North American Specification for the Design of Cold-Formed Steel Structural Members*;
- CAN/CSA W59.2-M1991 (R2008) *Welded Aluminum Construction*.

6.55.2.1.3 (IESNA) Illuminating Engineering Society of North America

- ANSI/IESNA RP-8-00 (R2005) *Roadway Lighting ANSI Approved Illuminating Engineering Society 01-Jul-2000*;
- IES HB-9-2000 *IESNA Lighting Handbook Edition: 9th Illuminating Engineering Society 01-Dec-2000*.

6.55.2.1.4 (MTQ) Ministère des Transport du Québec

- MTQ – *Cahier des charges et devis généraux (CCDG)*;
- MTQ – *Normes – Ouvrages routiers – Tome III Ouvrages d’art, Chapitre 2 Conception des ouvrages d’art*;
- MTQ – *Normes – Ouvrages routiers – Tome III Ouvrages d’art, Chapitre 6 Structure de signalisation, d’éclairage et de signaux lumineux*.

6.55.2.1.5 (UL) Underwriters Laboratories Inc.

- UL496 *Lampholders*.

6.55.3 MATERIALS

6.55.3.1 GENERAL

6.55.3.1.1 All devices, materials and equipment for the lighting system shall be CSA approved.

6.55.3.2 LIGHT FIXTURES

6.55.3.2.1 Light fixtures shall conform to standards CAN/CSA C22.2 NO. 0, CAN/CSA C22.2 NO.9.0 and CAN/CSA C22.10 and shall meet the requirements on the drawings and in the *Special Technical Conditions*.

6.55.3.2.2 Light fixture boxes shall be matrix-formed or folded-and-welded aluminum and shall be designed to withstand wind, ice and live loads (handling and installation) in accordance with the requirements set out in standard CAN/CSA S6.

6.55.3.2.3 The optical system of the light fixtures shall comprise an aluminum reflector with a specular finish with a reflection coefficient of 0.8 (80%) and a 3 mm heat-resistant borosilicate lens. The lens shall be smooth and convex.

6.55.3.2.4 All assembly joints on light fixture components shall have seals to keep dust and water away from the optical components in accordance with classification IP-64 in standard CAN/CSA E598-2-1.

6.55.3.2.5 Light fixtures shall permit butt joining and adjustment to a pole, bracket or tenon using a coupler with integrated galvanized clamps attached to the box.

6.55.3.2.6 Light fixtures shall have a plate or other suitable device allowing sideways and up-and-down adjustment in order to optimize photometric performance.

6.55.3.2.7 The efficiency of the optical system shall be greater than 65% based on the ratio between the nominal light output generated by the bulb and the light output distributed by the light fixture.

6.55.3.2.8 All light output from the light fixture shall conform to standards ANSI/IESNA RP-8 and IESNA HB-9.

6.55.3.2.9 Ballasts shall conform to standard ANSI C82.4 depending on the type of bulbs specified on the drawings and in the *Special Technical Conditions*. Further, ballasts shall have the following features:

6.55.3.2.9.1 be designed to light the bulb and operate at a temperature of -30°C at 90% of the nominal voltage;

- 6.55.3.2.9.2 have a range of input voltages of $\pm 10\%$ of the nominal voltage;
- 6.55.3.2.9.3 have a minimum power factor of 95%;
- 6.55.3.2.9.4 be mounted on a ballast pad attached to the box with a hinge and a fastener that allows the ballast to be hung without tools;
- 6.55.3.2.9.5 be designed so that it can be taken out without having to remove the fixture from its console.
- 6.55.3.2.10 The bulb socket shall be vibration resistant and shall comprise a vitreous porcelain receptacle, a coupler and a spring-loaded contact made of a corrosion-resistant copper-plated alloy or a stainless steel contact.
- 6.55.3.2.11 The socket shall be insulated for a minimum pulse temperature of 5 kV based on standard UL496.
- 6.55.3.2.12 The initial position of the socket shall be factory adjusted, but it shall also be possible to make adjustments on site.
- 6.55.3.2.13 All mounting accessories, such as bolts, nuts, springs, lock washers, hinges, screws, rivets, hooks, safety straps and cables, shall be stainless steel.

6.55.3.3 BULBS

- 6.55.3.3.1 Bulbs shall conform to standards CAN/CSA C22.2 NO. 0, CAN/CSA C22.2 NO. 74 and CAN/CSA C22.10 and shall meet the requirements set out on the drawings and in the *Special Technical Conditions*.

6.55.3.4 POLES, BRACKETS AND TENONS

- 6.55.3.4.1 Poles, brackets and tenons required on the deck of the structure shall be round galvanized steel conforming to standard CAN/CSA G164.
- 6.55.3.4.2 Poles, brackets and tenons required outside the deck of the structure shall be round galvanized steel or aluminum as specified in the *Special Technical Conditions* and shall conform to standard CAN/CSA G164.
- 6.55.3.4.3 Poles and tenons shall be the same material and finish as the poles to which they are attached.
- 6.55.3.4.4 Where an assembly of metal parts has to be galvanized, the **Contractor** is responsible for determining whether the type of components and the configuration of the assembly may be problematic in terms of the density and thickness of the required coatings and for applying as needed the recommendations on surface preparation set out in paragraph B6 of Schedule B of standard CAN/CSA-G164.

6.55.3.4.5 Galvanized surfaces damaged during shipment or installation shall be repaired to the satisfaction of the Engineer using one of the following cold galvanization products:

6.55.3.4.5.1 "Sealtight Galvafruid Zinc-Rich Coating", distributed by W.R. Meadows of Canada Limited;

6.55.3.4.5.2 "Z.R.C.", manufactured by Sealube (Quincy, Massachusetts) and distributed by Torfasco Limited;

6.55.3.4.5.3 "LPS-Instant Cold Galvanize", distributed by Furnace Engineering Company (Canada);

6.55.3.4.5.4 "Galvanox Type 1", manufactured by Carboline and distributed by Corrosion Service Company Limited.

6.55.3.5 FUSEHOLDERS AND FUSES

6.55.3.5.1 Fuses shall be designed for a current strength of 15 A with a breaking capacity of 100,000 A, HRC, size I-J (formerly class J), conforming to standard CSA C22.2 NO.106.

6.55.3.5.2 All fuses for this Contract shall be supplied by the same manufacturer.

6.55.3.5.3 Fuseholders shall be appropriate to the class of fuses prescribed in paragraph 6.55.3.5.1 above and shall conform to standard CAN/CSA C22.2 NO. 39.

6.55.3.5.3.1 No adaptor shall be used with fuseholders.

6.55.3.6 IDENTIFICATION PLATES

6.55.3.6.1 Pole identification plates shall be made of 3003-H140.8 aluminum alloy with a thickness of 0.8 mm.

6.55.3.6.2 The surface of the plates shall be treated with chromate before being coated with black Duracron series 630 thermo-setting enamel with a 15% sheen.

6.55.4 DESIGN

6.55.4.1 The **Contractor** is responsible for designing the light fixture support structure according to the basic parameters set out on the drawings.

6.55.4.2 Lighting structures comprising poles and brackets, as the case may be, shall be designed to withstand dead loads, wind and ice loads and live loads (handling and installation) in accordance with standard CAN/CSA S6.

- 6.55.4.2.1 The design of welded assemblies of aluminum structures shall conform to standard CAN/CSA W59.2.
- 6.55.4.2.2 Steel structures shall be designed in accordance with standard CAN/CSA S136.
- 6.55.4.3 At least fourteen (14) days before any lighting structures are ordered and fabricated, the **Contractor** shall submit to the Engineer for review and comment a detailed shop drawing of the new lighting structures, including dimensions and design notes and bearing the seal and signature of an engineer who is a member of the Ordre des ingénieurs du Québec.

6.55.5 EXECUTION OF WORK

6.55.5.1 GENERAL

- 6.55.5.1.1 Lighting structures and light fixtures shall be installed in accordance with the requirements of the drawings and specifications and the manufacturers' recommendations.

6.55.5.2 PLANNING

- 6.55.5.2.1 At least fourteen (14) days before installation of light fixtures begins, the **Contractor** shall submit to the Engineer for review and comment technical data sheets for the bulbs, ballasts and light fixtures along with photometric data.
- 6.55.5.2.2 The photometric data shall be determined by an independent test laboratory and shall include total absorbed power (in watts), light intensity (in candelas), spectral power distribution, light output (in lumens), standardized fixture performance, usage factor, type of bulb and name of bulb manufacturer.
- 6.55.5.2.3 The technical data sheets for the ballasts shall include the ballast factor and the total harmonic distortion rate.

6.55.5.3 INSTALLATION OF LIGHTING STRUCTURES COMPRISED OF POLES, BRACKETS AND TENONS

- 6.55.5.3.1 The **Contractor** shall handle the modules and segments of the lighting structures using the hoisting points identified by the manufacturer.
- 6.55.5.3.2 The **Contractor** shall supply and install conductors for power supply and grounding inside the poles and inside the brackets and tongues as the case may be, in accordance with the requirements set out in subsection 6.52 *Electrical Cables*. The type of conductor shall be as specified on the drawings and in the *Special Technical Conditions*.
- 6.55.5.3.3 The poles shall be installed level using a spirit level or a plumb bob.

- 6.55.5.3.4 The access door on the poles shall be oriented so that it opens on the traffic lane side and so that the electrician is facing the direction of traffic.
- 6.55.5.3.5 Electric or percussion tools shall not be used to tighten bolts.
- 6.55.5.3.6 The **Contractor** shall use a properly calibrated torque wrench to tighten bolts.
- 6.55.5.3.7 The **Contractor** shall supply and install nut caps after the poles are installed.
- 6.55.5.3.8 The wires inside the poles shall be connected to the electrical power distribution system using fuseholders and fuses accessible through the access door.
- 6.55.5.3.9 An identification plate shall be installed in such a manner that the information is on the traffic lane side and visible from the lane adjacent to the pole. Further, the plate shall be fastened to the pole with stainless steel rivets or screws.
- 6.55.5.3.10 Unless otherwise indicated in the *Special Technical Conditions*, the identification plates on the poles shall contain the following information:
 - 6.55.5.3.10.1 the name of the roadway infrastructure (“JC” for Jacques Cartier Bridge, “CH” for Champlain Bridge, “AB” for Bonaventure Expressway, “HM” for Honoré Mercier Bridge, “ES” for the Champlain Bridge ice control structure (Estacade) and “TM” for Melocheville Tunnel) immediately followed by the number of the section of the structure, the number of the phase to which the structure is connected and the identification number of the lighting structure (e.g., JC01-02-06);

6.55.5.4 INSTALLATION OF LIGHT FIXTURES AND BULBS

- 6.55.5.4.1 The **Contractor** shall connect the light fixtures to the power supply circuit and mount them on the supports as specified on the drawings and in the *Special Technical Conditions*.
- 6.55.5.4.2 The **Contractor** shall adjust the light fixtures on the supports so that they are horizontally level.
- 6.55.5.4.3 The **Contractor** shall install the bulbs and check the adjustment of the sockets based on the light distribution recommended by the manufacturer of the light fixtures.
- 6.55.5.4.4 The light fixtures included in this Contract shall not be run permanently until the Interim Certificate of Completion is issued.

6.55.5.5 REPLACEMENT OF BULBS

- 6.55.5.5.1 The **Contractor** shall provide the **Owner** with a set of replacement bulbs equal in number to 5% of the bulbs supplied (minimum of one bulb) for each type of bulb supplied and installed.
- 6.55.5.5.2 The replacement bulbs shall be supplied in their original container. The container shall indicate the type, strength and voltage of the bulbs, the name of the structure and the section number (e.g., "JC4").
- 6.55.5.5.3 A list of the replacement bulbs supplied shall be submitted to the Engineer before the Interim Certificate of Completion is issued.

6.55.6 QUALITY CONTROL

6.55.6.1 GENERAL

- 6.55.6.1.1 The **Contractor** shall provide qualified staff and ensure that measurement and testing devices are available to carry out any tests required under this Contract.
- 6.55.6.1.2 The **Contractor** shall notify the Engineer in writing at least fourteen (14) days in advance of the requested tests, and the Engineer shall have the option of inspecting the installation and being present when the tests are conducted.
- 6.55.6.1.3 No tests are to be conducted without the Engineer's authorization. Any flaws or defects that come to light during testing shall be rectified by the **Contractor** to the Engineer's satisfaction.

6.55.6.2 PHOTOMETRIC TESTING AND MEASUREMENT

- 6.55.6.2.1 The **Contractor** shall conduct run tests after the light fixtures are connected in order to check whether the bulbs and the photoelectric cell work.
- 6.55.6.2.2 Before the Interim Certificate of Completion is issued, the **Contractor** shall conduct lighting tests in the evening and at night in order to show the Engineer that the light fixtures are adjusted properly and the photometric measurements comply with the recommendations of the manufacturer of the light fixtures. To that end, photometric measurements shall be taken at each light fixture and the results shall be submitted to the Engineer in writing.
- 6.55.6.2.3 If the measurements and tests do not meet the requirements of the Contract or the manufacturer, the **Contractor** shall take the necessary corrective action at its expense and to the satisfaction of the Engineer.

END OF SUBSECTION