PART E

SPECIFICATIONS

Template Version: G220040901

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TECHNICAL SPECIFICATIONS for TRAFFIC SIGNAL LIGHT DUTY STRAIGHT SHAFT POLE of 10 FEET in HEIGHT

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1. Certified Detailed Design Drawings

1.1 The engineer certified detailed drawings include a material list and all dimensions and tolerances applicable to all critical dimensions. On the drawings, details are included for every element of the traffic signal light duty straight shaft pole, including:

a) Base plate
b) 4 ¾ inch x 24 inch (38 circuit) access panel detail
c) Removable terminal strip bracket/mounting bracket assemblies
d) 4 ¾ inch x 24 inch access panel cover
e) Tamper proof cup washer
f) Octagonal nipple plate for 10 foot pole

2. Certified Structural Stress Analysis

2.1 The engineer certified structural stress analysis of the traffic signal light duty straight shaft pole of 10 feet in height, includes calculations of stresses at the base of the pole and at the access panel. Placement of all attachments to the pole are as described in detail in **3.4** "Pole Attachment Configuration". Loading is prescribed in **3.2** "AASHTO Standards" and **3.3** "Wind Loading".

3. Design Standards

3.1 The following City of Winnipeg drawings are attached to and form part of this specification:

a) **ST-111, REV 2, April 26, 2004** – 4 3/4" x 24" Access Panel (38 Circuit) for Traffic Signal Pole
b) **ST-164, REV 1, April 26, 2004** - Cover for the (38 Circuit) Wiring Access Panel
c) **ST-165, REV 2, May 26, 2004** - Traffic Signal Light Duty Straight Shaft Pole of 10 Feet in Height

3.2 **AASHTO Standards:** The traffic signal light duty straight shaft pole of 10 feet in height is designed in accordance with the 2001 4th edition and latest revisions of The American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

3.3 **Wind Loading:** The traffic signal light duty straight shaft pole of 10 feet in height is designed to withstand design wind pressure $P_z = 0.00256\ K_z\ G\ V^2\ I_r\ C_d$ pounds per square foot, where $(0.00256\ G\ V^2) = 25.6$ psf, K_z as per AASHTO table 3-5 except not less than 1.0, $I_r = 1.0$ for 50 year design life and C_d as per AASHTO table 3-6. This pressure is applied to the pole and attachments as herein described in **3.4** "Pole Attachment Configurations".

3.4 **Pole Attachment Configuration:** The light duty straight shaft pole of 10 feet in height is designed to support traffic signal heads and traffic sign when loaded as specified without distress. The structural design calculations and stress analysis take into account the following configuration of attachments to the light duty traffic signal straight shaft pole of 10 feet in height as shown on sheet 2 of drawing **ST-165**, latest revision.

(a) One (4 section x 12 inch) signal head: "Top Mount", dimensioned 14 inches wide x 56 inches high – weight 64 lbs. (mounted on nipple at top of pole) **and**

(b) Two pedestrian heads at 90 degrees: each dimensioned 13 ½ inches wide x 13 ½ inches high – total weight 50 lbs. (each mounted 8 feet 7 inches above base to bottom of heads and each 16 inches out from edge of pole) **and**

(c) One traffic sign: dimensioned 24 inches wide x 24 inches high – weight 14 lbs. (mounted 5 feet,11 inches above base to bottom of sign)

TECHNICAL SPECIFICATIONS for TRAFFIC SIGNAL LIGHT DUTY STRAIGHT SHAFT POLE of 10 FEET in HEIGHT

4. Material

4.1 All materials used for fabrication of traffic signal light duty straight shaft poles of 10 feet in height shall be new and not previously used.

4.2 The octagonal pole shaft walls shall be fabricated from **11 gauge** structural steel meeting as a minimum the requirements of ASTM A570 Grade 50 (50 ksi Design Yield Strength).

NOTE: Steel shall not be acceptable unless the mill test certificate states the grade to be 50 ksi minimum yield. Lower grade steel shall not be acceptable (despite favourable published mill test yield results) and pole shafts fabricated without steel certification shall be rejected.

4.3 The structural steel shaft and access panel cover shall have silicon content less than or equal to 0.06 percent. Other components shall have silicon content controlled as required to prevent detrimental galvanizing effects.

4.4 The base plate material shall be steel meeting the requirements of CSA G40.21 44W.

4.4 The access panel cover shall be **7 gauge** steel meeting the requirements of ASTM 570 Grade 50.

4.6 Type 316 stainless steel (non-magnetic) hardware shall be used for:

a) the ¼ inch x 1 ½ inches long grounding bolt and the two grounding bolt nuts inside the access panel;

b) the two 3/8 inch x 2 ½ inches long hex head bolts which fasten the access panel cover to the wiring access panel;

c) the 3/8 inch x 1 ½ inches long hex head bolt which secures the removable terminal strip bracket to the upper mounting bracket within the wiring access panel.

4.7 Aluminum shall be used for the tamper-proof cup washers (Drawing No. ST-164, latest revision), associated with the wiring access panel.

5. Fabrication

5.1 Welding of steel structures shall be in accordance with the requirements of:

a) CSA W59-03 Welded Steel Construction (Metal Arc Welding)

b) The fabricator shall be fully approved by the Canadian Welding Bureau as per CSA W47.1-03 Certification of Companies for Fusion Welding of Steel.

5.2 All seams shall be continuously welded and free from any slag or splatter.

5.3 The longitudinal seam weld shall be a minimum of 60% penetration, excepting that within 6 inches of base plate and 4 inches from upper end of shaft shall be complete penetration.

Note: A 60% penetration longitudinal seam weld in the vicinity of the access panel will be acceptable, provided this seam weld does not intercept the circumference of the access panel.

5.4 Only one longitudinal seam weld is permitted in each pole shaft.

5.5 Pole shaft shall be one continuous length with no circumferential butt joint welds.

5.6 The surface of exposed welds shall be free of any slag or splatter.

5.7 All openings and surfaces of internal passages, through which cables will be routed, shall be free of burrs, sharp edges and points.

6. Testing

6.1 Notwithstanding the Contractor's own quality control testing of all materials, the Contract Administrator may arrange for inspection of welding procedures and steel fabrication to ascertain compliance with the Specifications and Drawings.

6.2 A testing agency may be engaged to work with the Contract Administrator to carry out shop inspections and fabrication testing of the work throughout the manufacturing process. The Contractor shall cooperate fully with the testing firm. The firm shall have access to all the Contractor's normal quality control records associated with this Contract.

6.3 Testing may include radiographic inspection and magnetic particle inspection, as determined by the Contract Administrator.

6.4 Weld inspection will be carried out in accordance with the requirements of CSA W59-03. Welds found by any of the inspection methods to be inadequate and unsatisfactory shall be repaired in accordance with CSA W59-03 and then retested. The cost of the repairs and the cost of the retest shall be paid for by the Contractor. No repair shall be made until agreed to by the Contract Administrator.

7. Protective Coating System

7.1 The sole approved protective coating system for traffic signal 10 foot poles is hot dip galvanizing.

7.2 Hot dip galvanizing shall be carried out in accordance with CSA Standard G164-M92 to a net minimum retention of 600 grams per square metre.

7.3 After hot dip galvanizing, all sharp edges and shards of galvanizing material on exterior of pole shafts shall be removed. The same standard of care shall apply to all accessible interior surfaces.

7.4 All areas of damaged galvanizing shall be repaired with self fluxing low temperature zinc based alloy rod. Use of spray-on coatings is not acceptable.

8. Design Features

8.1 Each traffic signal light duty straight shaft pole of 10 feet in height shall be complete in all respects. Shafts shall be of shell type construction, octagonal in cross section and uniformly tapered.

8.2 **Base Plate:** Each pole shaft will be base mounted and therefore suitable for installation on a concrete foundation, break away base or on a steel screw-in base using 1 inch diameter anchor bolts or connecting bolts.

a) Light duty straight shaft pole of 10 feet in height shall have base plate as shown on Drawing No. **ST-165,** latest revision. The base plate shall be G40.21 44W steel, 1 inch thick, 12 inches square, having 1 3/8 inches wide slotted bolt holes designed to suit 1 inch diameter anchor bolts which are spaced on a bolt square ranging from 6 ¾ inches to 8 1/8 inches square (9 ½ inches to 11 ½ inches bolt circle diameter). The base plate shall have an octagonal centre opening slightly larger than 7 inches "across flats" into which the bottom portion of the pole shaft wall shall be inserted and welded. The base plate corners shall be chamfered ¾ inch. Flame access slots (if necessary) shall radiate from the anchor bolt holes to the outer corners of the base plate and shall be ¼ inch maximum width.

b) Pole shaft shall be welded to the base plate by means of both interior and exterior continuous circumferential fillet welds. The interior weld shall be ground smooth prior to applying the protective coating (galvanizing). The tolerance for alignment of the base plate to the pole shaft shall be plus or minus one inch at the top of the pole shaft from perpendicular to the base plate.

8.3 **Ten (10) Feet High Straight Shaft Pole:** The pole shall consist of a straight shaft, which tapers uniformly from the base plate to the nipple plate.

a) **Overall height** of the pole from top surface of the nipple plate to the bottom of the base plate shall be **10 feet**, **±1 inch**.

b) The exterior dimensions of the 10 foot pole shaft walls measured "across the flats" shall be as follows:

i) exterior dimensions "across flats" at **top** of the shaft (at nipple plate) shall be **4 ¾ inches +0, - 1/8 inch**;
ii) exterior dimensions "across flats" at **bottom** of the shaft (at base plate) shall be **7 inches +0, -1/8 inch**.

c) At the top of each 10 foot straight shaft pole shall be a nipple plate made of ½ inch steel plate.
Centred within that plate shall be a 1 ½ inches IPS non-tapered threaded nipple extending through and projecting 1 ½ inches (+1/8", -0") above the nipple plate. The nipple shall be fastened to the plate with a circumferential weld on the interior side of the nipple plate. The nipple shall be aligned within 1 degree of the vertical centreline of the pole. The threads shall be continuous and uninterrupted from the top of the nipple to within a distance of 1/16 inch or less from the top surface of the nipple plate. The nipple shall be rethreaded after galvanizing and then covered completely with a slip on plastic protective cover, which shall be left in place for shipping. The nipple plate shall be level and smooth (its top surface completely free of any weld bead and weld splatter, such that a traffic signal head will sit "flat and true" on the plate). The nipple plate shall be octagonal in shape to match the internal "across flats" dimension of the 10 foot pole shaft and shall be inserted partially into and welded circumferentially to the top of the pole shaft (**ST-165**, latest revision).

8.4 **4 3/4 inch x 24 inch (38 Circuit) Wiring Access Panel:** Each pole shall be provided with a 4 ¾ inches wide x 24 inches long (38 circuit) wiring access panel for termination of signal control cables. The (38 circuit) wiring access panel, upper and lower mounting brackets, removable terminal strip bracket and lower terminal strip bracket support arrangement is shown on attached Drawing No. **ST-111,** latest revision. The (38 circuit) wiring access panel shall be located at a height of 46 ± 2 inches [3 foot, 10 inches] measured from centre line of panel to bottom of base plate.
The (38 circuit) access panel shall have a minimum clear opening of 4 ¾ inches wide by 24 inches long except at the corners (which are rounded as per Drawing No. **ST-111,** latest revision).
The (38 circuit) access panel ring shall be fabricated either of one continuous length of steel plate formed into a ring and welded at the junction, or may be formed of two symmetrical halves welded at the top and bottom of the panel opening.

a) The (38 circuit) access panel shall contain a **removable terminal strip bracket**, of 1 ¼ inches wide by 7 GA thick steel, having 12 drilled and tapped holes precisely located as specified on Drawing No. ST-111, latest revision, to accommodate both a 0.438 inch density double row 16 conductor terminal strip and a 0.438 inch density double row 22 conductor terminal strip. These 12 holes are located such that either the longer or the shorter terminal strip may be mounted higher or lower on the removable terminal strip bracket. The lower end of the removable terminal strip bracket shall be held captive by means of a lower terminal strip support bracket, serving as a retainer clip, welded across the interior flats near the bottom of the (38 circuit) access panel opening. A backing piece of 11 GA material, 1 inch wide shall be stitch welded to the back centreline of the removable terminal strip bracket as per ST-111, latest revision, to render the bracket more rigid.

b) **Upper Mounting Bracket and the Electrical Grounding Bolt:** An upper mounting bracket shall be provided with a ¼ inch diameter by 1 ½ inches long full threaded Type 316 stainless steel grounding bolt and two stainless steel hexagonal nuts, for the connection of ground wire(s). The grounding bolt shall be installed in a drilled and tapped hole as shown on the upper mounting bracket, its threaded portion facing outwards, and its head **welded** to the rear of the upper mounting bracket. The threads of the grounding bolt shall be kept clean and free of welding splatter etc. and shall either be protected during galvanizing, or rethreaded after.
The upper mounting bracket shall have two 3/8" - 16 UNC (Unified Standard Coarse Thread) General Purpose U-type nuts installed (Au-ve-co Part Number 10054, or equal). A lower mounting bracket shall also be installed as shown with one 3/8" - 16 UNC General Purpose U-type nut to fasten the access panel cover.
Three U-type nuts are required: two to fasten the access panel cover, the other secures the removable terminal strip mounting bracket to the upper mounting bracket. The three U nuts must be installed after galvanizing. All three U-nuts shall be installed "edgewise" (that is, with the fold of the U-nut facing the side of the access panel ring, not facing the top or bottom of the ring).
Three corresponding Type 316 stainless steel full-thread hexagonal head bolts (9/16 inch across flats) are required. Two stainless steel full thread hexagonal head bolts (9/16 inch across flats), both 3/8 inch diameter by 2 ½ inches long shall fasten the cover to the wiring access panel. A stainless steel full-thread hexagonal head bolt (also 9/16 inch across flats), 3/8 inch diameter by 1 ½ inches long shall secure the removable terminal strip bracket to the upper mounting bracket.

c) Prior to galvanizing, all sharp edges within the (38 circuit) access panel shall be ground smooth to eliminate any sharp edges or corners. The lower perimeter edge of the access panel ring, upper and lower mounting brackets and the removable terminal strip bracket shall be so treated.

8.5 **Cover for the (38 Circuit) Wiring Access Panel:** The (38 circuit) access panel shall be provided with a flanged, weatherproof steel cover. The access panel cover is detailed in Drawing No. ST-164, latest revision.

a) The cover shall be fabricated of **7 gauge** steel.

b) The access panel cover shall have a continuous circumferential perimeter flange. The flange shall overlap the access panel ring sufficient to prevent driven snow or rain entry into the access panel, even at 25.6 psf design wind pressure. Flat covers will be rejected.

c) The two holes in the cover for the mounting bolts shall be circular, ½ inch diameter and centred over the upper and lower bracket mounting holes both vertically and horizontally to match the U-nuts.

d) Covers shall have a smooth, continuous perimeter flange edge. All rough edges on the covers shall be ground smooth.

e) Covers shall have both interior and exterior surfaces galvanized.

f) After galvanizing, a weather strip of closed cell foam, ¼ inch thick and ¾ inch wide, shall be applied to form a continuous perimeter around the outer edge of the interior flat portion of the cover. This interior perimeter weather strip shall bear down onto the access panel ring to effectively seal the access panel when the cover is attached.

g) The Contractor shall install the access panel covers after the poles have been galvanized, prior to final delivery.

h) An alternate access panel cover manufactured from "non-steel" material may be substituted for the galvanized steel cover, subject to review and approval of the Contract Administrator prior to manufacturing. "Non-steel" type access panel covers shall be strong, durable, ultraviolet stabilized, tamper proof and not subject to breakage or deformation under temperatures ranging from –50º C to +50º C. A sample of the proposed alternate cover shall be provided to the Contract Administrator for inspection prior to approval.

i) The cover shall be secured to the access panel by two 3/8 inch diameter by 2 ½ inches long, fully threaded hexagonal head Type 316 stainless steel bolts (hex head bolts, 9/16 inch across flats), each bolt complete with tamper proof cup washer (Drawing No. **ST-164,** latest revision). The tamper proof cupwasher shall have an internal diameter of 13/16 inch.

9. Manufacturer's Identification

9.1 Each pole shall be marked in a clearly legible form to identify **the manufacturer and the production year**. Raised lettering shall be confined to the width of one "flat," not less than 1 inch in height and shall be raised not less than 1/16 inch in weld metal at the following prescribed location:

a) External face of pole within 24 inches of the bottom of shaft.

9.2 Format of the raised lettering markings shall be as follows:

a) "**XX – YR**" - where "XX" shall be the abbreviation or logo of the Contractor's firm, followed by "dash", followed by the last two digits of the year of manufacture.