



**MATERIAL SPECIFICATION FOR
RAISING AND LOWERING EQUIPMENT
FOR HIGH MAST LIGHTING POLES**

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2476.01 SCOPE

The specification covers the requirements for raising and lowering equipment for high mast lighting poles.

2476.02 REFERENCES

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

Ontario Provincial Standard Specifications, Construction

OPSS 911 Coating Structural Steel Systems

Ontario Provincial Standard Specifications, Material

OPSS 1704 Paint Coating Systems for Structural Steel

CSA Standards

C22.2 No. 38-18	Thermoset-Insulated Wires and Cables
C22.2 No. 42-10 (R2015)	General Use Receptacles, Attachment Plugs, and Similar Wiring Devices
C22.2 No. 49-18	Flexible Cords and Cables

C22.2 No. 94-M91 (R2011)	Special Purpose Enclosures
G40.20-13/G40.21-13 (R2018)	General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels
W47.1-09 (R2014)	Certification of Companies for Fusion Welding of Steel
W59-18	Welded Steel Construction
W178.1-18	Certification of Welding Inspection Organizations
W178.2-18	Certification of Welding Inspectors

Canadian General Standards Board (CGSB)

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

ASTM International

A 123/A 123M-17	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
F 593-17	Stainless Steel Bolts, Hex Cap Screws, and Studs
F 594-09 (2015)	Stainless Steel Nuts

IEEE

C62.1-1989 Gapped Silicon-Carbide Surge Arresters for AC Power Circuits

National Electrical Manufacturers Association (NEMA)

250-2018 Enclosures for Electrical Equipment (1000 Volts Maximum)

2476.04 DESIGN AND SUBMISSION REQUIREMENTS

2476.04.01 Design Requirements

Raising and lowering equipment for high mast lighting poles shall be designed such that under all conditions the load on the winch cable shall never exceed 25% of the minimum breaking strength of the winch cable.

Raising and lowering equipment for high mast lighting poles shall be designed such that under all conditions the load on each support cable shall never exceed 25% of the minimum breaking strength of each support cable.

2476.04.02 Submission Requirements

2476.04.02.01 Working Drawings

Working Drawings shall be prepared for the fabrication of raising and lowering equipment for high mast lighting poles.

Three sets of Working Drawings shall be submitted to the Contract Administrator at least 14 Days prior to commencement of fabrication of the raising and lowering equipment for high mast lighting poles, for information purposes only. Prior to making a submission, the seals and signatures of a design Engineer and a design-checking Engineer shall be affixed on the Working Drawings.

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

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

Working Drawings shall include the following:

- a) Detailed dimensioned layouts, including plans, elevations, and sections to clearly indicate the following:
 - i. Luminaire support rings and arms
 - ii. Luminaire mounting arrangements
 - iii. Counter-balancing arrangements
 - iv. Head assembly balancing arrangements
 - v. Motor mounting arrangements
 - vi. Winch mounting arrangements
 - vii. Electrical breaker box mounting arrangements
 - viii. Junction box details and mounting arrangements
 - ix. Electrical control enclosure mounting arrangements
- b) Detailed wiring diagrams for the internal drive luminaire raising and lowering equipment.
- c) Detailed wiring diagrams for the portable power units.
- d) Detailed bill of materials for the following:
 - i. Support cables and connectors
 - ii. Electrical cables and connectors
 - iii. Electrical circuit breakers
 - iv. Motors, reducers, and torque limiters
 - v. Electrical control enclosures
 - vi. Motor control circuitries
- e) Functional test data reports on the raising and lowering mechanism indicating that the gearbox mechanism meets manufacturer's specifications.
- f) Detailed parts list and sources of supply for each of the items listed.

2476.05 MATERIALS

2476.05.01 Attachment Hardware

All bolts, washers, spacers, springs, and locknuts shall be stainless steel type 304. Locknuts shall be vibration-proof and of the captive type. Self-tapping screws shall be stainless steel type 302HQ. Bolts shall be according to ASTM F 593 and nuts according to ASTM F 594.

2476.05.02 Latch Shaft and Locking Pin

The latch shaft and locking pin shall be formed from a continuous casting of type 316 stainless steel.

2476.05.03 Pulleys

Pulleys shall be fabricated from stainless steel or steel with a chromate finish.

2476.05.04 Luminaire Support Ring

The ring shall be fabricated from steel channel according to CAN/CSA G40.21, Grade 300W, and hot dip galvanized according to ASTM A 123. If required, counter balancing galvanized hardware shall be

supplied as part of the ring assembly. The steel shall be certified to be impact tested per heat to Category 3 and shall satisfy the Charpy V-Notch test requirements of 20 joules for Grade 300 WT. Silicon content in the steel shall be equal to or less than 0.06%.

2476.05.05 Luminaire Tenon Arms

The luminaire tenon arms shall be HSS 60 mm diameter x 6.4 mm thick. The tenon arms shall be fabricated according to CSA G40.20/G40.21, Grade 260 WT, for high strength weldable notch tough steel, and hot dip galvanized according to ASTM A 123. The steel shall be certified to be impact tested per heat to Category 3 and shall satisfy the Charpy V-Notch test requirements of 20 joules for Grade 260 WT. Silicon content in the steel shall be equal to or less than 0.06%.

2476.05.06 Electrical Junction Box on the Ring

The electrical junction box on the ring shall be of stainless steel, CSA C22.2 No. 94, Type 4X, or NEMA 250, Type 4X, size 300 x 300 x 150 mm complete with connector and terminal blocks.

The connector shall be according to CSA C22.2 No. 42. The connector shall be protected with a cover and shall be housed in a CSA C22.2 No. 94, Type 3R, or NEMA 250, Type 3R, weatherproof, gasketed, polyester fibreglass reinforced housing.

2476.05.07 Lightning Arresters

Secondary thyrte-type lightning arrestors shall be rated to 650 V and according to IEEE C62.1.

2476.05.08 Electrical Cables

The electrical wiring on the ring shall be type SOW or SOOW according to CSA C22.2 No. 49 or Type TWH according to CSA C22.2 No. 38.

The power riser cable shall be type SO, SOW, or SOOW according to CSA C22.2 No. 49.

The circuit breaker cable shall be type SO, SOW, or SOOW according to CSA C22.2 No. 49.

The motor power cable and remote operating switch cable shall be type SOW or SOOW according to CSA C22.2 No. 49.

The motor cable shall be #12 AWG, number of conductors suitable for single or 3 phase motors.

The remote switch cable shall be #14 AWG, 4 conductor cable.

2476.05.09 Bumper Guard

The bumper guard shall be made from extruded santoprene thermoplastic rubber.

2476.05.10 Centring Arms

Centring arms shall be stainless steel spring-loaded complete with rubber non-marking rollers.

2476.05.11 Latch Indicator Flags

Indicator flags shall be flat stainless steel and shall be covered on the bottom side with high reflectance material.

2476.05.12 Twist Lock Plug Connectors

Twist lock plug connectors shall be according to CSA C22.2 No. 42.

2476.05.13 Winch Cable

As a minimum, the winch cable shall be 7.94 mm (5/16") diameter pre-stretched, stainless steel type 302/304, 7 x 19 strand aircraft cable.

2476.05.14 Internal Drive Motor

The internal drive motor shall be a 600 V, 3-phase, 1.5 hp reversible motor suitable for the 347/600 V system or a 240 V, single-phase, 1.5 hp reversible motor suitable for the 120/240 V system.

2476.05.15 Portable Power Unit

Portable power units shall be supplied when external drive mechanisms are used for driving the winch and shall be capable of operating the system at the capacity described and as specified in the Contract Documents.

The portable power unit shall be provided with a remote operating switch.

The portable power unit shall be provided with a torque limiting device between the power unit and the winch.

The portable power unit shall be equipped with a shear key that will give way before the breaking strength of the support cables is exceeded.

The portable power unit shall operate using a 120 V single-phase power source. When required to suit the power distribution system, a step down transformer shall be supplied with the unit. The portable power unit and the transformer shall be equipped with a female connector component of the combination twist lock plug connector type unit as described in the Electrical Connectors and Fittings clause in the Electrical Cables and Equipment subsection to match the plug for the luminaire riser wire and so ensure that the riser cable is disconnected prior to lowering the luminaire support ring. The transformer is to be housed in a weatherproof enclosure suitable for portable use.

2476.05.16 Reversing AC Magnetic Starter

The reversing AC magnetic starter shall comprise of an overload relay and a reversing contactor assembly rated 600 V, 7.5 hp for the 347/600 V system or 240 V, 3 hp for the 120/240 V system. Coil voltage for the contactors shall be 30 V or less.

The magnetic starter shall be electrically and mechanically interlocked to ensure against both contactors being energized simultaneously.

2476.05.17 Control Transformer and Power Supply

A control transformer, 347/30 V for the 347/600 V system or 120/30 V for the 120/240 V system shall be used to provide the 30 V or less coil voltage for the starter.

2476.05.18 Torque Limiter

The torque limiter shall be fabricated from corrosion resistant materials.

The torque limiter shall have automatic resetting features and provide flexibility between shafts.

2476.05.19 Remote Operating Switch Assembly

The complete remote operating switch shall have a CSA C22.2 No. 94, Type 4X, or NEMA 250, Type 4X, enclosure and operate at 30 V or less.

2476.05.20 Support Cables and Fittings

As a minimum, the support cables shall be flexible, 4.76 mm (3/16") diameter, pre-stretched, stainless steel type 302/304, 7 x 19 strand aircraft cables with a nominal breaking strength of 1,678 kg.

All cable fittings shall be stainless steel compression type and their load rating shall be at least 95% of the minimum breaking strength of the cable.

2476.05.21 Shroud Material and Coating

The shroud shall be 1.5 mm thick reinforced anodized aluminum. Coating shall be according to OPSS 911 and OPSS 1704.

2476.05.22 Electrical Connectors and Fittings

Electrical plugs and connectors for use with the riser wiring shall be a combination twist lock type that includes a disconnect switch according to CSA C22.2 No. 42.

2476.05.23 Housing for Connector

The housing for connector shall be CSA C22.2 No. 94, Type 3R, or NEMA 250, Type 3R, weatherproof, gasketed, polyester fibreglass reinforced housing.

2476.05.24 Electrical Breaker and Control Enclosure

The electrical breaker and control enclosure shall be CSA C22.2 No. 94, Type 4X, or NEMA 250, Type 4X, aluminum enclosure.

2476.07 PRODUCTION

2476.07.01 General

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

All fabrication shall be according to the dimensions on the Working Drawings and the Contract Documents.

2476.07.02 Head Frame Assembly

The head frame assembly shall consist of the following:

- a) Pulleys designed to support the power riser and support cables. The pulleys shall be fabricated from stainless steel or steel with a chromate finish and shall run on permanently lubricated bearings. Pulley diameters shall be large enough to prevent damage to the riser and support cables.
- b) A slip fitter to suit the pole tenon.
- c) Guides to ensure cables remain on their pulleys.
- d) Guides and stops to ensure the luminaire support ring is properly positioned.
- e) Spun aluminum dome cover to protect the pulleys from the elements. The cover shall be bolted to the head frame with stainless steel hardware.

- f) Three latching mechanisms to support the ring when it is in the locked position. The latching mechanisms shall consist of a stainless steel cam cover, a latch cam, and a latch shaft with a locking pin. The latch shaft and locking pin shall be formed from a continuous casting of type 316 stainless steel. The locking pin shall not be welded onto the latch shaft. The latch shall engage the latch plate. The latching mechanisms shall remove all the load from the winch and support cables when in the locked position.

2476.07.03 Luminaire Support Ring Assembly

The luminaire support ring shall support a maximum of 12 luminaires weighing a total maximum of 400 kg. The ring for the 25, 30, 35, 40, and 45 m poles shall support luminaires complete with shields and shroud having a combined maximum luminaire effective projected area of 4.0 m². Rings shall be capable of being drilled to accept up to 12 equally spaced HSS 60 mm diameter x 6.4 mm thick wall luminaire tenon arms. The arms shall be bolted to the ring.

The ring shall be fabricated from steel channel and hot dip galvanized. The ring shall be a balanced assembly and, if required, counter balancing galvanized hardware shall be supplied as part of the ring assembly.

Each tenon arm shall be capable of supporting a luminaire and shield having a maximum combined effective projected area of 0.2 m².

One weatherproof, stainless steel junction box, size 300 x 300 x 150 mm complete with connector and terminal blocks shall be mounted to the ring in-line with the pole handhole. The box shall be readily accessible for maintenance and shall not obstruct the raising or lowering of the ring. The male connector mounted on the ring-mounted junction box shall be used for testing the luminaires when the ring is in the lowered position. The connector shall be angled downward and shall be mounted on the surface of the junction box. This male connector shall be the inlet component of a combination twist lock plug connector unit and shall be compatible with the female connector unit supplied with the riser wiring. The connector shall be protected with a cover and shall be housed in a weatherproof, gasketed, polyester fibreglass reinforced housing. Liquid-tight, strain-relief, zinc-plated steel cable fittings complete with stainless steel locknuts and sealing washers shall be used for cable entries.

Secondary thyrite-type lightning arrestors shall be installed from the phase conductor to ground. The arresters shall be mounted on the ring junction box.

The ring shall be wired to the junction box and luminaire arms as required. All wiring on the ring shall be SOW or SOOW, with the number, size, and phase of conductors as specified in the Contract Documents.

The ring shall be equipped with a bumper guard. The bumper shall be continuous and securely fastened to the inside of the ring using plastic bolts and an appropriate bonding agent.

The ring shall be equipped with three equally spaced centring arms.

The ring shall be equipped with a top latching mechanism. The top latching mechanism shall lock and maintain the ring in the raised position, allowing the tension on the winch cable to be released.

The ring shall have three high visibility reflector indicator flags showing the latched and unlatched condition of the latches.

2476.07.04 Transition Assembly

The transition assembly shall consist of a galvanized transition plate and attachment hardware for the winch and support cables. Each support cable shall be terminated with a galvanized or stainless steel thimble and compression sleeve and shall be attached to the transition plate either through a galvanized forged eyebolt or an anchor spring. The winch cable shall be terminated similarly and shall be attached to the plate through a galvanized or stainless steel shank ball or swivel of sufficient size to sustain the

loading on the cable. The support cables shall travel through the pole shaft, over the head frame pulleys to the luminaire support ring where they are led through guides and are terminated with a collet type device or strand vise. Shock-absorbing compression springs shall be installed either at the transition assembly or at the cable attachment on the ring. The transition assembly design shall prevent twisting of the support cables and assure smooth winding of the winch cable.

The power riser cable originating from the ring junction box shall enter the head frame assembly such that no pressure is exerted on the cable while the ring is raised or lowered. The cable shall be supported by head frame pulleys and terminated with a male connector which is the inlet component of a combination twist lock plug connector unit and shall be compatible with the female unit provided with the riser wiring. It shall be protected with a cover and shall be housed in a weatherproof, gasketed, polyester fibreglass reinforced housing.

2476.07.05 Winch Assembly

The winch to raise and lower the luminaire support ring shall be a sealed, maintenance free, oil bath worm gear that incorporates an internal friction drag brake to prevent free spooling. The winch drum shall have a cable guide assembly to guide the uncoiled cable neatly on the drum. The winch shall have a minimum lifting capacity of 750 kg and operate at 3 m/min \pm 0.5 m/min. The winch drive shall be a horizontal drive and through a 16 mm (5/8") hex socket input shaft.

The drum shall be large enough to hold sufficient cable to meet individual pole height requirements. As a minimum, the winch cable shall be 7.94 mm (5/16") diameter pre-stretched, stainless steel type 302/304, 7 x 19 strand aircraft cable. The free end of the cable shall be finished with a galvanized or stainless steel thimble and compression sleeve. The winch cable shall be connected to the transition assembly through a galvanized or stainless steel shank ball or swivel.

The winch shall fit through the handhole opening and shall be mounted to the winch mounting plate with the hex socket input shaft to the right of the drum and pointing up. The winch mounting plate shall be attached to the pole mounting plate inside the handhole.

Operating instructions for raising and lowering the ring shall be provided and inscribed on a piece of anodized aluminum. The operating instructions shall be mounted on the inside of the pole handhole cover using silicone sealant. The lettering shall be large enough to be easily discernible.

2476.07.06 Internal Drive Motor

The internal drive motor shall be totally enclosed, fan cooled, and require no maintenance.

The internal drive motor shall be assembled and mounted on the support plate by unistrut supports or similar products that facilitate quick easy removal of the complete unit when required. The removal of the internal drive motor shall be possible with a ring in either the latched or unlatched position without causing freewheeling of the winch drum.

The internal drive motor shall be operated by a remote operating switch.

2476.07.07 Reducer

A reducer used to reduce the speed of the motor shall be installed between the motor and torque limiter. The reducer shall be set such that the winch operates at 3 m/min \pm 0.5 m/min.

2476.07.08 Torque Limiter

The torque limiter shall have automatic resetting features and provide flexibility between shafts. The torque limiter shall be bidirectional and factory pre-set at a torque value such that the raising and lowering equipment is according to the Design Requirements subsection and the manufacturer's recommendations.

2476.07.09 Remote Operating Switch Assembly

The remote operating switch shall be enclosed in a yellow, soft rubber moulded box. The box shall be provided with a tongue-and-groove cover and have a weatherproof, neoprene gasket seal and compression type nylon cord grip. The remote switch shall be clearly marked "Raise" and "Lower" and be attached to a 13 m cord. The raise and lower labels shall coincide with the supporting mechanism in the raised and lowered positions respectively. The raise and lower labels or nameplates shall be attached to the face of the remote operating switch assembly.

When an internal drive motor is used, the switch shall include a stainless steel bracket complete with S hook.

2476.07.10 Shroud

The shroud shall be attached to the luminaire support ring by means of mounting brackets.

The shroud support brackets, stiffeners, and mounting arms shall be fabricated from aluminum angle with an anodized finish. All fastening bolts and hardware shall be stainless steel.

The interior surface of the shroud assembly, shroud sections, supporting brackets, stiffeners, and mounting arms shall have a matte black finish. The exterior surface of the shroud shall be painted to suit the colour and finish of the high mast lighting pole.

The shroud and its supporting mounting brackets shall be constructed as specified in the Contract Documents.

The diameter of each shroud shall accommodate the luminaires and tenon arms that it encompasses.

2476.07.11 Electrical Cables and Equipment

2476.07.11.01 Electrical Cables

The power riser cable shall be terminated with a male connector of the inlet type that shall be a component of a combination plug connector unit. The connector shall be protected with a cover and shall be housed in a weatherproof, gasketed, polyester fibreglass reinforced housing. The cable shall have sufficient length to meet individual pole height requirements. In addition, there shall be a 2 m type SO, SOW, or SOOW jumper cable installed at the cover mounted electrical panel. The jumper cable shall be used for the following:

- a) Connection to the power riser cable with a ring in the raised position.
- b) Connection to the connector on a ring junction box for luminaire testing with the ring in the lowered position.

The motor power cable shall be able to be disconnected by means of a combination plug connector. The cable shall consist of a male and female cord-to-cord device that is sized to match the line voltage, phasing, and horsepower rating of the motor, and be of the ampacity rating specified in the Contract Documents. The unit shall include a spring-loaded connector lid, safety shutter, and spring-loaded pawl to prevent the plug from disengaging from the connector. The dead front connector shall be provided with spring-loaded silver nickel contacts that make or break the circuits. The unit as a whole shall be housed in a weatherproof, gasketed, polyester fibreglass reinforced housing.

The cable colour coding for each phase shall be according to CSA C22.2 No. 49 and shall be consistent both in the head and panel circuitry and as specified in the Contract Documents.

A braided copper strap shall be connected between the pole handhole cover and ground stud.

2476.07.11.02 Electrical Connectors and Fittings

Electrical plugs and connectors for use with the riser wiring shall be a combination twist lock type that includes a disconnect switch. The cord-to-cord unit shall be sized to match the line voltage, phasing, and horsepower rating of the motor, and be of the ampacity rating specified in the Contract Documents. It shall include a spring-loaded receptacle lid, safety shutter, and spring-loaded pawl to prevent the plug from disengaging from the connector and, that when operated, disconnects the circuits. The dead front connector shall be provided with spring-loaded silver nickel contacts that make or break the circuits. The unit as a whole shall be housed in a weatherproof, gasketed, polyester fibreglass reinforced housing.

2476.07.11.03 Electrical Breaker and Control Enclosure

One aluminum enclosure, sized as required, shall be used to house one main disconnect switch; branch circuit breakers; and motor controller complete with control transformer, terminal board, and 30 V or less power supply as required for the equipment located in the pole handhole and the system voltage. The enclosure shall be mounted on the inside of the pole using angle brackets or standoffs as specified in the Contract Documents.

2476.07.12 Welding

All welding shall be according to CSA W59. Welding shall only be undertaken by a fabricator fully approved under the requirements of CSA W47.1.

Prior to commencement of welding, the Canadian Welding Bureau Qualification Certificates for each person to be employed on the work shall be made available to the Contract Administrator. Certificates shall be currently valid and shall indicate the positions that the operator is qualified to weld.

2476.07.13 Testing

The company and inspector undertaking welding inspection shall be engaged by the Contractor. All welds shall be 100% examined by Magnetic Particle Inspection (MPI). The raising and lowering equipment shall be subjected to all visual and non-destructive testing.

The company undertaking welding inspection shall be certified for testing bridges in conformance with CSA W178.1. The certification shall encompass at least the following methods: radiograph, ultrasonic, and magnetic particle.

The inspector undertaking welding inspection shall be certified for testing bridges in conformance with CSA W178.2. Certification shall be to either Level II or III for the methods used, as required by CAN/CGSB 48.9712.

2476.07.14 Quality Control

The manufacturer shall certify that the raising and lowering devices are according to the strength and material requirements as specified in the Contract Documents.

The inspector shall perform the visual inspection and non-destructive testing of the raising and lowering devices. Both the inspector and the company employing the inspector shall be certified according to the Testing subsection.

The inspector shall inspect the place of manufacturer of the raising and lowering equipment while work on the units is being performed and shall inspect and examine the plant records and certificates, materials used, and fabrication process. The inspector shall conduct any tests as may be considered necessary.

Two copies of the completed inspection report shall be submitted to the Contract Administrator. The inspection report shall be completed and certified by the inspector.

2476.07.15 Packaging and Shipping

Raising and lowering equipment shall be shipped complete with hardware, suitably packaged to ensure that all parts are delivered as an entity. A complete parts list shall be included in the shipment. All cartons shall be marked with appropriate pole numbers.

Raising and lowering equipment shall be subject to inspection during and on completion of off-loading. If any damage is encountered during the inspection, the Contractor shall be responsible for the necessary corrective measures subject to the approval of the Owner.

The Contractor shall advise the Owner 3 Business Days prior to the shipping date of the intent to deliver and confirm that arrangements for off-loading have been made.

2476.08 QUALITY ASSURANCE

2476.08.01 Welding

All welding may be subject to inspection by both visual and non-destructive testing. The procedure and technique for visual and non-destructive testing shall be according to CSA W59, Clause 7 and 8.

If faulty welding is encountered during the inspection, corrective welding measures shall be submitted to the Contract Administrator by the Contractor.

2476.08.02 Inspection

The Contract Administrator shall be notified of the dates that fabrication and testing of the raising and lowering equipment will commence.

The Contract Administrator shall have free access to the place where the raising and lowering equipment is manufactured for the purpose of inspecting and examining the plant records, certificates, materials used, and fabrication process, while work is being performed. The Contract Administrator shall make or witness any tests as may be considered necessary.

All raising and lowering equipment may be inspected by the Contract Administrator prior to shipment.