STREET LIGHTS

**From Rutland City-Proctor STP 2728(1) Rutland City NH 2716(1) Rutland City STP 019-3(57)

XX. DESCRIPTION. This work shall consist of furnishing and installing street light assemblies, complete with lamp, wiring, fuses, and fuse holders internal to the pole handhole, with ground rod installed, grounding connections, and all other items necessary to provide a complete and operational system.

The work under this Section shall be performed in accordance with these provisions, the Plans, and Section 679 of the Standard Specifications.

XX. GENERAL. The street light assemblies shall be as generally shown and as specified in the Contract Documents. The Contractor shall furnish all supervision, materials, equipment, accessories, handling, shipping, and delivery to provide the specified street lighting assemblies as specified, complete with all appurtenances.

XX. SUBMITTALS. The Contractor shall submit Fabrication Drawings in accordance with Section 105. The Fabrication Drawings shall include all aspects and dimensions, as well as equipment and material specifications of the proposed pole, luminaire, and appurtenances clearly detailed. The submittal shall include point-by-point photometric calculations. Calculations shall be in maintained fc. Include light loss factors in report. Point-by-point calculations shall utilize an IES standard grid. To facilitate these calculations the manufacturer may contact the Engineer to receive a MicroStation.dgn file of the project area and pole layout. The design of the new street lighting system was completed in general conformance with the VTrans Lighting Design Guide.

XX. MATERIALS.

(a) Luminaires. Luminaire housing shall be made of cast aluminum, and shall be die-cast or formed by a permanent mold. Cast aluminum one-piece frames with integral latches and hinges shall provide access to the optical chamber and driver compartments. Embedded one-piece memory retentive gaskets shall ensure weatherproofing. The luminaires shall feature toolless entry to the access to the inside of the luminaire.

(b) Light Engine. Light-emitting diode (LED) and LED Drivers composed of 5 main components: Lens/LED lamp/Optical System/Heat Sink/Driver Electrical components shall be RoHS compliant.

(c) Lens. Made of 18″ prismatic sphere polycarbonate lens, mechanically assembled and sealed onto the lower part of the heat sink.

(d) Lamp. Composed of high-performance white LEDs, 58w lamp wattage (350mA) or 116w lamp wattage, (700mA) as noted in specifications and on Plans. Color temperature of 4000 Kelvin nominal, 70 CRI. Operating lifespan, 70 000 hours after which the system emits 70% of its original lumen output. Provide a metal core board for greater heat transfer and longer lifespan of the light engine.

(e) Optical System. (LE3F), I.E.S type V. Composed of high-performance acrylic collimators, optimized with varying beam angles to achieve desired distribution. System is rated IP66. Performance shall be tested per LM63 and LM79 (IESNA) certifying its photometric performance. Street-side indicated.

(f) Heat Sink. Made of cast aluminum optimizing LED efficiency and life. Product does not use any cooling device with moving parts (only passive cooling device).

(g) Driver. High power factor of 90%. Electronic driver, operating range 50-60 Hz. Auto-adjusting to a voltage between 120 and 277 volt AC rated for both application line to line or line to neutral, Class II, THD of 20% max. Maximum ambient operating temperature from -40°C (-40°F) to 55°C (130°F). Certified in compliance to cULus requirement. Weather tightness rating IP66. Assembled on a unitized removable tray with quick disconnect plug resisting to 105°C (221°F).

The current supplying the LEDs will be reduced by the driver if the internal temperature exceeds 85°C (185°F), as a protection to the LEDs and the electrical components. Output is protected from short circuits, voltage overload, and current overload. Automatic recovery after correction.

(h) Surge Protector. LED Driver 3 poles 10KV surge protectors that protect Line-Ground, Line-Neutral, and Neutral-Ground in accordance with IEEE / ANSI C62.41.2 guidelines.

(i) Fitter. Cast aluminum /w set screws. Fits on a 3" outside diameter by 3" long tenon.

(j) Type C Mid-Pole Bracket Arm. (4) Made of aluminum tubing, 2 7/8" outside diameter, complete with a decorative element, welded. Decorative element adaptor made of aluminum, complete with a tenon penetrating inside the pole. Mount bracket arms at 90 degrees around pole. Mounted mid-pole @ ~ 12' top of globe shall match Type A fixture.

(k) Poles. Pole height shall be as specified and as listed in luminaire assembly number. Poles shall be delivered to the job site with a factory-applied shipping wrap of cardboard or other material to fully protect against scratches and coating stain. Poles shall be blocked and bundled in groups of multiple poles, or use other equivalent means to prevent shifting and damage during transport. Pole shall match City’s existing style.

(1) Type A Pole. The 12’ shaft post shall be all cast aluminum construction with a classic double-tapered, fluted base and a gracefully tapered 12-flute cast shaft; minimum 0.188” wall thickness or thicker as required to handle structural loading. The post shall be heavy wall, copper free, cast aluminum produced from certified ASTM 356.1 ingot per ASTM B179-95a or ASTM B26-95. The castings shall be formed true to the pattern with complete detail. Poles shall be structurally designed to AASHTO standards, minimum 90 mph wind loading plus a 1.3 gust factor. The cast shaft shall

be circumferentially welded to the base casting and shipped as one piece for maximum structural integrity. All exposed welds below 8′ shall be ground smooth. All welding shall be per ANSI/AWS D1.2-90. All welders shall be certified per Section 5 of ANSI/AWS D1.2-90. The post shall be 12′-0" in height with a 19" diameter base. The shaft diameter shall taper from 5.5" above the base to 3.5" at the top. An integral 3" O.D. x 3" tenon shall be provided at the top for luminaire mounting. The post top shall include a transitional donut between the fluted shaft and the tenon.

(2) Type B Pole. Type B Pole shall meet the requirements of Type A Pole specified herein, with the exception that Type B Pole shall be 8′-0″ in height.

(3) Type C Pole. Type C Pole shall meet the requirements of Type A Pole specified herein, with the exception that Type C Pole shall be 20′-0″ in height.

(4) Type D Pole. Type C Pole shall meet the requirements of Type A Pole specified herein, with the exception that Type D Pole shall be 7′-0″ in height.

(l) Hardware. All hardware shall be tamper resistant stainless steel. Anchor bolts to be completely hot-dip galvanized.

(m) Installation. The post shall be provided with four, hot-dip galvanized L-type anchor bolts to be installed on a 15" diameter bolt circle. A door shall be provided in the base for anchorage and wiring access. A grounding screw shall be provided inside the base opposite the door.

(n) Maintenance Opening. Provide pole with a 3.25" x 7.5" x 6″H maintenance opening top 17" from the bottom of the anchor plate, complete with a weatherproof embossed aluminum cover and a copper ground lug. Secure aluminum handhole cover with stainless steel vandal resistant screws. Pole shaft shall be provided with a dedicated grounding lug easily accessible within the pole's access door prepared to receive a #6 bonding wire.

(o) Base Cover. Provide two piece round base cover made from cast aluminum, mechanically fastened with stainless steel screws.

(p) Banner Arms on Type C Pole. Banner arms shall be removable non-breakaway style aluminum or steel arm that slip-fits into a separate permanently installed raintight gasket through the pole, and with decorative cast aluminum ball on each end. Sizes and pole locations shall be as shown on the Plans. Upper and lower connections shall be located at the top of the 20 foot pole.

(q) Anchor Bolts. The pole manufacturer shall provide an anchor bolt template for installation, and shall provide 3/4-inch hot-dipped fully galvanized steel anchor bolts in a configuration that exceeds the maximum wind rating of the pole. Bolt circle shall be within +/-15″.

(r) Wiring. All wiring internal to the pole, except the branch circuit conductors entering the pole base, shall be by the luminaire manufacturer. Luminaires shall be supplied from the factory with a quick-disconnect connector at the luminaire(s), and shall have sufficient length of 3#12 from luminaire(s) THWN, MTW, or TEW wire to reach 18" out of the handhole in the pole base.

s) Fasteners. All exposed fasteners shall be stainless steel with ceramic primer-seal basecoat to reduce seizing of the parts. All seals and sealing devices are made and/or lined with EPDM and/or silicone. All exposed fasteners below 10 feet above grade shall have vandal-resistant heads. Provide standard vandal-resistant fasteners in the "pinned allen-socket" style requiring a specialized allen wrench to install and remove. The allen wrench contains a hole in the end to allow engagement with the vandal-resistant fasteners. All references to vandal-resistant or tamper-resistant shall imply this standard vandal resistant fastener.

(t) Powder Coating Process. The manufacturer shall coat luminaires and poles in its own facility. Out-sourcing of the powder coating process is not allowed. Finish of all pole and fixture metallic parts shall be polyester powder coat paint.

Equipment, materials, luminaires and poles that are specified to be "powder coated" shall be polyester powder coated in the manufacturer's standard black "textured" finish with a UV resistant powder designed for outdoor use without color fade. The chemical composition shall provide a highly durable UV and salt spray resistant finish in accordance to the ASTM-B117-73 standard and humidity proof in accordance to the ASTM-D2247-68 standard.

The polyester powder coating process shall have pre-treatment steps that ensure complete cleaning and adherence of the coating materials, including at least the following steps: hot alkaline wash, rinse, hot phosphoric acid etching, and final rinse.

In addition, because the project area is in a marine environment, the interior of the pole shall be powder coated, all external aluminum parts shall be provided with a special marine environment prime coating prior to powder coating, and all steel parts of the pole (ex. banner arms) will be galvanized prior to powder coating. The polyester powder coating shall be electrostatically applied thermosetting polyester resin powder coating to a minimum thickness of 4 mils/100 microns.

(u) Mechanical Resistance. In order to ensure the mechanical resistance of the poles, the projected area shall be calculated according to AASHTO 2001.

(v) Lighting Equipment Warranty. Base Product Warranty shall be full parts and labor at job site for one-year following date of Substantial Completion. Component warranties shall be as detailed herein.

The manufacturer must provide a written confirmation of its ISO 9001-2008 and ISO 14001-2004 International Quality Standards Certification.

(1) Lenses. Lenses shall be warranted for 2 years from startup.

(2) Powder Coating Finish Warranty. All surfaces featuring a powder-coat finish shall carry a full 5-year Finish Warranty from date of installation. Finish Warranty shall provide for the full cost of refinishing in the event of a coating failure. As inclusions in the Fabrication Drawings, the manufacturer shall submit full warranty information, detailing the warranty terms and conditions in accordance with this specification.

The Finish Warranty shall provide protection against:

a. Peeling and Cracking.

b. Fading and Tint. UV damage and fading of more than 5% of the original color (tint).

c. Discoloration. Discoloration in excess of 5 E units (CIE 1976 CIELAB) as measured using procedure ASTM D 2244, latest revision, comparing an unexposed sample to an exposed surface after removal of dirt and chalk.

d. Gloss Retention. In accordance with procedure ASTM D 523, latest revision, comparing an unexposed sample to an exposed surface after removal of dirt and chalk.

e. Corrosion and Lack of Adhesion. Corrosion and lack of adhesion as measured using procedure ASTM D 610, latest revision, based on the complete product assembly (for the purpose of this warranty, this procedure applies to both aluminum and steel).

(w) Lamp. Furnish and install in the correct orientation according to manufacturer’s specifications for LED in each luminaire.

(x) Fuses. Luminaire and pole mounted fuses shall be current limiting, time delay fuses rated at 100,000 Amps interrupting current.

(y) Fuseholders. For mounting in the pole base for the luminaire fuses shall be rated at 20 amperes and shall have waterproof boots. Provide one two-pole in-line fuse holder per 240/208V circuit, and one single pole fuse holder per 120V circuit. Fuse holders shall allow quick changing of fuses without affecting permanent wiring connections. Wiring connections to fuse holders shall be mechanical compression type ordered specifically for the wire sizes installed. Fuse holders shall have weatherproofing rubber boots supplied by the fuse holder manufacturer installed over all of the wires and terminations.

(z) Ground Rods. Ground rods shall be 5/8-inch diameter by 10 feet long and be copper clad steel.

(aa) Ground Rod Conductor Connections. Ground rod conductor connections shall be thermal weld type or shall be made with a UL listed hydraulically applied (12 ton minimum) compression connector. Follow manufacturer's written instructions for installing ground rod connections. Do not exceed the rated wire bundle capacities of the type of ground rod connection used.

(bb) Wiring. Exterior and underground wiring in poles, conduit, and grounding conductors: 98% conductivity copper 600 volt insulation, XHHW, THHN/THWN, or THWN-2. Streetlight pole internal wiring: 98% conductivity copper 600 volt insulation, MTW, XHHW, THWN-2, or THHN/THWN.

(cc) Color Code. All conductors shall have color-coded insulation to designate ground, neutral conductor, and phases. Colored tape alone is not acceptable. Phases shall be blue and red, receptacle branch circuit shall be black, neutral shall be white, and ground shall be green.

(dd) Wire Markers. Wire markers shall be plastic cable wrap type with marking tag for permanent tagging. Plastic tag shall have controller and circuit number written on it with permanent ink marking pen per tag manufacturer's directions.

(ee) Splices and Junctions.

(1) All splices and junctions shall be made waterproof by a UL approved method. Conductor splice shall be made by UL listed compression type butt splice kit. Waterproofing method shall be by heat shrink, by sealant in waterproof splice cap, or by sealant in cold shrink.

(2) #10 AWG or smaller, above grade: UL listed compression type connectors.

(3) #8 AWG or larger, above grade: UL listed mechanical compression connector.

(4) Splices and junctions shall not be buried or installed in conduit.

(5) Splices in junction boxes shall be UL listed hydraulic compression (12 tons minimum) type butt or two-wire stub splice with UL listed heat shrink waterproof splice cover.

(6) End caps shall be used to seal and insulate the ends of 1/C wires. End caps shall be waterproof and of thermally stabilized, modified polyolefin heat shrink material with mastic sealant inside UL listed 600 Volt, 90°C.

(7) Wet location splices and junctions shall be accomplished with UL listed heat shrink 600 Volt, 90°C, waterproof splice kits.

XX. CONSTRUCTION REQUIREMENTS. Install poles plumb and true on the foundation and in strict accordance with the manufacturer's instructions. If needed, use stainless steel flat washers or stainless steel horseshoe shims to plumb the poles. Do not seal under the pole base (to allow for drainage). Tolerance in plumb: ¼ inch in 8 feet.

Factory-applied shipping wrap of cardboard or other material shall remain in place throughout handling and installation to protect pole finish (to be removed only after final pole installation). Pole grips, truck arms, jaws, trailers, and any other surfaces that contact poles prior to or during installation shall be fully and thickly padded to prevent scratching poles. Before final acceptance of the project, provide repair or touch-up on poles that have been damaged during construction, using a method approved by the manufacturer.

Each streetlight pole shall be provided with its own separate ground rod adjacent to its foundation and bonded to the pole's grounding lug as shown in the Contract Documents.

Install luminaires with the correct optical system orientation, socket position, and inclination angle to meet the specified photometric requirements. Align luminaires vertical and perpendicular (or tangent) to the centerline of the street, and clean luminaire components of all construction dirt and dust and fingerprints prior to final completion.

Handle lighting fixtures carefully to prevent breakage, denting, or scoring of fixtures' finishes. Do not install damaged lighting fixtures. Replace with undamaged units and return damaged units to equipment manufacturer. Install luminaire, fusing, and wiring complete. Install a wattage identification sticker inside the pole handhole. No other identifying numbers except the manufacturer's nameplate shall be installed on the poles, arms, or luminaries.

Splices and junctions shall be made only in pole handholes and underground handhole junction boxes. Perform no more splices than needed. Do not splice or junction any wires that continue through a pole or junction box, in other words, those conductors without a termination to the adjacent pole. Use junction box as a pulling point only. Cable pulled through poles or junction boxes shall be marked as specified herein and shall have sufficient loop to extend 18" beyond handhole or junction box lid for future maintenance, but shall not be spliced. All splices in junction boxes shall be made waterproof by a UL listed heat shrink splice cover.

Install a tie wrap type permanent wire marker on each and every pair of conductors passing through every junction box or pole handhole (bundle circuit pairs together). Mark controller number, circuit letter, and pole number on each tie wrap and designate home runs as encountered. Install markers in each pole handhole.

XX. METHOD OF MEASUREMENT. The quantity of Special Provision (Light Pole) of the type specified to be measured for payment will be for each light pole installed in the complete and accepted work.

The quantity of Special Provision (Street Light) of the type specified to be measured for payment will be for each street light assembly installed in the complete and accepted work.

XX. BASIS OF PAYMENT. The accepted quantity of Special Provision (Light Pole) of the type specified will be paid for at the Contract unit price per each. Payment will be full compensation for furnishing, transporting, handling, and placing the materials specified and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

The accepted quantity of Special Provision (Street Light) of the type specified will be paid for at the Contract unit price per each. Payment will be full compensation for furnishing, transporting, handling, and placing the materials specified including luminaries, arms/supports, and poles; for providing a complete street light assembly, wired in place; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Light pole bases will be paid separately under Contract item 679.21.

Payment will be made under:

Pay Item	Pay Unit
900.620 Special Provision (Light Pole, Type D)	Each
900.620 Special Provision (Street Light, Type A)	Each
900.620 Special Provision (Street Light, Type B)	Each
900.620 Special Provision (Street Light, Type C)	Each