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Street Light Construction

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CITY OF KENNEWICK
STANDARD SPECIFICATIONS
FOR
STREET LIGHT CONSTRUCTION

6-1 STREET LIGHTING SYSTEM

6-1.01 GENERAL

The work covered in this section shall apply to the furnishing and installation of all materials and equipment necessary to construct the street lighting system in accordance with the requirements of the plans, specifications, and the City of Kennewick standard drawings 6-1 through 6-6 inclusive. No materials shall be ordered until the city has approved the power source as specified.

6-1.02 RESIDENTIAL DEVELOPMENT

As part of all residential development instruction plans, there shall be a separate schematic drawing which at a minimum, shows the power source(s), wiring diagram and street light pole spacing.

6-1.03 ELECTRICAL REGULATIONS AND CODES

All electrical work required under this specification shall be complete and in accordance with the required standards of all state laws, rules and regulations and the National Electrical Code (NEC), hereinafter referred to as the "Code." The Contractor's attention is called to Section 8-20.1(2) of the SWSS for a listing of Electrical Industry Codes and their abbreviations which shall be used within the body of these specifications and to call out standard procedures, materials, and testing requirements.

6-1.04 REQUEST FOR POWER SOURCE

The city will make approval of the power source when proposing to connect to an existing street light circuit. The PUD will make approval of the power source in all other situations. It is the contractor's full responsibility to verify that the luminaires ordered are compatible with the power voltage that is available, or will be installed. If the required power source(s) for street lights is not existing for the site or subdivision, the owner/developer will be required to schedule to have the power feed and transformer installed during construction of the project.

The power source for the city street lights must be an independent and approved source. Combining the power source for city street lights with private lights or other non-city service use is not allowed.

6-1.05 ELECTRICAL PERMITS

The Contractor will be required to secure, at his own expense, from the State of Washington Department of Labor and Industries Electrical Division, all state inspection permits required to construct the lighting system.

In addition to the State Electrical permit, on all projects not directly administered by a city contract, a separate construction permit is required from the City Department of Public Works,

The Contractor shall ensure that all required state and city electrical inspections are coordinated with the appropriate agency and made, prior to covering or energizing the lighting system.

6-1.06 ACCEPTANCE OF THE LIGHTING SYSTEM

The City will direct the PUD to energize the lighting system after the Contractor has obtained, from the State Electrical Inspector, written approval that the lighting system components and construction have been installed in accordance with the requirements of the Electrical Code. All installations will be required to have an energized power source, prior to acceptance of the installation(s) by the city.

6-1.07 MATERIALS

Unless otherwise indicated on the plans or special provisions, all materials utilized in the project shall be new.

6-2 STREET LIGHT STANDARDS: (POLE, MAST ARM, AND ACCESSORIES)

6-2.01 GENERAL

Street light standards (poles) shall be in accordance with City of Kennewick Standard Drawing 6-1. The pole shaft shall be of a one-section design, fabricated from U.S. Standard 11 gauge (0.1196") steel having a minimum yield strength of 55,000 psi after fabrication. The single shaft section design shall be of a one-piece construction utilizing a single full length longitudinal high-frequency weld in accordance with applicable American Welding Society (AWS) procedures, standards and specifications. The pole shaft shall be of a uniform and cylindrical cross section having a uniform taper of 0.14 inches of diameter change per foot of length. The completed assembly, including pole, mast arm, and luminaire, shall be capable of sustaining a wind velocity of ninety (90) miles per hour.

6-2.02 UNDERGROUND WIRING ACCESS HOLE

A one and five-eighth inch by nine and five-eighth inch (1-5/8" X 9-5/8") minimum, oval-shaped underground access hole with its edges deburred inside and out shall be provided in the pole shaft and located a minimum of four feet six inches (4'6") above the base end of the pole shaft at 180 degrees from the luminaire mast arm attaching point.

6-2.03 HANDHOLE

A seven and nine-sixteenth inch by five and one-eighth inch (7-9/16" X 5-1/8") minimum, oval shaped above-ground handhole with removable access cover shall be provided in the pole shaft and located 24-inches above the ground or sidewalk. The hand hole will be located on the same side of the pole as the luminaire mast arm, per Standard Drawing 6-1.

6-2.04 GROUND SLEEVE

A seven (7) gauge, twelve-inch (12") long galvanized ground sleeve shall be welded to the pole shaft around the total circumference of the pole, both top and bottom of the sleeve. The location of the ground sleeve is to be attached to the pole and shall be in accordance with the City of Kennewick Standard Drawing 6-1 for individual luminaire mounting heights.

6-2.05 POLE TOP CAP

Each standard shall be provided with a cast-iron removable pole top cap which is secured in place with three (3) stainless steel or galvanized plated set screws equally spaced about its perimeter. The pole cap shall meet ASTM A-48 Class 30.

6-2.06 LUMINAIRE MAST ARM

The luminaire mast arm shall be constructed of two and three-eighths inch (2-3/8") O.D. by 0.121" wall steel tubing with a guaranteed minimum yield strength of 36,000 psi. The mast arm shall be constructed in such a fashion as to provide a uniform rise of 2.25 feet above its point of attachment to the light standard. The standard and mast arm attaching components shall be welded to their respective members as shown on City of Kennewick Standard Drawing 6-1. The mast arm shall be capable of being held in place, on the standard, by gravity while being secured with a single one-half inch (1/2") - 13 UNC galvanized high-strength carbon steel hex-head hub bolt. The installed attachment of the mast arm to the light standard shall provide an internal weather resistant wiring raceway.

6-2.07 STANDARD FINISH, FASTENERS, AND ACCESSORIES

The luminaire standard, mast arm, and accessories shall receive a hot-dipped galvanized finish after fabrication in accordance with ASTM designation A123. All fasteners and attaching devices shall be galvanized in accordance with ASTM designation A153.

6-2.08 GROUNDING LUG

Each light standard shall be provided with an internal threaded one-half inch (1/2") diameter nut holder and fastener for grounding the pole and mast arm assembly.

6-2.09 MEASUREMENT AND PAYMENT

The unit contract price for "Light Standard Type 1", or for "Light Standard Type 2)," per each, shall be full compensation for furnishing all labor, materials tools and equipment necessary or incidental to furnish and install the light pole, mast arm, pole top cap and other appurtenances to the pole at the locations shown on the plans or where directed by the Engineer.

6-3 LUMINAIRES

6-3.01 GENERAL

Luminaires shall be of the Illumination Engineering Society (IES) Type III distribution pattern, unless otherwise specified in the special provisions, and shall be of the wattage, average initial lumens, and spaced to meet the requirements for street widths as required on City of Kennewick Standard Drawing 6-2 or as on the contract drawing.

Luminaires shall be ballast in-head type with cobra head configuration, and shall provide a cut-off distribution using a refractorless housing and a high pressure sodium light source. The lamp compartment shall be sealed with an elastomer gasket and shall provide a charcoal filter for the vent.

Luminaries shall have a cast aluminum housing with a slip-fitter end mounting capable of being attached to a one and one-quarter inch (1-1/4") I.D. through two inch (2") I.D. pipe tenon on mast arms.

The reflector of all luminaires shall be manufactured of a polished aluminum. The flat lens shall be formed from heat-resistant, high-impact borosilicate or tempered glass and shall be mounted in a door frame assembly which shall be hinged to the luminaire at a point near the slip-fitter end and secured in the closed position to the luminaire by means of an automatic type latch. The flat lens and door assembly, when closed, shall exert pressure against a gasket seat. Gaskets shall be composed of materials capable of withstanding year round ambient air and lamp operating temperatures and shall be securely held in place.

All luminaires shall have their internal components secured to the luminaire frame with corrosion-resistant type hardware (nuts, bolts, washers, hinges, etc.). The slip-fitter bolts shall be either stainless steel or hot-dipped galvanized.

The luminaire housing complete with integral ballast shall be weathertight and shall receive a painted aluminum finish.

All luminaires shall be mounted level, both traverse and longitudinally, as measured across points specified by the manufacturer. Leveling shall be accomplished after luminaire standard is plumbed.

All luminaires shall be provided with markers for positive identification of light source, wattage and voltage.

Contractor's attention is called to City of Kennewick Standard Drawings 6-2 and 6-3 for luminaire minimum requirements for street widths and area uses.

6-3.02 BALLAST

Ballast for high-pressure sodium lamps shall be of the magnetic regulator (constant wastage) type with a power factor of 95 percent (nominal) or higher. The power delivered to the lamp shall be limited 7.5 percent, more or less, of the rated lamp power during normal operation. During warm-up of the lamp, lesser power delivery will be permitted.

6-3.03 PHOTOELECTRIC CONTROLS

Unless otherwise specified in the special provisions, the photoelectric controls shall be the primary control mechanism for each luminaire. Photoelectric controls shall be a plug-in type meeting EEI-NEMA standards for locking devices hermetically sealed, rated to operate at the proper voltage of the lamp furnished.

Photo controls shall conform to current I.E.S. Standards, ANSI C 136. 10-19, latest revision and UL773, Par. 25.2.

The outdoor lighting photoelectric control (OLC) shall be of a solid-state crystal (or photo transistor) sensing type. The OLC shall be designed to turn on at 1.5 foot candles (FC) (+/- 20%). The OLC shall be designed to operate properly over the input voltage range of 105Vac-285Vac with no change in the turn-on and turn-off FC values. The OLC shall be designed such that the output control relay shall have 5 seconds (+/-20%) time delay to prevent false turn-off from momentary brightness. The OLC shall not drift by more than 1% over ten years.

The OLC output relay shall be fully rated at 1800 VA., 15 amps for all HID lamps and shall be of the fail-on type design. The OLC shall have a built in MOV for lighting and transient/surge protection. The printed circuit board shall be properly coated to prevent

corrosion. The OLC cover shall be made of blue (ANSI color coding for 105-285 voltage range) hi-impact plastic that is UL approved break resistant and flame retarding material. The OLC window shall be made of acrylic with the proper UV stabilizers to prevent discoloration.

On demand, the supplier shall provide documentation from an independent nationally recognized laboratory attesting to the OLC meeting the preceding requirements.

The OLC shall conform to all IES street lighting standards and the ANSI C136.10 specs for twistlock photo control devices. The light-sensitive element shall be installed and oriented on the luminaire head so that it faces the north sky.

6-3.04 MEASUREMENT AND PAYMENT

The unit contract price for "(100, or 200, or 400) Watt Luminaire," per each, shall be full compensation for furnishing all labor, materials, tools, and equipment necessary and incidental to furnish and install the required luminaire with lamp, photoelectric control, and ballast on the light standard mast arm, installing electrical conductors, making splices, installing fusing and light standard grounding connections from the luminaire to the base of the pole together with any other work required to complete the luminaire and pole installation ready for connection to the power supply.

6-4 UNDERGROUND WIRING AND CONDUIT

6-4.01 UNDERGROUND CONDUIT

All underground electrical conductors, between the junction box or disconnect switch at the source of power and the junction boxes adjacent to the individual street lights, shall be installed within a one and one-half inch (1-1/2") (minimum diameter), Schedule 40, polyvinyl chloride (PVC) pipe conforming to the requirements of ASTM D1785.

The electrical conduit installation shall be installed in conformance with the appropriate articles of the Code, except that the minimum depth of bury on the conduit shall be twenty-four inches (24"). Conduits smaller than one and one-half inch (1-1/2") diameter shall not be used unless otherwise listed in the Special Provisions.

All conduits shall be installed per the City Standard Specification Drawing No. 6-4, 6-5, 6-6 and 6-7, and the trenches compacted as specified in Section 5-2 of these specifications.

Field cuts on conduits shall be made square and true and shall be well reamed inside and out to remove all burrs and rough edges.

Bends for rigid non-metallic conduit (PVC) shall conform to the requirements of Article 347-13 of the Code.

The twenty-four inch (24") minimum cover depth on the conduit shall be measured from the top of curb, where it exists. Where no curbing exists, the depth of cover shall be measured from the existing road centerline elevation plus six inches (6") or as directed by the Engineer.

Those conduits shown on the plans to receive future conductors shall be installed as described above and then blown clean with compressed air and end caps shall be used to seal the conduit ends. No pull wires shall be installed within the conduit. The Contractor shall install at each end of conduit a 4" x 4" x 4' cedar marker post as an end of conduit reference point.

Conduits shall enter all junction boxes through the bottom utilizing standard radius bends. The ends of the conduits inside the junction box shall terminate near the side walls of the box so as to leave a major area of the box open and clear.

Conduits shall enter or leave the junction box in the direction of the conduit run.

The conduit and wiring runs shown on the plans are for bidding purposes only and they may be changed by the Engineer to avoid existing underground obstructions which may show up during construction.

6-4.02 JUNCTION BOXES

Underground enclosures for the splicing and termination of wiring conductors and conduits shall be installed at the locations as shown on the plans or as directed by the Engineer. The size of the box shall meet the requirements of Article 370.18 and 370.19 of the State Electrical Code. At a minimum, a junction box shall be installed on both sides of each electrical conduit crossing of City right of way, at each street light and at maximum 300 foot intervals. All exposed metallic rings or covers must be bonded and grounded.

When an existing street light and junction box are relocated on the same circuit due to construction, and the junction box would be in the street and/or where a new commercial driveway or street widening would otherwise leave a J-Box in the driveway or widening area, the wires coming into the existing box shall be removed back to the first junction box on both sides. Remove the junction box to be abandoned and install conduit sweeps and conduit from the existing junction box site to the relocated or new junction box location and pull new wires as required to eliminate splices. A junction box will not be left at the abandoned location in the street and no wire splices will be allowed between junction boxes.

A. NON-TRAFFIC BEARING JUNCTION BOX

Junction boxes to be used in non-vehicular traffic bearing areas shall be composed of reinforced plastic materials and shall be equipped with a removable locking cover

with the word "Electric" formed into its top. The junction box shall be Model PG 1324 as manufactured by Quazite Company, San Jose, California, or 13 x 24 Series #PA10-1324-18 as manufactured by CDR Systems Corporation, or an approved equal.

B. TRAFFIC BEARING JUNCTION BOX

Junction boxes to be used in vehicular traffic bearing areas shall be in accordance with the requirements of Design "A" of the SWSS Standard Drawing J-11a entitled, "Concrete Junction Boxes", or Quazite 13-inch x 24-inch PG Style with HA series cover, or HH cover as conditions require, or equal.

When a traffic bearing junction box is required, it shall be called out on the plans.

C. JUNCTION BOX INSTALLATION

Junction boxes shall be located as shown on the plans or as directed by the Engineer. The Contractor may install, with the approval of the Engineer, and at his own expense, such additional junction boxes as may be desired to facilitate his work.

The Contractor shall place four inches (4") of five-eighths inch (5/8") crushed rock in the bottom of all junction boxes after installing the conduit and wiring. When placing the crushed rock in the junction box, the Contractor shall take special care to prevent any dust, dirt, rock chips, or objectionable materials from entering into the exposed ends of the conduit.

The Contractor's attention is called to the City of Kennewick Standard Drawing 6-4 for typical junction box location and installation.

6-4.03 WIRING

The minimum size of the lighting conductor shall be No. 6 aluminum, unless a larger conductor is required by load conditions as specified in Section 6-4.05 B. The conductor shall be cross-link poly USE insulation. The minimum ground wire shall be No. 8 THHN, green coded, insulated copper wire. A larger ground wire shall be used where load conditions require.

All wiring shall conform to appropriate articles of the Code. Wiring within pole bases, junction boxes, etc., shall be neatly arranged. The ground wire shall be color coded green the entire length.

Powdered soapstone, talc, or other approved lubricant shall be used in placing conductors in conduit.

Splicing of lighting conductors will only be permitted in junction boxes, in transformer boxes for transformer leads, and in control equipment boxes. Splices are not allowed in the street light pole or at pole hand holes.

Conductors in junction boxes shall be spliced by epoxy resin cast type insulation (3M Scotch Cast 82 B1 epoxy splice) or approved equal per SWSS Section 9-29.12(1), or plastisol insulated, molded polaris connectors, as manufactured by NSI Industries, Inc., IPL Series, IT Series, ISR Series or approved equal..

The handmade Western Union splice will be permitted for aerial installation only, per SWSS Section 9-29.12(1). All tape splice insulation shall consist of thermoplastic electrical insulating tape applied to a thickness equal to the original wire insulation. It shall be well lapped over the original insulation, and there shall be a coating of moisture resistant varnish applied and allowed to dry. Two layers of friction tape will then be applied and the splice shall be finished with a second complete coating of moisture resistant varnish.

Where heat shrink splice insulation is used, the insulation of the individual conductors will be wiped clean and dry. The splice material shall be well lapped over the conductor insulation. Care shall be taken to ensure that the conductor insulation is not damaged by the application of too much heat to the splice. If the conductor insulation shows indications of heat deformation, the entire splice shall be replaced. Heat shrink splices shall conform to SWSS Section 9-20.12(1).

Drip loops shall be provided on all conductors where they enter poles or transformer leads.

The Contractor shall provide additional conductor length inside all junction boxes equal to a loop of conductor having a diameter of one foot (1').

When conductors are being installed, care shall be exercised to not exceed tension limitations recommended by the manufacturer. Conductors may be pulled directly by hand; however, if conductors are pulled by any mechanical means, a dynamometer with drop-needle hand shall be used on every mechanical pull.

To limit the sidewall pressure at bends in duct and conduit runs, the pulling force in pounds shall not exceed 100 times the radius of the bend in feet. Adequate lubrication of the proper type to reduce friction in conduit and duct pulls shall be utilized as necessary.

6-4.04 BONDING, GROUNDING

All metallic appurtenances containing electrical conductors (luminaires, light standards, cabinets, etc.) shall be mechanically bonded to form a continuous grounding system which shall effectively be grounded to the PUD neutral conductor at the source of power.

The equipment-grounding conductor shall in all cases be sized consistent with Table 250-95 of the Code except that the minimum ground conductor shall be of equal grounding capacity to a No. 6 aluminum conductor. Where paralleled electrical circuits exist in an electrical conduit, the equipment-grounding conductor shall be sized as determined by the rating of the largest overcurrent device serving any circuit contained in the conduit.

The equipment-grounding conductor shall be insulated stranded copper, or aluminum wire approved for direct burial.

Equipment grounding conductors shall employ insulation rated at 60 degrees centigrade or higher and shall be chemically compatible to other insulations contained with the system.

Identification of the equipment-grounding conductor shall conform to all Code requirements.

Grounding of the neutral shall be accomplished only at the PUD's point of service. Grounding of the neutral at the service point shall be accomplished by the Contractor on a multiple fixture circuit, and by the PUD on a single fixture circuit.

6-4.05 LUMINAIRE FUSING AND ELECTRICAL CONNECTIONS AT LIGHT STANDARD BASES AND POWER SUPPLY

A. INDIVIDUAL LUMINAIRE FUSING

An in-line fused, watertight, electrical quick disconnect kit shall be installed inside the junction box, at every light standard base for every conductor above-ground potential. The fused watertight electrical quick disconnect kit shall be properly sized to accommodate the various conductors and fused as required by Section 6-4.05C of these specifications. All connections shall be made with compression fittings. The kit shall be designed so that upon disconnection of the fuse holder the fuse shall remain in the load side of the kit.

B. FUSED SAFETY DISCONNECT SWITCH

A fused safety disconnect switch shall be required and located adjacent to the PUD's source of power, on single and multiple fixture installations. The number of disconnects within a subdivision shall be kept to a minimum, with typically ten to thirteen lights on a single leg of the circuit. Where fewer than ten lights are scheduled for installation, all lights shall be energized from a single disconnect, unless extenuating circumstances are encountered and the Engineer's approval is received.

For a typical 60 amp disconnect controlled circuit, which tee's into two directions, the feeder wire from the power source to the junction box at the 'T' shall be #4 gauge. Each leg of the circuit can then typically be serviced with #6 wire. The

typical maximum lights (200 W) on a leg shall be thirteen (13) and the maximum lights on a circuit (200 W) shall be twenty-one (21). Wire requirements and number of lights allowed, shall be evaluated by the Engineer, when higher wattage lights are required.

In subdivisions, the street light disconnect location shall be coordinated with the power company to ensure that the transformer will be installed in a timely manner, as required to allow energizing of the street light circuit as soon as practical. The safety disconnect switch shall be Model TG3222RH, as manufactured by "General Electric" or equal. The switch shall be within a NEMA 3R enclosure with a 35 amp fuse. The safety disconnect switch shall be drilled for a lock or be of such type that it can be locked on. The switch shall not be capable of being disconnected when locked on. The Contractor will leave the box unlocked at all times and the city crew will secure the box when it is energized. The Contractor shall install the fused safety disconnect switch in accordance with the requirements of the City of Kennewick Standard Drawing 6-5.

C. SYSTEM PROTECTION REQUIREMENTS (Fuses and Breakers)

Protection furnished for street lights shall be capable of handling the operating voltage of the circuit involved and shall have the following characteristics:

- 1) Protection shall be capable of indefinitely supporting 100 percent of the rated load.
- (2) Protection shall be capable of supporting 135 percent of the rated load for approximately one (1) hour.
- (3) A load of 200 percent of the rated load will effectively cause instantaneous failure of the fuse or circuit breaker.
- (4) Protection shall be rated as listed below and shall be sized to fit the fuse containers furnished on this project, according to the manufacturer's recommendations therefore:

		Service Voltage		
		480V	240V	120V
Luminaire Size	400 W	10A.	15A.	15A.
	200 W	5A.	10A.	10A.
	100 W	5A.	10A.	10A.

- (5) Protection shall be UL Listed.

6-4.06 FIELD TEST

Prior to completion of the work, the Contractor shall cause the following tests to be made on all electrical circuits whose nominal operating voltage is between 115 volts and 600 volts:

- A. Test for continuity of each conductor.
- B. Verify grounds in each circuit, this shall consist of the physical examination of the installation to ensure that all required ground jumpers, devices and appurtenances do exist and are mechanically firm.
- C. A functional test in which it is demonstrated that each and every part of the system functions as specified or intended herein.

6-4.07 RETESTING

Any fault in any material or in any part of the installation revealed by these tests shall be replaced or repaired by the Contractor at no expense to the City in a manner approved by the Engineer, and the tests shall be repeated.

6-4.08 MEASUREMENT AND PAYMENT

The unit contract price for "Wiring and Conduit," per linear foot, junction box to junction box, shall be full compensation for furnishing all labor, materials, tools and equipment, trench excavation and backfill, install conduit, conduit fittings, conductors, junction boxes, installing fused safety disconnect switches and electrical disconnect kits, making splices, grounding equipment, connecting power conductors to luminaire conductors, making all required field tests of the lighting system, adjusting junction boxes to finished grade, and all other incidental work necessary to install the lighting system complete or as directed by the Engineer.

The unit contract price for "4-inch spare electrical conduit" per linear foot, shall be full compensation as specified above and shall also include a terminal junction box at each end of the specified spare conduit, where the conduit would not otherwise terminate in a junction box installed in conjunction with the street light wiring and conduit installations.