

SECTION 18 STREETLIGHTING

18.01 DESCRIPTION

Streetlight work shall consist of furnishing, installing, modifying, and removing one or more streetlight components or systems, including provisions for future systems, in the public right-of-way, as shown on the plans and as provided in these Specifications. All systems shall be complete and in operating condition prior to acceptance of the Contract.

All materials, equipment and system components shall be submitted for approval or noted as in full compliance with the City Authorized Material List. All incidental parts which are not shown on the Standard Details, included in the Authorized Material List, or specified herein, and which are necessary to complete or modify the existing system, shall be pre-approved by the City Engineer and shall be furnished and installed as though such parts were shown on the Standard Details or specified herein.

18.02 REGULATIONS AND CODES

All electrical equipment shall conform to the standards of the National Electrical Manufacturers Association (NEMA), the Underwriters' Laboratories, Inc. (UL), or the Electronic Industries Association (EIA), wherever applicable. In addition to the requirements of the Plans, these Specifications, and any Special Provisions, all materials and workmanship shall conform to the applicable provisions in Section 86 and 87 of the State Standard Specifications and Standard Plans; National Electrical Code (NEC), hereinafter referred to as the Code; California Administrative Code, Title 8, Subchapter 5, Electrical Safety Orders; Rules and Overhead Electrical Line Construction, General Order No. 95 and Rules for Construction of Underground Electrical Supply and Communication Systems, General Order No. 128, of the Public Utilities Commission; Standards of the American Society for Testing and Materials (ASTM); American National Standards Institute (ANSI), and any local ordinances which may apply.

All separate electrical components and major control assemblies shall be UL approved.

Wherever reference is made to any of the Standards mentioned above, the reference shall be construed to mean Code, Order, or Standard that is in effect on the day the Notice to Contractors for the work is dated.

18.03 DEFINITIONS

STANDARD STREETLIGHT shall mean a tapered steel pole and an arm extending from the pole, to which the luminaire is mounted.

POST MOUNTED OR POST TOP STREET LIGHT shall mean a tapered or non-tapered steel pole with the luminaire mounted on top of the pole.

ELECTROLIER OR STREETLIGHT shall mean the entire pole, mounting arm, luminaire, wiring, foundation, and miscellaneous appurtenances, complete in place.

LUMINAIRE shall mean the lighting fixture, supplied as a complete unit, which is attached to the streetlight pole, consisting of a housing, reflector, refractor, integral ballast (when required), terminal strip and mounting device. The lighting distribution type shall be as shown on the Plans or City Standard Detail #613.

18.04 LIGHT EMITTING DIODE (LED) LUMINAIRES

All street light luminaires shall meet State Standards, approved by the City Engineer, or meet City's Authorized Material List. All streetlight luminaires shall be LED type of the size and types indicated on the City Standard Details, City Authorized Material List and as provided in these Specifications. The luminaires shall be one hundred twenty (120) volts, two hundred forty (240) volts, or two hundred seventy-seven (277) volts depending on service voltage AC and shall have photo-electrical receptacle.

All standard fixtures shall be as specified in the State Standards, Standard Details, or the City's Authorized Material List. All post-top fixtures shall be LED with an appropriate refractor, if necessary.

Photo-electric controls shall be "Long Life," or approved equal. All light systems shall have an external photocell control mounted within the assigned service panel, unless the power for the light is fed directly from a service provider with no service pedestal, then the streetlight will have a dedicated photocell in that luminaire.

18.05 POLES

All poles shall meet State Standards, City's Authorized Material List, or as directed by the City Engineer. Poles shall be tapered steel, unless otherwise noted on the construction plans and approved by the City Engineer, fabricated from weldable grade hot rolled commercial quality carbon steel and hot-dip galvanized after fabrication per existing ASTM A-123. The thickness shall be United States standard eleven (11) gage or ten (10) gauge, depending on material strength. Each pole shall be one-piece construction, cylindrical in cross-section, with a uniform taper from base to top.

All poles must include a designated shop drawing providing the product specifications as part of the submittal process for approval by the City Engineer.

Poles shall be supplied with a shop fabricated and welded anchor base plate. The baseplate shall have shop drilled holes for the anchor bolts. The anchor bolt holes shall provide for a plus or minus bolt adjustment of one-half (1/2) inch.

All poles shall have a shop fabricated handhole. The minimum size of opening for standard street light poles shall be four (4) inches by six and one half (6-1/2) inches. The minimum size of opening for post top streetlight poles shall be two (2) inches by four (4) inches. The handhole opening shall be reinforced with a shop fabricated and welded steel lip. The handhole shall be provided with a removable raintight cover with theft-proof bolt. The pole shall be provided with a grounding terminal, which shall be accessible from the handhole.

The luminaire arm attachment device shall be such that gravity will hold the arm in place prior to permanently fastening with an appropriately sized bolt.

The pole manufacturer shall supply all anchor bolts, anchor bolt covers, anchor base cover, pole top cap, grounding terminal, conductor support device, and any other miscellaneous mounting or fastening hardware.

Each pole shall be hot-dip galvanized after completion of all welding. Scratches shall be repaired to the satisfaction of the City Engineer.

18.06 CONDUIT

All conduit and fittings shall be Underwriters' Laboratory (UL) listed and shall be Schedule 40 rigid polyvinyl chloride (PVC) pipe. Each complete length shall bear the manufacturer's name and UL label. The type of PVC cement shall conform to the manufacturer's recommendations. Galvanized steel tubing shall not be used.

18.07 WIRING (CONDUCTORS)

All wires shall be copper and shall have a moisture and heat-resistant type of thermoplastic insulation (Type THW or THWN). All wires #8 American Wire Gauge (AWG) and larger shall be stranded except for #6 ground wires. The City Engineer will approve all wiring materials prior to their incorporation into the work.

All conductors shall have clear, distinctive and permanent markings on the outer surface throughout the entire length, which indicate the manufacturer's name or trademark, insulation type letter designation, conductor size, and voltage rating. Conductor insulation shall be a solid color.

The minimum size for street lighting conductors shall be #10 AWG, except that #12 may be used from the luminaire to the adjacent pull box. The ground wire may be bare and shall

meet the minimum NEC Standard for grounding copper wire applications. A #6 solid copper ground wire shall be installed at each electrolier as shown in the Standard Details.

18.08 PULL BOXES

All pull boxes, pull box extensions, and pull box covers, shall be precast reinforced concrete conforming to the State Standard Specifications or City's Authorized Material List, three and a half (3-1/2) pull box. Boxes may be larger in size or be traffic rated load bearing depending on the application and location.

Box covers shall be of locking type per the City's Authorized Material List or as approved by the City Engineer. Any locking mechanisms shall be recessed below the surface of the cover. The cover shall be marked "Streetlighting." Where pull boxes are to be placed in areas subject to traffic loads, a traffic rated load bearing box and a lockable steel cover of suitable design to withstand traffic loads shall be provided instead of the concrete cover.

Approved boxes are Christy N09 and Brooks three and a half (3-1/2). Larger pull boxes may be required for additional conduit entering the box and meeting State Standards.

The outgoing conduit shall be located on the same side of the pull box as the service provider's (i.e., PG&E, SMUD, etc.) service wires. Streetlight conduits and conductors shall be encased in a red colored cement slurry as specified in Section 18.12 below and as shown in the City Standard Details.

18.09 EXISTING LIGHTING SYSTEMS

The Contractor shall notify the City Engineer at least three (3) working days prior to performing any work on existing systems.

Lighting system shutdowns shall not interfere with the regular lighting schedule, unless otherwise permitted by the City Engineer.

The Contractor shall ascertain the exact location and depth of existing conduits, pull boxes and other electrical facilities before using any tools or equipment that may damage such facilities or interfere with any electrical system.

Where roadways are to remain open to traffic and existing lighting systems are to be modified, the lighting systems shall remain in operation and the final connection to the modified circuit shall be made so that the modified circuit will be in operation by nightfall on the same day.

18.10 EXISTING IMPROVEMENTS

Improvements such as sidewalks, curbs, gutter, Portland cement concrete, asphalt concrete pavement, underlying materials, lawns, plants, and any other improvements removed, broken or damaged by the Contractor's operations, shall be replaced or reconstructed with the same kind of material as found on the work or with materials of equal quality. All such improvements shall be left in a serviceable condition.

Whenever a part of a square or slab of existing concrete sidewalk, curb, gutter, or driveway is broken or damaged, the entire square or section of slab shall be removed and the concrete reconstructed.

The outline of all areas to be removed in Portland cement concrete sidewalks and driveways and in pavements shall be sawcut the full section thickness prior to removing the sidewalk, driveways, and pavement material. Cuts shall be neat and true along score lines, with no damage outside the removal area.

18.11 SALVAGED ELECTRICAL EQUIPMENT

Existing equipment removed and not reused shall remain the property of the City. Salvaged equipment shall be delivered to the City's Corporation Yard (4300 West Capitol Avenue) unless otherwise specified.

18.12 CONDUIT INSTALLATION

Conduit shall be installed for all conductors and meet State Standards, except where conductors are inside poles. All conduits shall be installed underground, shall not be smaller than one (1) inch nominal diameter, and shall be of the sizes shown on the plans or as specified in the State Standard Specifications or these specifications. Limit the number of bends in a conduit run to no more than three-hundred-sixty (360) degrees between pull points per Section 87-1.03B (1) of the State Standard Specifications. At the Contractor's option and expense, conduit of a larger size than that shown or specified may be used, provided that the larger size is used for the entire length of the run from outlet to outlet. Reducing couplings shall not be permitted.

Underground conduit placed within road right-of-way areas (roadway) shall meet NEC code, or at a minimum be twenty-four (24) inches deep, measured from the top of conduit to the pavement surface. Conduits crossings under existing roadways must be jacked or drilled unless otherwise approved by the City Engineer. Conduits may be installed by the Trenching in Pavement Method as specified in the State Standard Specifications and described below. Conduits placed in roadways under construction shall be in trenches approximately two (2) inches wider than the outside diameter of the conduit to be installed. Trenches shall not be

less than six (6) inches in width. All conduit crossings shall be perpendicular to the street center line.

All conduit installation in new roadways shall be performed prior to completion of subgrade. Conduit shall be placed per City's Design Standards. PVC conduit placed outside the roadway shall meet NEC code, or at a minimum be twenty-four (24) inches deep, measured from the top of conduit to the finished surfaced. Electrical excavation warning tape shall be placed above the initial backfill. In the event that required depths cannot be maintained, the conduit shall be encased with Slurry Cement Backfill per Section 19-3.02E of the State Standard Specifications, color dyed red, with a minimum thickness of six (6) inches around the conduit. The remaining backfill shall meet City backfill requirements.

At locations where conduit is required to be installed under pavement and existing underground facilities require special precautions, conduit may also be installed by the "Conduit Installation by the Trenching-in-Pavement Method" as specified in Section 87-1.03 B (6) of the State Standard Specifications. Conduit shall be the rigid non-metallic type, Schedule 40 or 80 PVC. Conduit shall be placed under existing pavement in a trench approximately two (2) inches wider than the outside diameter of the conduit installed. Trenches shall not be less than six (6) inches in width. PVC conduit depth shall be installed with twenty-four (24) inch cover below the surface they are located. For installation of conduits and ducts containing cables operating at a potential greater than one thousand volts shall meet NEC code or at a minimum be thirty (30) inches. In areas where additional pavement is to be placed, trenching installation shall be completed prior to completing subgrade.

Where any portion of a utility trench is to be cut in existing pavement within thirty-six (36) inches of the concrete lip of gutter, the pavement shall be removed and replaced all the way to the gutter.

The outline of all areas of pavement to be removed shall be sawcut the full section thickness with a rock-cutting excavator specifically designed for this purpose. Cuts shall be neat and true with no shatter outside the removal area.

The conduit shall be placed in the bottom of the trench and the trench shall be backfilled consistent with the City and State Standard Specifications for backfill material.

Prior to spreading asphalt concrete, paint binder (tack coat) shall be applied as specified in Section 39-2.07B(3), "Asphalt Binder" of the State Standard Specifications. Spreading and compacting asphalt concrete shall be performed by any method, which will produce an asphalt concrete surfacing of uniform smoothness, texture, and density.

All excavated areas in the pavement shall be backfilled.

In all conduit systems, installation shall permit the wire to be drawn into the conduit without injury. In any case, bend radii in conduit shall not be less than six (6) times the inside diameter of the conduit.

Field cuts shall be made square and true with all burrs removed and ends cleaned prior to gluing the connection.

Conduit terminating in standards or pedestals shall extend between three (3) inches and five (5) inches above the top of finished concrete foundation, whichever is most accessible for maintenance, and shall be sloped toward the hand hole and below the bottom of the hand hole opening. Conduit entering concrete pull boxes shall terminate two (2) inches away from inside the wall of the box and not less than three (3) inches above the bottom and shall be sloped to facilitate pulling of the cable. Conduit entering through the bottom of a pull box shall be located near the end walls to leave the major portion of the box clear. At all outlets, conduit shall enter from the direction of the run.

Conduit entering service equipment enclosures shall have "end bells" and be sealed to prevent the entrance of gases by the use of duct sealing or other sealing compound approved by the City Engineer.

18.13 PULL BOX INSTALLATION

Pull boxes shall be installed at the locations as shown on the plans, as specified in the Design Standards, and as directed by the City Engineer.

The Contractor may install, at the Contractor's expense, such additional pull boxes that may facilitate the work with the approval of the City Engineer.

Pull boxes shall be installed per City Standard Detail #606. Covers shall be level with the top of the curb, pavement, sidewalk, or one-quarter (1/4) inch above turf areas, or one-half (1/2) inch above other landscaped or other areas when there is no established grade. Excavation for the installation of pull boxes shall be at least eighteen (18) inches below the bottom of the pull boxes and at least six (6) inches larger on all sides of the pull boxes. This area outside the pull box shall be filled with pea gravel for drainage. Grout shall be placed in bottom of pull boxes. A minimum of three (3) inches of gap shall be maintained between the bottom of the pull box lid and the top of the conduit and end bell. Pull boxes shall also have a concrete collar around the exterior edge as shown on the City Standard Details. Concrete collar shall be sloped to drain away from the lid.

All pull boxes installed in landscape or unpaved areas shall have a twelve (12) inch wide by three and one half (3.5) inch deep 4,000 psi min. concrete apron. Concrete Apron shall be sloped to drain away from the pull box.

18.14 BACKFILL

Conduit shall not be covered until inspected and approved by the City Engineer. Trenches shall be backfilled up to the elevation of the top of sidewalk or adjacent finish grade and shall be leveled and smoothed. Backfill material and methods shall conform to City and State Standard Specifications. Sidewalk reconstruction shall be in accordance with other sections of these Standard Construction Specifications and City Standard Details.

18.15 STREET LIGHT INSTALLATION

Unless otherwise shown on the plans or required in the Design Standards, street light foundations shall be placed adjoining the back edge of sidewalk. The bolt pattern shall be laid out so that the mast arm is perpendicular to the street centerline, unless otherwise shown on the plans, or directed by the City Engineer.

All construction and materials shall conform to the City Standard Details #602 and #603.

18.16 FOUNDATIONS

Concrete for use in foundations shall be min. 4,000 psi and conform to the provisions of the State Standard Specifications. The Contractor shall be responsible for locating and marking the positions of all streetlights in the field. The locations shall be approved by the City Engineer prior to commencement of foundation work.

All miscellaneous mounting materials, including nuts, bolts, and washers, shall be galvanized in accordance with the provisions of ASTM A-153.

Foundation bolts and conduit to be set into the concrete shall be suspended and held in place by a template securely fastened to the foundation forms. Foundations shall be poured in two lifts, the first lift extending up to approximately six (6) inches of the top of finished concrete. The first lift will serve to hold the bolts in place. Nuts, with washers above and below the street light base, will be placed on the bolts and poles set upon these nuts. Reinforced (rebar "cages") cast-in- drilled-hole concrete foundations shall cure at least seven (7) calendar days prior to erecting poles. For lesser foundations, three (3) calendar days shall be the minimum.

18.17 POLE INSTALLATION

Poles shall be erected and set in a vertical position. Poles shall be erected after the first lift of concrete has cured as required. All nuts shall be tightened to a snug fit prior to placing the second lift of concrete.

Poles with mast arms shall be erected so that the arm is perpendicular to the street

centerline, unless otherwise shown on the plans, or directed by the City Engineer. The second lift of concrete shall be placed and finished after the pole has been erected.

18.18 LUMINAIRE INSTALLATION

The luminaire for standard streetlights shall be installed on the mast arm in accordance with the manufacturer's recommendation. It shall be installed and adjusted to obtain the required lighting distribution pattern.

The luminaires for post-pop streetlights shall be installed in accordance with the manufacturer's recommendations. It shall be installed in a true vertical position in the proper orientation to produce the required lighting distribution pattern.

All luminaires shall be installed so as to produce weathertight connections. The luminaire shall be wired in accordance with the requirements of Section 18.19 "Electrical Wiring" below.

18.19 ELECTRICAL WIRING

- A. CONDUCTOR INSTALLATION - No conductors shall be drawn into any conduit until the installation run of conduit is complete and inspected. Conduit within a concrete foundation shall have no wires drawn through it until the concrete has set for at least twenty-four (24) hours. Conductors shall be installed without injury to the insulation. All conductors shall be drawn into the conduit at the same time. The pull-in wire or rope used for drawing conductors into the conduit shall not be attached to the copper conductor alone. A cable grip shall be used and applied in such a manner to place tension on both conductor and insulation. A UL listed inert lubricant shall be used.

Cables shall be continuous from luminaire to luminaire or pull box to pull box without splices. Splices, if any, shall be made in pull boxes and the base of light standards.

- B. CONDUCTOR SUPPORT - Conductor support shall be provided in all light poles where the distance from the post base to the luminaire exceeds twenty-five (25) feet in height. The conductor support shall be attached to the inside wall of the pole or mast arm. It shall be a clamping device constructed of or employing insulating wedges or other suitable insulating support. Where clamping of insulation does not adequately support the cable, the conductor shall also be clamped.
- C. CONNECTORS - Conductors shall be joined by the use of copper C-tap connectors and soldered. Aluminum wire splices shall not be allowed.
- D. SPLICES - Splices will only be permitted in pull boxes and the base of light standards. All splices shall be capable of satisfactory operation under continuous submersion in water. All connectors or splices shall be wrapped with "Scotchcast," Scotch Super 88 Tape, and Scotchkote or approved equal.

- E. FUSED SPLICE CONNECTORS - In each light pole, level with the hand hole, a fused disconnect splice connector shall be installed in each undergrounded conductor between the line and the luminaire.

For two-hundred-forty (240) and two-hundred-seventy-seven (277) volt circuits each connector shall be designed so that both underground conductors are disconnected simultaneously. Streetlight installation shall be per the approved construction plans or as approved by the City Engineer. The connector shall have no exposed metal parts, except the head of a stainless-steel assembly screw may be exposed. The head of the metal assembly screw shall be recessed a minimum of one thirty-second (1/32) of an inch below the top of a plastic boss which surrounds the head.

The splice connector shall completely enclose the fuse and shall protect the fuse against damage from water and weather. The contact between the fuse and fuse holder shall be spring pressure. The terminals of the splice connector shall be rigidly crimped, using a tool of the type recommended by the manufacturer of the fused splice connector, onto the line conductors and shall be insulated and made waterproof in accordance with the splice connector manufacturer's recommendations. Fuses shall be standard midget, ferrule type.

18.20 TESTING

Prior to acceptance of the work, the following test shall be made on all lighting circuits, in the presence of the City Engineer.

- A. TEST FOR CONTINUITY OF EACH CIRCUIT
- B. TEST FOR GROUNDS IN EACH CIRCUIT - The insulation integrity shall be as specified in Article 110-7 of the National Electrical Code, latest edition.
- C. A FUNCTIONAL TEST IN WHICH IT IS DEMONSTRATED that each part of the system functions as specified or intended herein. Streetlights shall be functional for a continuous period of seven (7) days.

Any faults in the materials or in any part of the installation revealed by these tests shall be replaced or repaired in a manner approved by the City Engineer, and the same test shall be repeated until no faults appear.

18.21 SERVICE

Service pedestals are required at all streetlight service locations. Service pedestals shall meet the State Standard Specifications and the City Authorized Material List. Upon satisfactory completion of testing and all contract work, the Contractor will arrange with the service provider (i.e., PG&E, SMUD etc.) to complete service connections to the streetlights and commence service.

18.22 IDENTIFICATION NUMBERS

The Contractor shall place identification numbers, to be assigned by the City or service provider (i.e., PG&E, SMUD, etc.), on each street light pole conforming to the Standard Detail #610.

18.23 RESERVED

18.24 RESERVED

18.25 MEASUREMENT AND PAYMENT

The work performed under these specifications will be measured by the unit or lump sum as designated in the contract bid item list for constructing the Streetlight system. Lump sum payment shall be accompanied by a Schedule of Values for the items of work included in the lump sum.

The below prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals; and for doing all the work involved in installing the Street Lighting system, complete in place, as shown on the plans, and specified in these specifications and any special provisions, and as directed by the City Engineer, including any structure excavation, and structure backfill.

- A. STREETLIGHTS - Streetlights shall each be measured and paid for as one complete installed unit in operable condition including concrete foundation, pole with mast arm(s), luminaire complete and lamp, photoelectric control, conductors in the pole and grounding.
- B. CONDUIT - Conduit shall be paid for by the linear foot as measured horizontally through all phases of the electrical underground street lighting system.
- C. PULL BOXES - Pull Boxes shall be measured and paid for as one complete installed unit, including the base and lid.
- D. CONDUCTORS - Conductors shall be paid for by the linear foot, as measured horizontally, for the wires through pull boxes.