

SECTION 18 STREET LIGHTING

18.01 DESCRIPTION

Street light work shall consist of furnishing, installing, modifying, and removing one or more street lighting 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 incidental parts which are not shown on the Standard Details, or specified herein, and which are necessary to complete or modify the existing system, 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 of the State Standard Specifications and Standard Plans; National Electrical Code, 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 STREET LIGHT 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 steel pole with the luminaire mounted on top of the pole.

ELECTROLIER OR STREET LIGHT 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 street light pole, consisting of a housing, reflector, refractor, integral ballast, terminal strip and mounting device. The distribution type shall be as shown on the Plans.

18.04 HIGH PRESSURE SODIUM LUMINAIRES

All street light luminaires shall be high-pressure sodium of the sizes and types indicated on the Standard Details and as provided in these Specifications. The luminaires shall be 120, 240 or 277 volt depending on service voltage AC, and shall have photo-electrical receptacle.

All luminaires shall have a regulator type ballast.

All standard fixtures shall be as specified in the Standard Details, or an approved equal. All post top fixtures shall be General Electric PM17 Series with Lexan refractor if 150 watt or less and glass refractors if 200 watt or more, or approved equal.

Photo-electric controls, shall be General Electric 402G660, or approved equal.

Photo cell-All light systems shall have a photo cell in each luminaire.

18.05 POLES

All poles shall be tapered steel; fabricated from weldable grade hot rolled commercial quality carbon steel and hot-dip galvanized after fabrication per ASTM A-123. The thickness shall be United States standard 11 gage or 10 gage, depending on material strength. Each pole shall be one-piece construction, cylindrical in cross-section, with a uniform taper from base to top.

The 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 inch.

All poles shall have a shop fabricated handhole. The minimum size of opening for standard street light poles shall be 4-inches by 6-1/2-inches. The minimum size of opening for post top street light poles shall be 2-inches by 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 appropriate 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. 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 be a minimum #8 AWG copper wire. 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 3-1/2 pull box. Boxes may be larger in size depending on the application.

Box covers shall be provided with two 3/8-inch brass hold down bolts with brass washers and nuts. Nuts shall be recessed below surface of the cover. The cover shall be marked "Street lights". Where pull boxes are to be placed in areas subject to traffic loads, a steel cover of suitable design to withstand traffic loads shall be provided instead of the concrete cover.

Approved boxes are Christy N9 and Brooks 3-1/2.

The out going conduit shall be located on the same side of the pull box as the PG&E service wires. Street light conduits and conductors shall be encased in concrete as shown in the Standard Details.

18.09 EXISTING LIGHTING SYSTEMS

The Contractor shall notify the City Engineer at least two (2) 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 of the same day.

18.10 EXISTING IMPROVEMENTS

Improvements such as sidewalks, curbs, gutter, portland cement concrete and asphalt concrete pavement, underlying materials, lawns and 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. 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 to a minimum depth of 2-inches 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 (1951 South River Road) unless otherwise specified.

18.12 CONDUIT INSTALLATION

Conduit shall be installed for all conductors, except where conductors are inside poles. All conduit shall be installed underground, and shall not be smaller than one (1) inch nominal diameter, and shall be of the sizes shown on the plans or as specified. 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 will not be permitted.

Underground conduit placed within road right-of-way areas (roadway) shall be thirty (30) 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. At locations where conduit is required to be installed under existing pavement and if delay to any vehicle will not exceed five (5) minutes. Conduits may be installed by the Trenching in Pavement Method as specified in Section 86-2.05C of the State Standard Specifications, and described below. Conduits placed in roadways under construction shall be in trenches with a maximum width of six (6) inches. All conduit crossings shall be perpendicular to the street centerline.

All conduit installation in new roadways shall be performed prior to completion of subgrade. Conduit placed parallel with roadways shall be approximately one (1) foot behind the sidewalk. PVC conduit placed outside the roadway shall have a minimum cover of twenty-four (24) inches. In the event that required depths cannot be maintained, the conduit shall be encased with 2-sack slurry with a minimum thickness of six (6) inches around the conduit.

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 "Trenching in Pavement Method" as specified in Section 86-2.05C of the State Standard Specifications. Conduit shall be the rigid non-metallic type. Conduit shall be placed under existing pavement in a trench approximately two (2) inches wider than the outside diameter of the conduit to be installed. Trench shall not exceed six (6) inches in width. Conduit depth shall not exceed twelve (12) inches or conduit trade-diameter plus ten (10) inches, whichever is greater, except that at pull boxes the trench may be hand dug to the required depth. The top of the installed conduit shall be a minimum of nine (9) inches below finish grade.

In areas where additional pavement is to be placed, trenching installation shall be completed prior to placing final pavement layer.

Where any portion of a utility trench is to be cut in existing pavement within 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 cut to a minimum depth of three (3) inches 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 with commercial quality Class "A" concrete, containing not less than 564 pounds of cement per cubic yard. Concrete backfill shall be placed to the pavement surface except, when the trench is in asphalt concrete pavement and additional pavement is not being placed, the top 0.10-foot of the trench shall be backfilled with asphalt concrete produced from commercial quality paving asphalt and aggregates.

Prior to spreading asphalt concrete, paint binder (tack coat) shall be applied as specified in Section 39-4.02, "Prime Coat and Paint Binder (Tack Coat)". Spreading and compacting of 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, except for the top 0.15-foot, by the end of each work period. The top 0.15-foot shall be placed within 3 working days after trenching.

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 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 a minimum of three (3) inches above the top of finished concrete foundation, and shall be sloped toward the hand hole. Conduit entering concrete pull boxes shall terminate two (2) inches 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 be sealed to prevent the entrance of gases by the use of paraffin 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.

Pull boxes shall be installed so that the covers are level with the top of the curb, pavement, sidewalk, or level with the surrounding ground 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.

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 Division IV, Section 12 "Excavations" of these specifications and the 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.

18.16 FOUNDATIONS

Concrete for use in foundations shall conform to the provisions of the State Standard Specifications for Class "A" concrete. 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 to extend up to within 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 street lights shall be installed on the mast arm in accordance with the manufacturer's recommendation. It shall be installed and adjusted to obtain the required distribution pattern.

The luminaires for post top street lights 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 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 pullbox to pullbox 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 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 UL listed connectors. "Skotchlok" connectors or an approved equal shall be required for splicing all #8 AWG conductors or smaller. Compression type connectors, "T and B" or approved equal or split-bolt connectors, "Burndy" or approved equal, shall be used to make up all splices #6 or larger on copper wire. Aluminum wire splices shall be made up by using compression type connectors, "T and B" or approved equal. Aluminum wire shall be coated with "Noalox" or approved equal, prior to splicing.

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. "Scotchcast" splice kits or approved equal shall be used to insulate below-ground splices. Scotch Tape "88" and "Skotch-Kote" or approved equal shall be used to insulate above-ground splices.

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 ballast. The connector shall be readily accessible regardless of whether the ballast is remote or is integral with the luminaire.

For 240 and 277-volt circuits each connector shall be designed so that both undergrounded conductors are disconnected simultaneously. 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 1/32-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 the conductors to the ballasts 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.

1. Test for continuity of each circuit.
2. Test for grounds in each circuit. The insulation integrity shall be as specified in Article 110-7 of the National Electrical Code, latest edition.
3. A functional test in which it is demonstrated that each part of the system functions as specified or intended herein. Street lights shall be functional for a continuous period of two (2) 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

Upon satisfactory completion of testing and all contract work, the City Engineer will arrange with Pacific Gas and Electric Company to complete service connections to the street lights and commence service.

18.22 IDENTIFICATION NUMBERS

The Contractor shall place identification numbers, to be assigned by Pacific Gas and Electric Company, on each street light pole conforming to the Standard Details.

18.23 MEASUREMENT AND PAYMENT

- A. Street lights - Street lights 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 with ballast 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.