

DIVISION II.
CONSTRUCTION AND MATERIAL SPECIFICATION

SECTION 2800 STREET LIGHTS

APPROVED AND ADOPTED THIS 15TH DAY OF DECEMBER, 1982

**KANSAS CITY METROPOLITAN CHAPTER
OF THE AMERICAN PUBLIC WORKS ASSOCIATION**

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DIVISION II CONSTRUCTION AND MATERIAL SPECIFICATIONS

SECTION 2800 STREET LIGHTS

SECTION 2801 GENERAL

2801.1 Scope: This section governs the furnishing of all labor, materials and equipment for the installation and testing of a complete, operational street light system in accordance with the standard drawings and specifications, special provisions and as shown on the plans.

2801.2 Specification Modifications: These specifications may be modified or deleted by appropriate items in the Special Provisions or by notes on the plans.

2801.3 Revision of Standards: When reference is made to a standard (ANSI, ASTM, IES, etc.) the standard referred to shall be the latest revision of said standard as amended at the time of the Notice to Bidders, except as noted on the plans or in the Special Provisions.

SECTION 2802 MATERIALS AND EQUIPMENT

2802.1 Scope: This section governs the furnishings of all luminaires, poles, cable and other materials as required to complete the work as shown on the plans and as provided for in the Special Provisions.

2802.2 Concrete: Concrete for foundations, whether reinforced or nonreinforced, shall be MCIB Mix Number A558-1-2 or A618-1-4, or as provided for in the Special Provisions or plans.

2802.3 Reinforcing Steel: Reinforcing steel shall be placed as shown on the plans or on the Standard Drawings and shall conform to ASTM A615, Grade 40 or 60.

2802.4 Conduit: Conduit shall be placed as shown on the plans or on the Standard Drawings.

A. Polyvinyl Chloride (PVC): Conduit and fittings shall be rigid polyvinyl chloride (PVC), Schedule 40 and shall conform to NEMA Standard TC-2 and NEMA Standard TC-3. Conduit, fittings and cement shall be supplied by the same manufacturer.

B. Metal: Conduit shall be rigid steel meeting the requirements of ANSI C80.1.

2802.5 Anchor Bolts: Anchor bolts shall be of size, length and deformation as shown on the plans, on the Standard Drawings or in the Special Provisions and shall conform to ASTM A307. Nuts, washers and no less than the top eight inches of the bolts shall be galvanized (2.02 ounces per square foot) as specified by ASTM A153. Nut dimensions shall conform to requirements of ANSI B18.2 for heavy semifinished hex nuts. Washer dimensions shall conform to ASTM F436.

2802.6 Screw Anchor Foundations: Screw anchor foundations shall be fabricated of new steel. The length and diameter shall be as shown on the Standard Drawings, the plans or in the Special Provisions. The shaft shall be steel pipe conforming to ASTM 252, Grade 2 with minimum wall thickness per ASTM A53, Schedule 40. The teeth and the conduit access slot shall be saw cut or flame cut. The edges of the conduit access slot shall be smooth and clean to prevent damage to the conduit. The conduit access slot shall be large enough for entry of three, two inch diameter ducts. The base plate steel shall conform to ASTM A36, shall telescope the shaft and shall be fastened to the shaft with continuous circumferential welds, top and bottom. Mounting holes shall be radially elongated. After fabrication, the foundation shall be hot dip galvanized conforming to ASTM A123. Mounting bolts shall be one inch diameter. Bolts, nuts and washers shall conform to Section 2802.5.

2802.7 Breakaway Supports: Breakaway supports shall conform to "Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals", by AASHTO.

2802.8 Cable:

- A. **Direct Buried Cable:** The cable shall be type USE, 600 volt, copper stranded, sized as shown on the plans.
- B. **Pre-Assembled "Cable in Duct":** The duct shall meet the requirements of ANSI/ASTM D3485. The cable shall be type THWN, 600 volt, copper stranded and sized as shown on the plans.
- C. **Overhead Cable and Hardware:** Overhead cable shall be TRIPLEX. Conductors shall be aluminum, insulated with cross link polyethylene and sized as shown on the plans. The messenger shall be bare ACSR the same AWG size as the insulated conductors. Supporting hardware shall be 5/8 inch or 16,000 pound, standard pole line hardware. Wedge clamps shall have aluminum wedges and stainless steel bails and shells. Connectors shall be plated copper bolted type connectors.
- D. **Pole Wiring:** Cable used within the poles shall be stranded copper, type THWN, 600 volt, and color coded red and black, and sized as shown on the plans or in the Special Provisions.

2802.9 Enclosures: Enclosures shall be as specified on the plans, the Standard Drawings, or in the Special Provisions.

2802.10 Lighting Contactors: Lighting contactors shall be as specified on the plans, the Standard Drawings, or in the Special Provisions.

2802.11 Circuit Breakers: Circuit breakers shall be as specified on the plans, the Standard Drawings, or in the Special Provisions.

2802.12 Fuses: Fuses and fuseholders shall be as specified on the plans, the Standard Drawings, or in the Special Provisions.

2802.13 Photoelectric Controls: The photoelectric control shall meet the requirements of ANSI C136.10. The control shall be adjusted to operate at 1.5 ± 0.5 footcandles, as measured in accordance with the standard. The control shall be designed so that if it fails, the system is energized.

2802.14 Pull and Junction Boxes: Pull and junction boxes shall be as specified on the plans, the Standard Drawings, or in the Special Provisions.

2802.15 Poles: The type and length of pole and arm will be specified in the Special Provisions, or on the plans.

A. Aluminum Poles: The pole shaft shall be a seamless, round, tapered tube of aluminum alloy 6063-T6. The pole base flange shall be a one piece casting of aluminum alloy 356 and be attached to the shaft by a continuous circumferential weld. The pole shall be furnished with an internally mounted dampner to damp wind induced harmonic vibration. The arm shall be of 6063-T6 alloy, of the length specified, and provide a two inch NPS luminaire mount. Anchor bolt covers of aluminum alloy 356 and hex socket attachment screws of 300 series stainless steel shall be provided. The shaft, base, anchor bolt covers and arm shall have a natural color satin finish, unless otherwise specified on the plans or in the Special Provisions. A handhole shall be provided near the base for wiring access. The handhole shall be positioned 90 degrees from the luminaire mounting arm. The handhole cover shall be secured with hex socket attachment screws of 300 series stainless steel. A ground connector capable of accepting 6 AWG wire shall be provided inside the pole, convenient to the handhole. The pole shall mount on the bolt circle diameter specified on the Standard Drawings, the plans or in the Special Provisions. The top of the pole shall be equipped with a removable cap. The cap shall be interchangeable with a cap fitted with an ANSI standard socket for a three prong twist-lock photoelectric control. The pole and arm, when equipped with the specified luminaire and installed on a standard foundation, shall withstand an 80 MPH wind with gusts to 104 MPH while covered with one-half inch of ice.

B. Steel Poles: The shaft shall be round or octagonal, tapered, and fabricated from cold rolled open hearth, basic oxygen or electric furnace steel. The arm shall be of the same material and finish as the pole, the length specified, and shall provide a two inch NPS luminaire mount. The shaft shall be one piece for lengths to 40 feet and may be two piece for lengths exceeding 40 feet. The two piece shaft shall be field assembled by a slip joint, the minimum length of which is one and one half times the diameter of the shaft at the joint. The field assembled pole must not require a weld to develop full strength. All welds in the fabrication of the shaft shall be continuous and longitudinal. The pole base flange shall be of cast steel or fabricated steel plate. It shall telescope the shaft and be secured top and bottom, by continuous circumferential welds. It shall be designed to avoid stress risers under dynamic loading. The anchor bolt covers shall be formed, forged or cast and shall be attached to the base with hex socket threaded fasteners. A handhole shall be provided near the base for wiring access. The handhole shall be positioned 90 degrees away from the mounting arm. The handhole cover shall be secured with hex socket threaded fasteners. A ground connector capable of accepting 6 AWG wire shall be provided inside the pole convenient to the handhole. The steel pole, arm, and all incidental parts shall be finished with hot dip galvanizing in accordance with ASTM A123. All fasteners shall be of 300 series stainless steel or of carbon steel galvanized in accordance with ASTM A153. The pole shall mount on the bolt circle diameter specified on the Standard Drawings, the plans, or in the Special Provisions. The top of the pole shall be equipped with a removable cap. The cap shall be interchangeable with a cap fitted with an ANSI standard socket for a three prong twist-lock photoelectric control. The pole and arm, when equipped with the specified luminaire and installed on a standard foundation, shall withstand an 80 MPH wind with gusts to 104 MPH while covered with one-half inch of ice.

2802.16 Luminaires: The manufacturer, type and model of approved, acceptable luminaires will be specified on the plans or in the Special Provisions.

A. Rectilinear Luminaire: The housing shall be aluminum or steel and shall provide a moisture proof and dust proof light chamber and weather protection for the ballast. The lens shall be a single piece of optically clear, flat, heat resistant, impact resistant glass. The lens shall be enclosed in a frame which is hinged to the underside of the luminaire housing. The frame shall be securely retained in the open or closed position and shall be readily opened, closed, or removed. The luminaire shall mount to the pole with a rectilinear mounting arm. Aluminum shall be finished with Bronze Integral Color, Aluminum Association Class I Anodizing (Dura-nodic or Kalcolor), unless otherwise specified on the plans or in the Special Provisions. Steel shall be electroplated with a zinc rich phosphate base, electrocoated with a zinc rich epoxy powder, and finally electroco-

ated with an acrylic bronze coating and baked, unless otherwise specified on the plans or in the Special Provisions. The luminaire shall be pre-wired, requiring only connection of service wires to a terminal. The luminaire shall be equipped with a regulator type ballast capable of operating the specified lamp. The ballast shall operate at 240 vac, have a power factor of 0.90 or better, shall provide reliable lamp starting at -20 degrees F or higher, and shall provide 10% or better lamp power regulation with a 10% input voltage variation. The ballast assembly shall be separated from the lamp compartment by a metal heat barrier. The ballast shall be unitized with plug disconnects for easy removal. The luminaire shall provide cutoff distribution. The vertical angle of maximum intensity shall be between 65 and 75 degrees in all vertical planes between the horizontal angles of 60 and 90 degrees. The maximum permissible luminous intensity at a vertical angle of 80 degrees and above shall be 100 candela per 1000 lumens. The illuminance on the roadway surface shall be the required level and uniformity without hot spots, dark spots or striations as determined by the Engineer.

- B. Cobrahead Luminaire:** The housing shall be cast aluminum with a slipfitter arrangement for attachment to a two inch NPS arm. The luminaire shall be adjustable \pm three degrees for leveling. It shall provide a moisture proof and dust proof light chamber and weather protection for the ballast. The lens shall be a single piece of optically clear, flat, heat resistant, impact resistant glass. The lens shall be enclosed in a frame which is hinged to the underside of the luminaire housing. The frame shall be securely retained in the open or closed position, and shall be readily opened, closed, or removed from the open position. The luminaire shall have an ANSI standard twist-lock photoelectric receptacle in the top of the housing prewired to the single location connection terminal board. A weather tight shorting plug shall be supplied for operation on centrally controlled systems. The luminaire shall be finished in light grey conversion coating or acrylic base paint, unless otherwise specified on the plans or in the Special Provisions. The luminaire shall be pre-wired, requiring only connection of service wires to a terminal. The luminaire shall be equipped with a regulator type ballast capable of operating the specified lamp. The ballast shall operate at 240 vac, have a power factor of 0.90 or better, shall provide reliable lamp starting at -20 degrees F or higher, and shall provide 10% or better lamp power regulation with a 10% input voltage variation. The ballast assembly shall be separated from the lamp compartment by a metal heat barrier. The ballast shall be unitized with plug disconnects for easy removal. The luminaire shall provide cutoff distribution. The vertical angle of maximum intensity shall be between 65 and 75 degrees in all vertical planes between the horizontal angles of 60 and 90 degrees. The maximum permissible luminous intensity at a vertical angle of 80 degrees and above shall be 100 candela per 1000 lumens. The illuminance on the roadway

surface shall be the required level and uniformity without hot spots, dark spots or striations as determined by the Engineer.

- C. Post Top Luminaire:** The luminaire housing shall be constructed of cast aluminum and shall provide a moisture proof and dust proof light chamber and weather protection for the ballast. It shall be fitted with a pressed prismatic refactor. The luminaire shall mount on a three inch slipfitter pole top. The housing shall be finished with black acrylic base paint unless otherwise specified on the plans or in the Special Provisions. The luminaire shall be pre-wired, requiring only connection of service wires to a terminal. The luminaire shall be equipped with a regulator type ballast capable of operating the specified lamp. The ballast shall operate at 240 vac, have a power factor of 0.90 or better, shall provide reliable lamp starting at -20 degrees F or higher, and shall provide 10% or better lamp power regulation with a 10% input voltage variation. The ballast assembly shall be separated from the lamp compartment by a metal heat barrier. The ballast shall be unitized with plug disconnects for easy removal.

The vertical and horizontal angles of maximum intensity shall be 75 degrees. In the plane of maximum intensity, the maximum at a vertical angle of 80 degrees shall not exceed 115 candela per 1000 lumens and at 90 degrees shall not exceed 10 candela per 1000 lumens. The illuminance on the roadway surface shall be the required level and uniformity without hot-spots, dark spots or striations as determined by the Engineer.

- D. Luminaire Approval Procedures:** To be considered for specification, a luminaire must be approved prior to final design of a project. Once approved, a luminaire will be listed in future plans or Special Provisions as an acceptable luminaire if performance requirements are still met. When photometric reports on which original approval was based become seven years old, the luminaire must again be approved based on new test reports. Manufacturers or suppliers wishing to gain approval of their luminaires shall submit to the Engineer the following data:

1. **Manufacturer's descriptive data and specifications.**
2. **Photometric test reports from an independent test laboratory and certified by the laboratory, or test reports from the manufacturer's test facility and certified by a responsible officer of the company. In either case, the test shall have been conducted not less than five years prior to submission and shall have been conducted by the IES approved Method for Testing of Roadway Luminaires. The test reports shall contain, as a minimum:**
 - a. **Tabulation of candlepower in vertical and horizontal increments.**

Candlepower shall be given in vertical planes oriented at each of the following horizontal angles: 0, 5, 15, 25, 35, 45, 55, 65, 75, 85, 90, 95, 105, 115, 125, 135, 145, 155, 165, 175, 180 degrees. In each vertical plane, candlepower shall be give at each of the following vertical angles: 0, 5, 15, 25, 35, 45, 55, 60, 62.5, 65, 67.5, 70, 72.5, 75, 82.5, 85, 87.5, 90 degrees.

- b. Coefficient of utilization curves to three mounting heights on the street side and two mounting heights on the house side.
 - c. Manufacturer's name and catalog number. Lamp identification including type and rating in watts and lumens.
3. A sample of the luminaire if requested.

2802.17 Lamps: Luminaires shall be equipped with high pressure sodium vapor lamps. Lamp life shall be not less than 24,000 hours. Burnout at 20,000 hours shall not exceed 20%. Rated initial lumen output shall be:

A.	50 watt:	4,000 lumens
B.	70 watt:	5,800 lumens
C.	100 watt:	9,500 lumens
D.	150 watt:	16,000 lumens
E.	200 watt:	22,000 lumens
F.	250 watt:	27,500 lumens
G.	310 watt:	37,000 lumens
H.	400 watt:	50,000 lumens
I.	1000 watt:	140,000 lumens

2802.18 Shop Drawings: Eight copies of complete shop drawings for manufactured equipment shall be submitted to the Engineer. Manufacturer's bulletins, leaflets and other descriptive data which contain cuts, dimensions, specifications and wiring diagrams will be acceptable for standard cataloged equipment. Such bulletins, leaflets and other descriptive data shall be clearly marked to show which item is to be used and which paragraph of the contract specification it is to satisfy. Orders for equipment shall not be placed until written approval is obtained from the Engineer.

2802.19 Spare Equipment: If spare equipment is included in the contract, it shall conform to these specifications, the Standard Drawings, and the Special Provisions. All spare equipment shall be from the same manufacturer and of the same style, model, etc. as equipment installed on the project. The items shall be delivered to the jurisdictional agency at a place and time mutually agreed on by the contractor and the Engineer. The place will normally be an agency warehouse.

SECTION 2803 POLE FOUNDATION CONSTRUCTION

2803.1 Scope: This section governs furnishing all labor, equipment, tools, materials and the performance of all work required to construct pole foundations where shown on the plans or where directed by the Engineer. Foundations shall be constructed in accordance with these specifications, the Standard Drawings and the Special Provisions.

2803.2 Conduit Bends: Conduit bends shall be installed in concrete foundations in the quantity shown on the plans and positioned in the direction of the duct or cable run.

2803.3 Anchor Bolts: Anchor bolts shall be installed in concrete foundations as shown on the plans and the Standard Drawing. A positioning jig shall be used to hold the bolts firmly in place during concrete placement.

2803.4 Finishing Concrete Foundation: Finishing should be done with the anchor bolt positioning jig in place. If the jig must be removed for finishing, it shall be re-installed immediately after finishing and left in place throughout the cure period. Safety devices shall be installed and secured firmly in place over the foundations immediately after finishing, and shall remain in place until poles are installed. Prior to pole installation, the positioning jigs shall be removed, loose concrete cleaned from around conduit ends and the conduit trimmed to provide clearance for the pole base.

2803.5 Expansion Joints: Expansion joints shall be provided where a concrete pole foundation is adjacent to concrete. After concrete has cured a minimum of seven days, the joint shall be cleaned, filled and sealed as shown on the Standard Drawings.

2803.6 Screw Anchor Foundations: Screw anchor foundations shall be power installed using an adapter on a power digger. There shall be no pre-boring except for a depression to improve location accuracy. A spirit level shall be used to insure the foundation is plumb as it is rotated into the earth. The rotation shall continue until the bottom of the foundation base plate is at ground level.

SECTION 2804 UNDERGROUND CABLE

2804.1 Scope: This section governs furnishing all labor, equipment, tools, materials and the performance of all work required to install underground cable in duct or direct buried cable where shown on the plans or where directed by the Engineer. It includes trenching, placing duct and/or cable, backfilling, connecting to overhead cable, and surface restoration. The work shall be done in accordance with these specifications, the Standard Drawings, and the Special Provisions. Deviations required due to the terrain or underground obstructions shall be in accordance with the National Electrical Code, ANSI C1, the National Electrical Safety Code, ANSI C2, and have prior concurrence of the Engineer. All cable and duct shall be routed to avoid root damage. Conduit shall be sloped to drain.

2804.2 Trenching: Trenches shall be sufficiently deep to assure that the top of the duct or direct buried cable is not less than 24 inches below final grade. The trench shall be no more than 6 inches in width. If the bottom of the trench is in rock or rocky soil, the duct or cable shall be placed on a 6 inch protective layer of clean, tamped backfill, meeting the requirements of Section 2804.7. Direct buried cable shall be placed in the trench in S curves to allow for expansion and contraction.

2804.3 Alternate Methods: Pushing, augering or boring may be used instead of trenching. Cable in duct may be installed by plowing. Minimum depth of cover of 24 inches shall be maintained.

2804.4 Duct Joints: Duct shall be joined using materials and method recommended by the manufacturer. The interior shall be sufficiently smooth to prevent cable damage during pulling.

2804.5 Cable Splices: Splices shall be only where shown on the plans or the Standard Drawings where specified by the Special Provisions or where directed by the Engineer. There shall be no buried, underground or concealed splices. *If the cable is damaged or cut after installation is complete, it may be spliced with the concurrence of, and as directed by the Engineer.*

2804.6 Pull or Junction Boxes: Pull or junction boxes shall be installed as shown on the plans, Standard Drawings, or as directed by the Engineer. In joint use boxes, cables shall be clearly identified as street light cables with plastic or metal tags. Additional pull boxes may be installed when approved by the Engineer.

2804.7 Backfilling: Backfill within six inches of the conduit or cable shall be free of rock or other solid material likely to damage the conduit or cable. The backfill shall be compacted to a density at least 90% of the maximum density for the material used as determined by ASTM Designation D698 and within

the tolerance of the moisture for the type of material at 90% of maximum density as shown on the moisture-density curve obtained. The six inches of backfill nearest the cable shall not be machine compacted.

2804.8 Surface Restoration: Disturbed areas shall be restored to a condition equal to or better than that existing prior to construction. Sidewalk and street cuts shall be restored in accordance with current standards of the jurisdictional agency.

SECTION 2805 OVERHEAD CABLE INSTALLATION

2805.1 Scope: This section governs furnishing all labor, equipment, tools, materials, and the performance of all work required to install overhead cable where shown on the plans or where directed by the Engineer. It includes installation of the cable, pole line hardware, anchors, guys, grounds, and connections. The work shall be done in accordance with these specifications, the Standard Drawings, the Special Provisions, the National Electrical Safety Code, and Utility Company requirements.

2805.2 Cable Installation: All terminations shall be by wedge clamp. Connections shall be made with bolted type connectors. When cut, the insulated conductors shall be secured to the messenger with aluminum tie straps.

SECTION 2806 FEED POINT INSTALLATION

2806.1 Scope: This section governs furnishing all labor, equipment, tools, materials and the performance of all work required to install the enclosure, cabinet, circuit breakers, fuses, contactor, photoelectric control, control cable, mounting pad, meter socket, and entrance cable, where shown on the plans or where directed by the engineer. The feed point shall be in accordance with the plans, utility company requirements, the specifications, the Standard Drawings and the Special Provisions.

2806.2 Coordination: The contractor shall coordinate his activities with the utility company to insure delivery of power to the feed point when and where required.

SECTION 2807 POLE AND LUMINAIRE INSTALLATION

2807.1 Scope: This section governs furnishing all labor, equipment, tools, materials and the performance of all work required to install the street lighting poles and luminaires and to connect the luminaires to the distribution system. Poles and luminaires shall be installed where shown on the plans or where directed by the Engineer. Poles and luminaires shall be installed in accordance with these specifications, the Standard Drawings and the Special Provisions.

2807.2 Wiring: The luminaire shall be connected to the distribution system through in-line, waterproof, breakaway fuseholders installed in the pole wiring, and fused as shown on the plans. Sufficient slack shall be left in the pole wire so that the fuseholder can be brought out of the pole through the handhole for fuse replacement or disconnection. The wire shall be without splices from the fuseholder to the connection at the luminaire. In joint use poles, cables shall be clearly identified with plastic or metal tags as street light cables. The neutral shall not be fused.

2807.3 Pole and Luminaire Erection on a Concrete Foundation: No sooner than five days after construction of the foundation, a nut and washer shall be installed on each anchor bolt. The pole base shall then be installed on the anchor bolts and held in place by another washer and nut on each bolt. Using the lower nuts, the pole shall be brought into vertical alignment (plumb), the top nuts tightened, and the anchor bolt covers installed. The luminaire and arm shall project from the street side of the pole and be perpendicular to the curb line. The opening between the pole base and the foundation shall be taped and grouted as shown on the Standard Drawings.

2807.4 Pole and Luminaire Erection on a Screw Anchor Foundation: The pole shall be fastened to the foundation with bolts and nuts. The nut shall be on top. A washer shall be installed under the bolt head and another under the nut. The pole shall be checked for plumb, minor corrections made using galvanized or cadmium plated steel shim stock, the nuts tightened and the anchor bolt covers installed. The luminaire and arm shall project from the street side of the pole and be perpendicular to the curb line.

2807.5 Luminaire on Wood Pole: The luminaire and arm shall be installed on the wood pole as shown on the plans or on the Standard Drawings. The luminaire and arm shall project from the street side of the pole and be perpendicular to the curb line.

2807.6 Luminaire on Mast Arm Pole: The luminaire slipfitter shall be installed on the davit supplied with the mast arm pole. Internal wiring shall be as specified in Section 2807.2. The luminaire and davit shall project from the street side of the pole and be perpendicular to the curb line.

2807.7 Luminaire Adjustment: The luminaire shall be adjusted and levelled in accordance with the manufacturer's instructions, to place the nadir directly below the light center.

2807.8 Lamp Installation: The installation date shall be marked on the base of the lamp prior to installing it in the luminaire.

2807.9 Clean Up: Poles and luminaires shall be cleaned of wrapping, shipping material, dirt, grease, etc. Scratches, abrasions or other surface damage shall be repaired to like new condition.

SECTION 2808 GROUNDING

2808.1 Individual Ground: Each pole and the feed point shall be grounded. A 5/8 inch x 8 foot copperweld rod shall be driven into the bottom of the trench adjacent to the pole or feed point foundation. The top three to four inches of the rod shall project above the bottom of the trench. A 6AWG BSSD copper grounding conductor shall be fastened to the ground rod with a thermit weld or compression clamp. The grounding conductor shall go through a conduit bend and the other end shall be fastened to the ground connector inside the pole shaft. At the feed point the grounding conductor shall connect to the neutral bus and the enclosure.

On a wood pole, the grounding conductor shall go up the pole and fasten to the luminaire or the arm. The lower eight feet of the grounding conductor on a wood pole shall be covered with standard molding. If an existing utility ground is available, the grounding conductor should connect to it instead of another ground rod.

Separate grounding is not required for a pole installed on a screw anchor foundation.

If rock is encountered or another condition exists which prevents the driving of the ground rod, it may be replaced, when authorized by the Engineer, with not less than 100 feet of 6 AWG BSSD copper wire fastened to the grounding connector, run through a conduit bend, stretched out in the trench and buried alongside the distribution cable or duct.

2808.2 System Ground: A 5/8 inch x 8 foot copperweld rod shall be driven into the bottom of the trench adjacent to the feed point foundation. The top three to four inches of the rod shall project above the bottom of the trench. A 6 AWG BSSD copper conductor shall be fastened to the ground rod with a thermit weld or compression clamp. The grounding conductor shall go through a conduit bend and the other end shall be connected to the neutral bus and the enclosure.

A neutral conductor is required for each branch circuit. At each pole, the neutral conductor shall be connected to the ground connector inside the pole shaft.

SECTION 2809 SYSTEM TESTING

2809.1 Cable Testing: Prior to final inspection, the contractor shall test all cables for unscheduled grounds. Each conductor shall be tested to ground with

a megohmmeter at 500 volts. Readings in each case shall be infinity.

2809.2 Operational Testing: Prior to acceptance, the entire system shall operate satisfactorily for fourteen consecutive days. Satisfactory operation is: turn on at dusk, all lights operate continuously until dawn, turn off at dawn, all lights remain off until turned on again at dusk.

SECTION 2810 REMOVAL

If removal of street lights is included in the contract, it shall include removal of all above ground equipment, foundations to a level of 18 inches below the finished surface, and restoration of disturbed surfaces to match the adjacent surface. Unless otherwise specified on the plans or in the Special Provisions, all removed items will become the property of the contractor. Abandoned section of buried cable shall be de-energized at its power source, taped and labeled "abandoned"

SECTION 2811 MEASUREMENTS AND PAYMENTS

2811.1 Scope: This section governs the method of measurement and basis for payment of the furnishing of all labor, equipment, tools and materials and for the performance of all work necessary to complete any construction and installation covered by Section 2800.

2811.2 Items Not Listed in the Proposal: There shall be no measurement or separate payment for any items of work not specifically identified or listed in the Proposal and all costs pertaining thereto shall be included in the contract unit prices for other items which are listed in the Proposal.

2811.3 Method of Measurement: The amount of completed and accepted work will be measured or determined as follows:

- A. Pole Foundations:** Pole foundations will be measured per each for each type listed in the Proposal.
- B. Trenching:** Trenching will be measured along the trench from center of facility to center of facility, per linear foot (metre) or tenth part thereof.
- C. Conduit:** Conduit will be measured along the conduit from center of facility to center of facility, per linear foot (metre) or tenth part thereof.
- D. Underground Cable:** Underground cable will be measured along the trench line from center of facility to center of facility, per linear foot (metre) of each size of cable installed or tenth part thereof. Five feet shall be added to the measured length for each entry into and for each exit from foundation, service entrance and junction box. Twenty five feet shall be

added to the measured length for each connection to the overhead cable system. The measured ground length, plus additions, multiplied by the number of cables in the trench is the number of cable feet. For measurement purposes, a cable is defined as the group of conductors required to complete a circuit. A cable will normally consist of two conductors plus, if specified, a neutral conductor. If preassembled "cable in duct" is specified, the cable will consist of the duct and all conductors contained therein.

- E. **Overhead Cable:** Overhead cable will be measured on the ground along the pole line from center of facility to center of facility, per linear foot (metre) or tenth part thereof.
- F. **Feed Points:** Feed points will be measured per each for each type listed in the Proposal.
- G. **Poles and/or Luminaires:** Poles and/or luminaires will be measured per each for each type listed in the Proposal.
- H. **Pull or Junction Boxes:** Pull or junction boxes will be measured per each for each type listed in the Proposal.
- I. **Spare Equipment:** Spare equipment will be measured per each for each type listed in the Proposal.
- J. **Removal:** Removal will be measured as one per contract.

2811.4 Basis of Payment: Payment for the completed and accepted work will be made as follows:

- A. **Pole Foundations:** Pole foundations will be paid for by one of the following:
 1. Contract unit bid price.
 2. Contract lump sum bid price.
- B. **Trenching:** Trenching will be paid for by one of the following:
 1. Contract unit bid price.
 2. Contract lump sum bid price.
- C. **Conduit:** Conduit will be paid for by one of the following:
 1. Contract unit bid price.

2. Contract lump sum bid price.
- D. Underground Cable:** Underground cable will be paid for by one of the following:
1. Contract unit bid price.
 2. Contract lump sum bid price.
- E. Overhead Cable:** Overhead cable will be paid for by one of the following:
1. Contract unit bid price.
 2. Contract lump sum bid price.
- F. Feed Points:** Feed points will be paid for by one of the following:
1. Contract unit bid price.
 2. Contract lump sum bid price.
- G. Poles and/or Luminaires:** Poles and/or luminaires will be paid for by one of the following:
1. Contract unit bid price.
 2. Contract lump sum bid price.
- H. Pull or Junction Boxes:** Pull or junction boxes will be paid for by one of the following:
1. Contract unit bid price.
 2. Contract lump sum bid price.
- I. Spare Equipment:** Spare equipment will be paid for by one of the following:
1. Contract unit bid price.
 2. Contract lump sum bid price.
- J. Removal:** Removal will be paid for at the contract lump sum bid price.