

## SECTION 26 56 00

## EXTERIOR LIGHTING

07/06

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO LTS-4 (2006) Standard Specifications for  
Structural Supports for Highway Signs,  
Luminaires and Traffic Signals

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C136.21 (2004) Roadway Lighting Equipment -  
Vertical Tenons Used with Post-Top-Mounted  
Luminaires

ASTM INTERNATIONAL (ASTM)

ASTM A 153/A 153M (2009) Standard Specification for Zinc  
Coating (Hot-Dip) on Iron and Steel  
Hardware

ASTM B 108 (2006) Standard Specification for  
Aluminum-Alloy Permanent Mold Castings

CALIFORNIA ENERGY COMMISSION (CEC)

CEC Title 24 (1978; R 2009) California's Energy  
Efficiency Standards for Residential and  
Nonresidential Buildings

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA HB-9 (2000; Errata 2004; Errata 2005) IES  
Lighting Handbook

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2007; Errata 2007) National Electrical  
Safety Code

IEEE Std 100 (2000) The Authoritative Dictionary of IEEE  
Standards Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2008) Enclosures for Electrical Equipment  
(1000 Volts Maximum)

- NEMA C136.13 (2004) Roadway Lighting Equipment, Metal Brackets for Wood Poles
- NEMA C136.3 (2005) Roadway and Area Lighting Equipment Luminaire Attachments
- NEMA C78.42 (2004) Standard for High-Pressure Sodium Lamps
- NEMA C82.4 (2002) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2007; AMD 1 2008) National Electrical Code - 2008 Edition

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

- Energy Star (1992; R 2006) Energy Star Energy Efficiency Labeling System

UNDERWRITERS LABORATORIES (UL)

- UL 1029 (1994; Rev thru Feb 2006) Standard for Safety High-Intensity-Discharge Lamp Ballasts
- UL 1598 (2008; Rev thru Nov 2008) Luminaires

1.2 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.
- b. Average life is the time after which 50 percent will have failed and 50 percent will have survived under normal conditions.
- c. Groundline section is that portion between one foot above and 2 feet below the groundline.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Luminaire drawings; G

Poles; including anchor bolts; G

## SD-03 Product Data

Energy Efficiency; G

Luminaires; G

Lamps; G

Ballasts; G

Aluminum poles; including anchor bolts, G

Brackets; luminaires; video camera mounting; G

## SD-05 Design Data

Design Data for luminaires; G

## SD-06 Test Reports

Operating test; G

Submit operating test results as stated in paragraph entitled "Field Quality Control."

## SD-10 Operation and Maintenance Data

Operational Service

Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and/or reuse.

## 1.4 QUALITY ASSURANCE

## 1.4.1 Drawing Requirements

## 1.4.1.1 Luminaire Drawings

Include dimensions, effective projected area (EPA), accessories, and installation and construction details. Photometric data, including zonal lumen data, average and minimum ratio, aiming diagram, and computerized candlepower distribution data shall accompany shop drawings.

## 1.4.1.2 Poles

Include dimensions, wind load determined in accordance with AASHTO LTS-4, pole deflection, pole class, and other applicable information.

## 1.4.2 Design Data for Luminaires

- a. Distribution data according to IESNA classification type as defined in IESNA HB-9.
- b. Computerized horizontal illumination levels in footcandles at ground level, taken every 10 feet. Include average maintained footcandle level and maximum and minimum ratio.

c. Amount of shielding on luminaires.

#### 1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

#### 1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

##### 1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

##### 1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

##### 1.5.1 Aluminum Poles

Do not store poles on ground. Support poles so they are at least one foot above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

#### 1.6 ENERGY EFFICIENCY STANDARDS

##### 1.6.1 Energy Efficiency

Comply with National Energy Policy Act and Energy Star and CEC Title 24 requirements for lighting products. Submit data indicating lumens per watt efficiency and color rendition index of light source.

#### 1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render

satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

## PART 2 PRODUCTS

### 2.1 PRODUCT COORDINATION

Products and materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 33 70 02.00 10 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND, and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Lighting fixtures and accessories mounted on exterior surfaces of buildings are specified in Section 26 51 00 INTERIOR LIGHTING.

### 2.2 LUMINAIRES

**UL 1598.** Provide luminaires as indicated. Provide luminaires complete with lamps of number, type, and wattage indicated. Details, shapes, and dimensions are indicative of the general type desired, but are not intended to restrict selection to luminaires of a particular manufacturer. Luminaires of similar designs, light distribution and brightness characteristics, and of equal finish and quality will be acceptable as approved.

#### 2.2.1 Lamps

##### 2.2.1.1 High-Pressure Sodium (HPS) Lamps

**NEMA C78.42.** Wattage as indicated. HPS lamps shall have average rated life of 16,000 hours (minimum) for 35 watt lamps and 24,000 hours (minimum) for all higher wattage lamps. 150 watt lamps, if required, shall be 55 volt lamps. Lamps shall have Luminaire Efficiency Ratings (LER) as follows:

- a. Upward efficiency of 0%
  1. 150-399 watts: minimum 58 LER for closed fixture; minimum 68 for open fixture
  2. 400-999 watts: minimum 63 LER for closed fixture; minimum 84 for open fixture
- b. Upward efficiency of 1%-10%
  1. 150-399 watts: minimum 64 LER for closed fixture; minimum 63 for open fixture
  2. 400-999 watts: minimum 82 LER for closed fixture; minimum 89 for open fixture
  3. 1000+ watts: minimum 109 LER for open fixture
- c. Upward efficiency of 11% to 20%
  1. 150-399 watts: minimum 78 LER for open fixture
  2. 400-999 watts: minimum 94 for open fixture
- d. Upward efficiency greater than 20%
  1. 150-399 watts: minimum 75 LER for closed fixture; minimum 77 for

open fixture

### 2.2.2 Ballasts for High-Intensity-Discharge (HID) Luminaires

UL 1029 and NEMA C82.4, and shall be constant wattage autotransformer (CWA) or regulator, high power-factor type (minimum 90%). Provide single-lamp ballasts which shall have a minimum starting temperature of minus 30 degrees C. Ballasts shall be:

- a. Designed to operate on voltage system to which they are connected.
- b. Constructed so that open circuit operation will not reduce the average life.

HID ballasts shall have a solid-state igniter/starter with an average life in the pulsing mode of 10,000 hours at the intended ambient temperature. Igniter case temperature shall not exceed 90 degrees C.

### 2.3 POLES

Provide poles designed for wind loading of 100 miles per hour determined in accordance with AASHTO LTS-4 while supporting luminaires and all other appurtenances indicated. The effective projected areas of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole. Poles shall be anchor-base type designed for use with underground supply conductors. Poles shall have oval-shaped handhole having a minimum clear opening of 2.5 by 5 inches. Handhole cover shall be secured by stainless steel captive screws. Metal poles shall have an internal grounding connection accessible from the handhole near the bottom of each pole. Scratched, stained, chipped, or dented poles shall not be installed.

#### 2.3.1 Aluminum Poles

Provide aluminum poles manufactured of corrosion resistant aluminum alloys conforming to AASHTO LTS-4 for Alloy 6063-T6 or Alloy 6005-T5 for wrought alloys and Alloy 356-T4 (3,5) for cast alloys. Poles shall be seamless extruded or spun seamless type with minimum 0.188 inch wall thickness. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire. Tops of shafts shall be fitted with a round or tapered cover. Base shall be anchor bolt mounted, made of cast 356-T6 aluminum alloy in accordance with ASTM B 108 and shall be machined to receive the lower end of shaft. Joint between shaft and base shall be welded. Base cover shall be cast 356-T6 aluminum alloy in accordance with ASTM B 108. Hardware, except anchor bolts, shall be either 2024-T4 anodized aluminum alloy or stainless steel. Aluminum poles and brackets for walkway lighting shall have a uniform satin dark anodic bronze finish to match fixtures and shall not be painted. Manufacturer's standard provision shall be made for protecting the finish during shipment and installation. Minimum protection shall consist of spirally wrapping each pole shaft with protective paper secured with tape, and shipping small parts in boxes.

### 2.4 BRACKETS AND SUPPORTS

NEMA C136.3, NEMA C136.13, and ANSI C136.21, as applicable. Pole brackets shall be not less than 1 1/4 inch aluminum secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaires provided, and brackets for use with one type of luminaire shall

be identical. Brackets for pole-mounted street lights shall correctly position luminaire no lower than mounting height indicated. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with luminaire head, or video cameras.

## 2.5 POLE FOUNDATIONS

Anchor bolts shall be steel rod having a minimum yield strength of 50,000 psi; the top 12 inches of the rod shall be galvanized in accordance with ASTM A 153/A 153M. Concrete shall be as specified in Section 03 31 00.00 10 CAST-IN-PLACE STRUCTURAL CONCRETE.

## 2.6 EQUIPMENT IDENTIFICATION

### 2.6.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

## 2.7 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

#### 3.1.1 Aluminum Poles

Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end. Provide ornamental covers to match pole and galvanized nuts and washers for anchor bolts. Concrete for anchor bases, polyvinyl chloride (PVC) conduit ells, and ground rods shall be as specified in Section 33 70 02.00 10 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit ell. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.

#### 3.1.2 GROUNDING

Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 33 70 02.00 10 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

### 3.2 FIELD QUALITY CONTROL

Coordinate lighting and controls installation and testing with commissioning for all lighting systems. Upon completion of installation,

verify that equipment is properly installed, connected, and adjusted.

### 3.3 OPERATIONAL SERVICE

Conduct an [operating test](#) to show that the equipment operates in accordance with the requirements of this section.

-- End of Section --