

## SECTION 26 56 00

### EXTERIOR LIGHTING

#### PART 1 - GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.02 SUMMARY

- A. Section Includes:
  - 1. Exterior luminaires with lamps and ballasts.
  - 2. Poles and accessories.
- B. Related Sections:
  - 1. Section 26 51 00 "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

##### 1.03 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. IES: Illuminating Engineering Society
- D. LED: Light Emitting Diode.
- E. LER: Luminaire efficacy rating.
- F. Luminaire: Complete lighting fixture, including ballast or power supply housing if provided.
- G. Pole: Luminaire support structure, including tower used for large area illumination.
- H. Standard: Same definition as "Pole" above.

##### 1.04 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.
  - 1. Basic wind speed for calculating wind load for poles 50 feet high or less is 100 mph.
    - a. Wind Importance Factor: 1.0.
    - b. Minimum Design Life: 25 years.
    - c. Velocity Conversion Factors: 1.0.

##### 1.05 ACTION SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
  - 2. Details of attaching luminaires and accessories.
  - 3. Details of installation and construction.
  - 4. Luminaire materials.
  - 5. Photometric data based on IES LM-79 laboratory tests of each luminaire type, complete with indicated LED engines, power supplies, operating current in milliamps (mA), and accessories.
    - a. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
  - 6. Power supplies, including energy-efficiency data.

7. LED engines, including life based on IES LM-80, output based on IES LM-79 testing methods, CCT, CRI, lumens, operating current in milliamps (mA), and energy-efficiency data.
8. Materials, dimensions, and finishes of poles.
9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
10. Anchor bolts for poles.

**1.06 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For luminaires to include in emergency, operation, and maintenance manuals.

**1.07 QUALITY ASSURANCE**

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with IEEE C2, "National Electrical Safety Code."
- D. Comply with NFPA 70.

**1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

**1.09 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
  1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
  2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
  3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
  4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings.
- B. Product Substitutions: Provide product data per "Action Submittals" for all proposed substitute products submitted during bid period for Architect and Engineer review. Substitute products are any products not specifically detailed on Drawings with full model numbers. Substitute products are subject to review and acceptance of Architect and Engineer. Listing on Drawings of alternate manufacturer's names without detailed full model numbers does not equate to specific product approval or acceptance.

**2.02 GENERAL REQUIREMENTS FOR LUMINAIRES**

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

1. LED Fixtures: Test in accordance with IES LM79 & LM80.
- B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
  1. White Surfaces: 85 percent.
  2. Specular Surfaces: 83 percent.
  3. Diffusing Specular Surfaces: 75 percent.
- J. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- K. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- L. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or "SSPC-SP 8, "Pickling."
  2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
    - a. Color: As selected from manufacturer's standard catalog of colors.
- M. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  1. Color: As selected from manufacturer's standard catalog of colors.
- N. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  1. Label shall include the following lamp and ballast characteristics:
    - a. "USES ONLY" and include specific LED engine type.
    - b. CCT and CRI for all luminaires.

### **2.03 LED LIGHT SOURCE REQUIREMENTS**

- A. Solid State Lighting (LED) sources must meet the following requirements:
  1. Luminaires must be rated for -40°C to +50°C operation
  2. Correlated Color Temperature (CCT) shall 4000K.

3. Color Rendering Index (CRI) of:  $\geq 80$
4. Lumen Maintenance:  $\geq 50,000$  hours to 70% Lumen Maintenance per IES LM-80, tested per IES LM-79 procedures.
5. Luminaire efficiency shall be  $\geq 100$  lumens per watt. Small lumen output fixtures (less than 1000 lumens) and decorative fixtures may be below 100 lumens per watt.
6. Fixtures shall be Energy Start or DesignLights Consortium "DLC" labeled / qualified.

#### **2.04 DRIVER REQUIREMENTS**

- A. Power Supply Units (PSUs) including drivers must meet the following requirements:
  1. Must have a minimum efficiency of 85%
  2. Must be rated to operate between  $-40^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$
  3. Input Voltage: capable of 120 to 277 ( $\pm 10\%$ ) volt, single phase as required by the site.
  4. Power supplies can be UL Class I or II output.
  5. Operating frequency must be 60 Hz.
  6. Drivers must have a Power Factor (PF) of:  $\geq 0.90$ .
  7. Drivers must have a Total Harmonic Distortion (THD) of:  $\leq 20\%$ .
  8. Drivers must comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards
  9. Drivers must be Reduction of Hazardous Substances (RoHS) compliant.

#### **2.05 LUMINAIRE REQUIREMENTS**

- A. General Requirements:
  1. Luminaire must be UL-listed for wet locations and wiring cavity must be field accessible for service or repair needs.
  2. Optical cavity must be a minimum IEC 60529/IP65.
  3. Fully assemble and electrically test luminaires before shipment from factory.
  4. If a lens not integral to the LED is used, construct the luminaire optical enclosure (lens/window) of clear and UV-resistant polycarbonate, acrylic or glass.
- B. Mechanical Vibration
  1. The luminaire must be subjected to 100,000 cycles of 2 Gs at the resonant frequency of the luminaire (between 5 and 30 Hz) applied at the center of gravity of the luminaire on 3 primary axes per ANSI C136.31 without damage to the luminaire. The luminaire must be fully functional upon completing the test.

#### **2.06 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS**

- A. Structural Characteristics: Comply with AASHTO LTS-4-M.
  1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
  1. Materials: Shall not cause galvanic action at contact points.
  2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
  3. Anchor-Bolt Template: Plywood or steel.
- D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

- E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 03 30 00 "Cast-in-Place Concrete."

## **2.07 STEEL POLES**

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; one-piece construction up to 40 feet in height with access handhole in pole wall.
  - 1. Shape: Round, straight.
- B. Brackets for Luminaires: Detachable, cantilever, without underbrace.
  - 1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.
  - 2. Match pole material and finish.
- C. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- D. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- E. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
  - 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
  - 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
    - a. Color: As selected by Architect from manufacturer's full range.

## **PART 3 - EXECUTION**

### **3.01 LUMINAIRE INSTALLATION**

- A. Install LED engines in each luminaire if not factory installed.
- B. Fasten luminaire to indicated structural supports.

### **3.02 POLE INSTALLATION**

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
  - 1. Fire Hydrants and Storm Drainage Piping: 60 inches.
  - 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
  - 3. Trees: 15 feet from tree trunk.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 03 30 00 "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
  - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.

2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
  3. Install base covers unless otherwise indicated.
  4. Use a short piece of 1/2-inch-diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 2-inch-wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch below top of concrete slab.
- F. Raise and set poles using web fabric slings (not chain or cable).

### **3.03 CORROSION PREVENTION**

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

### **3.04 GROUNDING**

- A. Ground metal poles and support structures according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
1. Install grounding electrode for each pole unless otherwise indicated.
  2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

### **3.05 FIELD QUALITY CONTROL**

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

### **3.06 SPARE PARTS AND TOOLS**

- A. Replace non-functioning lamps at time of final acceptance and provide 20% spare lamps for each lamp type on project.

**END OF SECTION 26 56 00**