

SECTION 16521
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section

1.2 SUMMARY

- A. This Section includes the following
 - 1. Exterior luminaires with lamps and ballasts
 - 2. Luminaire-mounted photoelectric relays
 - 3. Poles and accessories

1.3 DEFINITIONS

- A. CRI: Color-rendering index
- B. HID: High-intensity discharge
- C. Luminaire: Complete lighting fixture, including ballast housing if provided
- D. Pole: Luminaire support structure, including tower used for large area illumination
- E. Standard: Same definition as "Pole" above

1.4 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
- B. Live Load: Single load of 500 lb, distributed as stated in AASHTO LTS-4
- C. Ice Load: Load of 3 lb/sq. ft., applied as stated in AASHTO LTS-4
- D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4, except basic wind speed shall be 100MPH per the Regional Building Code.

1.5 SUBMITTALS

- A. In accordance with Section 01340

- B. 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 laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories
 - 6. Photoelectric relays
 - 7. Ballasts, including energy-efficiency data
 - 8. Lamps, including life, output, and energy-efficiency data
 - 9. Materials, dimensions, and finishes of poles
 - 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved
 - 11. Anchor bolts for poles
 - 12. Verification that submittal items meet the required structural specifications
- C. Shop Drawings
 - 1. Anchor-bolt templates keyed to specific poles and certified by manufacturer
- D. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design
- E. Qualification Data: For agencies providing photometric data for lighting fixtures
- F. Field quality-control test reports
- G. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals
- H. Warranty: Special warranty specified in this Section

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use
- B. Comply with IEEE C2, "National Electrical Safety Code"
- C. Comply with NFPA 70

1.7 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

1.8 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 lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion
 - 5. 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

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents
 - 1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type
 - 2. Glass and plastic lenses, covers, and other optical parts: 10 for every 100 of each type and rating installed. Furnish at least one of each type
 - 3. Ballasts: 10 for every 100 of each type and rating installed. Furnish at least one of each type
 - 4. Globes and guards: 10 for every 20 of each type and rating installed. Furnish at least one of each type

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified

2.2 LUMINAIRES, GENERAL REQUIREMENTS

- 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
- B. 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 scheduled 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. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes
 2. Natural satin finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax
 - a. Color: Natural

2.3 BALLASTS FOR HID LAMPS

- A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features, unless otherwise indicated
1. Ballast circuit: Constant-wattage autotransformer or regulating high-power-factor type
 2. Minimum starting temperature: Minus 22 deg F
 3. Normal ambient operating temperature: 104 deg F
 4. Ballast fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer
- B. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C
1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W
 - a. Restrike Range: 105- to 130-V ac
 - b. Maximum Voltage: 250-V peak or 150-V ac RMS
 2. Minimum Starting temperature: Minus 40 deg F

2.4 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum

1. Dual-arc tube lamp: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output

2.5 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4
 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 Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3
 2. Strength analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis
- 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 stainless-steel items are indicated
 3. Anchor-bolt template: Steel
- D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 03300. Utilize premanufactured forms for pole bases as indicated on the Drawings

2.6 ALUMINUM POLES

- A. Poles
 1. Seamless, extruded structural tube complying with ASTM B429, Alloy 6063-T6 with access handhole in pole wall
 2. ASTM B209, 5052-H34 marine sheet alloy with access handhole in pole wall
 3. Shape: Round, straight
 4. Mounting provisions: Butt flange for bolted mounting on foundation or breakaway support
- B. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top
- C. Grounding and Bonding Lugs: Welded ½-inch threaded lug, complying with requirements in Section 16060, listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole

- D. Aluminum Mast Arms: 4-foot long single arm type with continuously welded pole attachment plate
- E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts
 - 1. Tapered oval cross section, with straight tubular end section to accommodate luminaire
 - 2. Finish: Same as pole and luminaire
- F. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes
 - 2. Natural satin finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax
 - 3. Insert finish
 - a. Color: Natural

2.7 POLE ACCESSORIES

- A. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole
- B. Handhole: Provide handhole with gasketed screw cover on base of pole

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire
- B. Fasten luminaire to indicated structural supports
 - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer
- C. Adjust luminaires that require field adjustment or aiming

3.2 POLE INSTALLATION

- A. 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
- 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 03300
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer
1. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space
 2. Install base covers, unless otherwise indicated
 3. Use a short piece of ½-inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole

3.3 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 16130. In concrete foundations, wrap conduit with 0.010-inch thick, pipe-wrapping plastic tape applied with a 50 percent overlap

3.4 GROUNDING

- A. Ground metal poles and support structures according to Section 16060
1. Install grounding electrode for each pole, unless otherwise indicated
 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system

3.5 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
1. Verify operation of photoelectric controls
- C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices

END OF SECTION