

SECTION 26 56 00
EXTERIOR LIGHTING

SPEC WRITER NOTE: Use this section only for NCA projects. Delete between // _____ // if not applicable to project. Also, delete any other item or paragraph not applicable in the section and renumber the paragraphs.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of exterior luminaires, poles and supports. The terms "lighting fixtures", "fixtures" and "luminaires" are used interchangeably.

1.2 RELATED WORK

- A. Section 09 06 00, SCHEDULE FOR FINISHES: Finishes for exterior luminaires and poles.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that apply to more than one section of Division 26.
- C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.
- F. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground handholes and conduits.

1.3 QUALITY ASSURANCE

- A. Quality assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit in accordance with Paragraph, SUBMITTALS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:

- a. Sufficient information, clearly presented, shall be included for each type of luminaire shown on the LIGHTING FIXTURE SCHEDULE..

- b. Include electrical ratings, dimensions, mounting, material and construction details, wiring schematic and connection diagrams, installation details, energy efficiency data, photometric data, complete lamp data, and complete ballast or LED driver data, and complete pole data.
2. Manuals: Two weeks prior to final inspection, submit four copies of operating and maintenance manuals to the Resident Engineer/COR. Include technical data sheets, wiring and connection diagrams, and information for ordering replacement parts.
 3. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Resident Engineer/COR:
 - a. Certification that the materials are in accordance with the drawings and specifications.
 - b. Certification, by the Contractor, that the complete installation has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
 - LRFDLTS-22.....Structural Supports for Highway Signs, Luminaries and Traffic Signals
- C. American Concrete Institute (ACI):
 - 318-19(R 2022)Building Code Requirements for Structural Concrete
- D. American National Standards Institute (ANSI):
 - AA ANSI H35.1-17Alloy and Temper Designation Systems for Aluminum
- E. American Society for Testing and Materials (ASTM):
 - A123/A123M-17Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - A153/A153M-16.....Zinc Coating (Hot-Dip) on Iron and Steel Hardware - AASHTO No.: M232
 - B108/108M-19Aluminum-Alloy Permanent Mold Castings
 - C1089-19.....Spun Cast Prestressed Concrete Poles

- F. Institute of Electrical and Electronics Engineers (IEEE)
 C57.12.00-21.....General Requirements for Liquid-Immersed
 Distribution, Power, and Regulating
 Transformers
- G. Illuminating Engineering Society of North America (IESNA)
 IES LIGHTING HDBK-11....Lighting Handbook
 LM-79-19.....Electrical and Photometric Measurements of
 Solid-State Lighting Products
 LM-80-21.....Measuring Luminous Flux and Color Maintenance
 of LED Packages, Arrays and Modules
 RP-8-21.....Roadway Lighting
- H. National Electrical Manufacturers Association (NEMA):
 C78.41-16.....Electric Lamps - Guidelines for Low-Pressure
 Sodium Lamps
 C78.42-09(S 2022)Electric Lamps - Guidelines for High-Pressure
 Sodium Lamps
 C78.43-17Electric Lamps - Single-Ended Metal-Halide
 Lamps
 C78.1381-98.....Electric Lamps - 70-Watt M85 Metal-Halide Lamps
 C82.4-17Ballasts for High-Intensity-Discharge and Low-
 Pressure Sodium Lamps (Multiple-Supply Type)
 C136.3-20Roadway and Area Lighting Equipment - Luminaire
 Attachments
 C136.17-05(S 2017)Roadway and Area Lighting Equipment - Enclosed
 Side-Mounted Luminaries for Horizontal-Burning
 High-Intensity-Discharge Lamps - Mechanical
 Interchangeability of Refractors
 ICS 2-00(R 2020)Industrial Control and Systems Controllers,
 Contactors and Overload Relays Rated 600 Volts
 ICS 6-93(R 2016)Industrial Control and Systems Enclosures
- I. National Fire Protection Association (NFPA):
 70-23National Electrical Code (NEC)
- J. Underwriters Laboratories, Inc. (UL):
 496-17Edison-Base Lamp holders
 773-16.....Plug-in, Locking Type Photo controls, for Use
 with Area Lighting
 773A-16Non-industrial Photoelectric Switches for
 Lighting Control

1029-94.....High-Intensity-Discharge Lamp Ballasts
 1598-21Luminaires
 8750-15Standard for Safety Light Emitting Diode (LED)
 Equipment for Use in Lighting Products

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store poles on ground. Store the poles so they are at least 305 mm (one foot) above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials and equipment shall be in accordance with ANSI, NFPA, NEMA, UL, and as shown on the drawings and specified.

SPEC WRITER NOTE: NCA projects usually do not employ pole-mounted site lights. A/E shall edit specification in accordance with project scope and requirements. Delete between // _____ // if not applicable to project.

//2.2 POLES

A. General:

1. Poles shall be as shown on the drawings, and as specified. Finish shall be as specified on the drawings.
2. The pole and arm assembly shall be designed for wind loading of 161 km/hr (100 miles per hour)//, with an additional 30 percent gust factor, supporting luminaire(s) having the effective projected areas indicated. The effective projected area of the pole shall be applied at the height of the pole base as shown on the drawings.
3. Poles shall be //embedded// //anchor-bolt// type designed for use with underground supply conductors. Poles shall have oval-shaped handhole having a minimum clear opening of 65 by 125 mm (2.5 by 5 inches). Handhole cover shall be secured by stainless steel captive screws.
4. Provide a steel-grounding stud opposite handhole openings.
5. Provide a base cover matching the pole in material and color to conceal the mounting hardware pole-base welds and anchor bolts.
6. Hardware and Accessories: All necessary hardware and accessories shall be the products of the pole manufacturer.

B. Types:

- //1. Aluminum: Provide //round// //square// aluminum poles manufactured of corrosion resistant AA ANSI H35.1 aluminum alloys

conforming to AASHTO. Poles shall be seamless extruded or spun seamless type. //

//2. Steel: Provide //round// //square// steel poles having minimum 11-gage steel with minimum yield/strength of 48,000 psi and //hot-dipped galvanized// //iron-oxide primed// factory finish.

//Galvanized steel poles shall comply with ASTM A123 and A153.// //

//3. Concrete: Provide //round// //square// //multi-sided// concrete poles conforming to ASTM C1089 with integral cast bases. Poles shall hve hollow core suitable as raceway.// //

//2.3 FOUNDATIONS FOR POLES

- A. Foundations shall be cast-in-place concrete, having 3000 psi minimum 28 day compressive strength.
- B. Foundations shall support the effective projected area of the specified pole, arm(s), luminaire(s), and accessories, such as banner arms, and banners, under wind conditions previously specified in this section.
- C. Place concrete in spirally wrapped treated paper forms for round foundations, and construct forms for square foundations.
- D. Rub-finish and round all above-grade concrete edges to approximately 6 mm (1/4 inch) radius.
- E. Anchor bolt assemblies and reinforcing of concrete foundations shall be as shown on the drawings. Anchor bolts shall be in a welded cage or properly positioned by the tie wire to stirrups.
- F. Prior to concrete pour, install electrode per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.//

SPEC WRITER NOTE: A/E shall consider and specify LED lighting for outdoor when appropriate. Edit the paragraph below to comply with project requirements. Delete the paragraphs with lighting type and components not used in the project.

2.4 LUMINAIRES

- A. Luminaires shall comply with NEMA, NFPA, and UL.
- B. LED luminaires shall be provided as a complete unit with housing, LED module, and LED driver.
- C. Illumination distribution patterns, BUG ratings and cutoff types as defined by the IESNA shall be as shown on the drawings.
- D. Incorporate ballasts in the luminaire housing except where otherwise shown on the drawings.
- E. Lenses shall be frame-mounted heat-resistant, borosilicate glass, prismatic refractors. Attach the frame to the luminaire housing by

hinges or chain. Use heat and aging resistant resilient gaskets to seal and cushion lenses and refractors in luminary doors.

- F. Lamp sockets for high intensity discharge (HID) fixture shall have locking type porcelain enclosures in conformance to the applicable requirements of ANSI C81.61 and UL 496.
- G. Pre-wire internal components to terminal strips at the factory.
- H. Bracket mounted luminaries shall have leveling provisions and clamp type adjustable slip-fitters with locking screws.
- I. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.
- J. Provide manufacturers' standard finish, as scheduled on the drawings. Where indicated on the drawings, match finish process and color of pole or support materials. Where indicated on the drawings, provide finishes as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.
- K. Luminaires shall carry factory labels, showing complete, specific lamp and ballast/LED driver information.

2.5 LAMPS

- A. Install the proper lamps in every luminaire installed // and every luminaire relocated or reinstalled //as shown on the drawings.
- B. Lamps to be general-service, outdoor lighting types.
- C. Mercury vapor lamps shall not be used.
- D. Metal-Halide Lamps: NEMA C78.43 or NEMA C78.1381. Lamps shall be pulse start or ceramic type with wattage and correlated color temperature as shown on the LIGHTING FIXTURE SCHEDULE.
- E. LED source shall meet the following requirements:
 1. Shall be certified, listed and warranted by the manufacturer for operating temperature rating between -40 degrees C (-40 degrees F) and 50 degrees C (122 degrees F).
 2. Correlated Color Temperature (CCT): as indicated on the LIGHTING FIXTURE SCHEDULE.
 3. Color Rendering Index (CRI): ≥ 70 .

2.6 HIGH INTENSITY DISCHARGE BALLASTS

- A. For low voltage systems, the ballasts shall be the high efficiency, high power factor, copper-wound constant wattage type and shall meet the requirements of UL 1029 and NEMA C82.4.
 1. Ballasts shall operate the discharge lamp of the type, wattage, and voltage shown on the drawings.

2. Ballasts shall have individual overcurrent protection (inline fuse holder) as recommended by the ballast manufacturer.
 3. Ballasts shall be capable of providing reliable starting of the lamps at minus 30 degrees C.
 4. Open-circuit operation shall not reduce the average life.
- B. Locate protective devices for ballasts to be accessible if the devices are not integral with ballasts.
- C. Each ballast shall operate not more than one lamp except where otherwise shown on the drawings.

2.7 METAL HALIDE CORE AND COIL BALLASTS

- A. Shall be pulse start, linear reactor type for 277 volt luminaires and constant-wattage autotransformer (CWA) type for other voltage luminaires (if not otherwise specified).
- B. Ballasts shall have individual overcurrent protection in each ungrounded supply conductor.
- C. Power factor shall be not less than 90%.
- D. Ballast shall have an allowable line voltage variation of $\pm 5\%$ for linear reactor type and $\pm 10\%$ for CWA, with a maximum 20% lamp wattage regulation spread.
- E. Ballast shall have a minimum starting temperature of -40 degrees C (-40 degrees F).
- F. Lamp current crest factor shall be 1.8 or less, in accordance with lamp manufacturer recommendations.

2.8 METAL HALIDE ELECTRONIC BALLASTS

- A. Ballast shall be low-frequency electronic type, and shall operate pulse start and ceramic metal halide lamps at a frequency of 90 to 200 Hz square wave.
- B. Ballast shall be labeled Type '1' outdoor, suitable for recessed use, Class 'P'.
- C. Ballast shall have auto-resetting thermal protector to shut off ballast when operating temperatures reach unacceptable levels.
- D. Ballast shall have an end of lamp life detection and shut-down circuit.
- E. Lamp current crest factor shall be 1.5 or less.
- F. Ballasts shall comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
- G. Ballast shall have a minimum ballast factor of 1.0.
- H. Input current THD shall not exceed 20% for the primary lamp.

- I. Ballasts shall have IEEE/ANSI C62.41, category 'A' transient protection.
- J. Ballasts shall have power factor greater than 90%.
- K. Ballast shall have a Class 'A' sound rating.

2.9 LED DRIVERS

- A. LED drivers shall meet the following requirements:
 - 1. Drivers shall have a minimum efficiency of 85%.
 - 2. Starting Temperature: -40 degrees C (-40 degrees F).
 - 3. Input Voltage: 120 to 480 ($\pm 10\%$) volt.
 - 4. Power Supplies: Class I or II output.
 - 5. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50 μ s, 10kA/8 x 20 μ s) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ANSI C62.41.2 CORR 1, Scenario 1 Location Category C.
 - 6. Power Factor (PF): ≥ 0.90 .
 - 7. Total Harmonic Distortion (THD): $\leq 20\%$.
 - 8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
 - 9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

2.10 LIGHTING CONTACTORS

- A. NEMA ICS 2, //electrically // // mechanically // held contactors. Rate contactors as indicated. Provide in NEMA // 4 // enclosure conforming to NEMA ICS 6. Contactors shall have silver alloy double-break contacts and coil clearing contacts for mechanically held contactor] and shall require no arcing contacts. //Provide contactors with //hand-off-automatic // // on-off // selector switch.//

2.11 CONTROLS

- A. Each Lighting System:
 - 1. Shall be controlled by one of the following methods as shown for each system on the drawings:
 - a. A photocell to act as the pilot device. The photocell shall be the type which fails safe to the closed position meeting UL 773 or 773A.
 - b. A time clock to act as the pilot device.
 - c. A combination, photocell-time clock to act as dual pilot devices connected in series. The photocell shall provide the "on" function at dusk and the time clock(s) shall control specific circuit "off" functions during dark hours.

- d. A time clock to act as the pilot device for a circuit (or circuits) when luminaries are individually photocell controlled.
 - e. The pilot devices shall control the power circuit through the contractor or relay as shown on the drawings.
2. Mount and connect photocells and time clocks as shown on the drawings.
 3. Photocells shall have the following features:
 - a. Quick-response, cadmium-sulfide type.
 - b. A 15 to 30 second, built-in time delay to prevent response to momentary lightning flashes, car headlights or cloud movements.
 - c. Energizes the system when the north sky light decreases to approximately 1.5 foot candles, and maintains the system energized until the north sky light increases to approximately 3 to 5 foot candles.
 4. Time clocks shall have the following features:
 - a. A 24-hour astronomic dial, motor-driven.
 - b. A spring-actuated, reserve power mechanism for operating the timer during electrical power failures and that automatically winds the spring when the electrical power is restored.
 5. The arrangement and method of control and the control devices shall be as shown on the drawings.

//2.12 EXISTING LIGHTING SYSTEMS

- A. For modifications or additions to existing lighting systems, the new components shall be compatible with the existing systems.
- B. New poles and luminaries shall have approximately the same configurations and dimensions as the existing poles and luminaries except where otherwise shown on the drawings.//

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.

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- //B. Pole Foundations:

1. Excavate only as necessary to provide sufficient working clearance for installation of forms and proper use of tamper to the full depth of the excavation. Prevent surface water from flowing into the excavation. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath, and the end of conduit.
 2. Set anchor bolts according to anchor bolt templates furnished by the pole manufacturer.
 3. Install poles to provide a permanent vertical position with the bracket arm in proper position for luminaire location.
 4. After the poles have been installed, shimmed and plumbed, grout the spaces between the pole bases and the concrete base with non-shrink concrete grout material. Provide a plastic or copper tube, of not less than 9 mm (3/8-inch) inside diameter, through the grout tight to the top of the concrete base for moisture weeping.//
- C. Photocell Switch Aiming: Aim switch according to manufacturer's recommendations. // Mount switch on or beside each luminaire when switch is provided in cast weatherproof aluminum housing with swivel arm. // // Set adjustable window slide for proper footcandles photocell turn-on.//

3.2 GROUNDING

- A. Ground noncurrent-carrying parts of equipment including metal poles, luminaries, mounting arms, brackets, and metallic enclosures as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding a conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable and listed for this purpose.

3.3 ACCEPTANCE CHECKS AND TESTS

- A. Verify operation after installing luminaires and energizing circuits.

- - - E N D - - -