

SECTION 26 50 00
LIGHTING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Canadian Standards Association (CSA).
2. Federal Communications Commission (FCC).
3. Illuminating Engineering Society of North America (IESNA).
 - a. HB-9, Lighting Handbook.
 - b. LM-79, IES Electrical and Photometric Measurements of Solid-State Lighting Products.
 - c. LM-80, IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources.
 - d. RP (Recommended Practices) Series.
 - e. TM-21, Projecting Long Term Lumen Maintenance of LED Light Sources.
4. Institute of Electrical and Electronics Engineers (IEEE): C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
5. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
 - b. ICS 6, Industrial Control and Systems: Enclosures.
6. National Energy Policy Act.
7. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC) – 2023.
8. National Park Service, Denver Service Center Lighting Standards:
<https://www.nps.gov/dscw/ds-lighting.htm>.
9. UL:
 - a. 773, UL Standard for Safety Plug-In Locking Type Photocontrols for Use with Area Lighting - Fourth Edition; Reprint with Revisions Through and Including March 08, 2002.
 - b. 924, Emergency Lighting and Power Equipment.
 - c. 1598, UL Standard for Safety Luminaires.
 - d. 8750, UL Standard for Safety Light Emitting Diode (LED) Equipment for Use in Lighting Products - First Edition; Reprint with Revisions Through and Including April 1, 2015.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
 - a. General:
 - 1) Provide catalog data sheets and pictures for all products listed below.
 - b. Interior Luminaires:
 - 1) Catalog data sheets with pictures.
 - 2) Luminaire material, finish, dimensions, and metal gauge.
 - 3) Lens material, pattern, and thickness.
 - 4) Candle power distribution curves in two or more planes.
 - 5) Candle power chart 0 degree to 90 degrees.
 - 6) Lumen output chart.
 - 7) Average maximum brightness data in foot lamberts.
 - 8) Mounting or suspension details.
 - c. Exterior Luminaires:
 - 1) Catalog data sheets with pictures. Luminaire material, finish, dimensions, and metal gauge.
 - 2) Lens material, pattern, and thickness. Filters.
 - 3) IESNA lighting classification (BUG rating).
 - 4) Isolux diagram.
 - 5) Lighting distribution data and lighting distribution classification type as defined in IESNA HB 9.
 - 6) Fastening details to wall, pendant, or pole.
 - 7) For light poles, submit catalog sheet, wind loading, pole deflection with fixture attached, total weight, all accessories, complete dimensions, and finish.
 - 8) Brackets and supports.
 - 9) Pole foundations.
 - d. LED Source Systems:
 - 1) General:
 - a) IESNA LM-80 test reports.
 - b) IESNA TM-21 ratings.
 - c) Operating Temperature Range: Data sheet (chart/graph) describing life as a function of temperature.
 - d) Warranty: Light engine and driver.
 - e) Rated life.
 - f) Surge protection.
 - g) Thermal control device, heat sink.
 - h) Enclosure and wiring information.
 - i) Operating voltage range.

- 2) Electronic Module/Light Engine:
 - a) Correlated Color Temperature (CCT).
 - b) Color Rendering Index (CRI).
- 3) Drivers:
 - a) Input Current Total Harmonic Distortion.
 - b) Power factor.
 - c) Sound rating.
 - d) Dimming system information.
- e. Time Switches:
 - 1) Wiring diagram.
 - 2) Contact ratings.
 - 3) Functional features.
 - 4) Programmable capabilities.
 - 5) Enclosure type, dimensions.
- f. Lighting Contactor:
 - 1) Type (mechanically or electrically held).
 - 2) Enclosure.
 - 3) Contact ratings and configuration.
 - 4) Coil operating voltage.
- g. Photoelectric Switches (Photocells):
 - 1) Voltage.
 - 2) Power consumption.
 - 3) Load capacity (watts).
 - 4) Contact ratings and configuration.
 - 5) Time delay.
 - 6) Light operating level controls.
 - 7) Enclosure type and dimensions.
 - 8) Mounting type.
 - 9) Temperature range.
 - 10) Features and options.
- h. Photo Sensors/Controls for Daylight Harvesting Control:
 - 1) System description, overall functionality.
 - 2) Each component.
 - 3) Electrical ratings (voltage, amperage, watts).
 - 4) Wiring diagrams.
 - 5) Programming.
 - 6) Testing.
- i. Wall box dimmers.
- j. Dimming systems.
- k. Occupancy Sensors:
 - 1) Type.
 - 2) Switching capacity.
 - 3) Coverage.
 - 4) Time delay AUTO/OFF adjustment.

- l. Low Voltage Remote Control Wiring System:
 - 1) Type.
 - 2) Switching capacity.
 - 3) Voltage rating.
 - 4) Wiring diagrams.
- m. Outdoor Motion Sensors.
- n. Emergency Shunt Relay.
- o. Standby lighting panel.
- p. Seismic anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.

B. Informational Submittals:

- 1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
- 2. Manufacturer's printed installation instructions.
- 3. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.

1.03 QUALITY ASSURANCE

- A. Provide Work in accordance with NFPA 70, National Electrical Code (NEC). Provide material and equipment labeled or listed by a nationally recognized testing laboratory or other organization to provide a basis for approval under NEC.
- B. Provide materials and equipment manufactured within the scope of standards published by UL in conformance with those standards and with an applied UL listing mark.
- C. Standard Products:
 - 1. Provide materials and equipment of manufacturers regularly engaged in the production of products specified in this section and that are of equal material, design, and workmanship.
 - 2. Provide products that have been in satisfactory commercial or industrial use for 2 years prior to Bid opening in similar applications under similar circumstances and of similar size. Provide products that have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.
 - 3. Material and Equipment Manufacturing Date: Do not use products manufactured more than 3 years prior to date of delivery to Site.
 - 4. Provide assembled fixture, complete with lamps, in accordance with California Code of Regulations Title 24 requirements.

D. Standard Products:

1. Provide materials and equipment of manufacturers regularly engaged in the production of products specified in this section and that are of equal material, design, and workmanship.
2. Provide products that have been in satisfactory commercial or industrial use for 2 years prior to Bid opening in similar applications under similar circumstances and of similar size. Provide products that have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.
3. Material and Equipment Manufacturing Date: Do not use products manufactured more than 3 years prior to date of delivery to Site.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Aluminum Poles:

1. Provide manufacturer's standard protection for the finish during shipment and installation. At minimum, spirally wrap each pole shaft with protective paper secured with tape, and ship small parts in boxes.
2. Do not store poles on ground.
3. Support poles so they are at least 1 foot above ground level and growing vegetation.
4. Do not remove factory-applied pole wrappings until just before installing pole.
5. Ship poles with bolt circle template, base cover, handhold cover, and shaft cap or tenon.

PART 2 PRODUCTS

2.01 LUMINAIRES

A. Physical Characteristics:

1. Mounting: As indicated.
2. Component Access: Accessible and replaceable without removing luminaire from ceiling.
3. External label per ANSI C136.15.
4. Internal label per ANSI C136.22.
5. Junction Box: Feed-through type, or separate.
6. Wire Leads: Minimum 18 AWG.
7. Manufacturer's Nameplate: Provide each item of equipment with a nameplate bearing manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; nameplate of distributing agent will not be acceptable.
 - a. Provide clear markings located to be readily visible to service personnel.

8. Finish: Provide equipment with factory-applied painting systems that, at minimum, meet the requirements of NEMA 250 corrosion-resistance test.

B. Functional Characteristics:

1. Provide luminaires and components tested, listed, and labeled by UL, or other approved testing agency.
2. Luminaires are to be rated by the manufacturer to start and operate to their full lumen capacity for rated life of the luminaire at the minimum low and maximum high ambient temperatures given in the Contract Documents.
3. Provide luminaires with Illumination Engineering Society of North America (IESNA) formatted photometric files, ".ies" format, certified by the luminaire manufacturer for use with lighting software.
4. Soffit Installations (Interior or Exterior Damp Locations):
 - a. UL Labeled: SUITABLE FOR DAMP LOCATIONS.
 - b. Ballast: Removable, prewired.
5. Exterior Installations:
 - a. In accordance with National Park Service Denver Service Center lighting standards.
 - b. UL Labeled: SUITABLE FOR WET LOCATIONS.
 - c. When factory-installed photocells are provided, entire assembly shall have UL label.

C. Performance Characteristics:

1. Exterior lighting must be full cut-off, shielded, emitting no light above the horizontal plane.
2. Color temperature of emitted light shall be less than or equal to 3000 Kelvin.

2.02 EXIT SIGNS

A. Physical Characteristics:

1. Body: As scheduled.
2. Face: Translucent.
 - a. Letters:
 - 1) 6-inches high by 3/4-inch stroke.
 - 2) Color: Green.
3. Mounting: As indicated.
4. Directional Arrows: As indicated on the Drawings.
5. External label per ANSI C136.15.
6. Internal label per ANSI C136.22.
7. Junction box: Feed-through type, or separate.
8. Wire Leads: Minimum 18 AWG.

9. Manufacturer's Nameplate: Provide each item of equipment with a nameplate bearing manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; nameplate of distributing agent will not be acceptable.
 - a. Provide clear markings located to be readily visible to service personnel.
10. Finish: Provide equipment with factory-applied painting systems that, at minimum, meet the requirements of NEMA 250 corrosion-resistance test.

B. Functional Characteristics:

1. Power Pack: Self-contained, 120/277-volt nickel cadmium battery, and indicator switch in accordance with UL 924.
2. Lighted, push-to-test indicator.

C. Performance Characteristics:

1. Capable of providing full illumination for 1-1/2 hours in emergency mode.
2. Capable of full recharge in 24 hours, automatically upon resumption of normal line voltage.

2.03 EMERGENCY LUMINAIRES

A. Physical Characteristics:

1. External label per ANSI C136.15.
2. Internal label per ANSI C136.22.
3. Junction box: Feed-through type, or separate.
4. Wire Leads: Minimum 18 AWG.
5. Manufacturer's Nameplate: Provide each item of equipment with a nameplate bearing manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; nameplate of distributing agent will not be acceptable.
 - a. Provide clear markings located to be readily visible to service personnel.
6. Finish: Provide equipment with factory-applied painting systems that, at minimum, meet the requirements of NEMA 250 corrosion-resistance test.

B. Functional Characteristics:

1. Power Pack: Self-contained, 120/277-volt nickel cadmium battery, and indicator switch in accordance with UL 924.
2. Lighted, push-to-test indicator.
3. Capable of protecting against excess charging and discharging.

C. Performance Characteristics:

1. Capable of providing full illumination for 1-1/2 hours in emergency mode.
2. Capable of full recharge in 24 hours, automatically upon resumption of normal line voltage.

2.04 LED SOURCE SYSTEMS AND LIGHT ENGINES

A. Physical Characteristics:

1. Mount all light engine components to a single plate and factory prewired with quick-disconnect plugs.
2. Include a driver, thermal control device, thermal protector device, and surge protector device.
3. Provide LEDs mounted to a metal-core circuit board and aluminum heat sink for optimal thermal management and long life.
4. Provide drivers mounted in an all metal can.

B. Functional Characteristics:

1. Listed To: UL 8750 Standard for Safety for Light Emitting Diode (LED) Equipment for use in Lighting Products.
2. For light engines, provide surge protector tested in accordance with IEEE/ANSI C62.41.2 to Category C Low.
3. Operating Voltage Range: As indicated on the Luminaire Schedule as shown on the Drawings with sustained variations of plus or minus 10 percent voltage with no damage to the driver.
4. Input Current Total Harmonic Distortion: Less than 20 percent up to 50 percent of full load rating.
5. Power Factor: Greater than 0.90 for primary application up to 50 percent of full load rating.
6. Dimming:
 - a. Continuously dimmable from 5 percent to 100 percent.
 - b. Provide driver compatible with standalone dimming controls and/or dimming systems used.

C. Performance Characteristics:

1. Warranty: 5 years, minimum.
2. Light Engine Rating per TM-21: 60,000 hours at 65 degrees C, L84.
3. Drivers to have an expected life of 65,000 hours at 65 degrees C.

4. Correlated Color Temperature (CCT): As indicated on the Luminaire Schedule as shown on the Drawings.
5. Color Rendering Index (CRI): As indicated on the Luminaire Schedule as shown on the Drawings, minimum of 80 except for exterior lighting where dark sky friendly light is required.
6. Sound Rating: Class A.

2.05 LIGHTING CONTROL, PHOTOCELLS

A. Physical Characteristics:

1. Housing: Self-contained, die-cast aluminum, unaffected by moisture, vibration, or temperature changes.
2. Mounting Type: Twist lock plug.

B. Functional Characteristics:

1. Automatic Solid State ON/OFF Switching Photo Control:
 - a. Dry Contacts:
 - 1) Configuration: SPST.
 - 2) Rating: 1,000 VA inductive.
 - 3) Compatible with connected load device indicated on the Drawings.
2. Time delay feature to prevent false switching.
3. Field adjustable to control operating light levels.
4. Integral surge protection.

C. Performance Characteristics:

1. Setting: ON at dusk and OFF at dawn.

2.06 POLE MOUNTED FIXTURES

A. Physical Characteristics:

1. Material: Extruded aluminum with shield for full cut-off of light above the horizontal plane.
2. Exterior Light Pole Conduit Connections: Rigid galvanized steel.
3. Mounting Height: As shown on the Drawings.
4. Color: Black or dark bronze, subject to approval of the submittal reviewer.

B. Functional Characteristics:

1. Wind Rating (With Luminaire): 130 mph steady winds, without incurred damage.
2. Concrete Pole Bases: Coordinate size and location with structural contractor.

C. Performance Characteristics: None.

PART 3 EXECUTION

3.01 LUMINAIRES

A. General:

1. Install in accordance with manufacturer's recommendations.
2. Provide proper hangers, pendants, and canopies as necessary for complete installation and meeting specified seismic requirements.
3. Provide additional ceiling bracing, hanger supports, and other structural reinforcements to building and to concrete pole bases required to safely mount.
4. Install plumb and level.
5. Install each luminaire outlet box with galvanized stud.

B. Mounting:

1. General:
 - a. Coordinate mounting, fastening, and environmental conditions with Section 26 05 02, Basic Electrical Requirements.
 - b. Refer to Fastener Schedule in Section 05 50 00, Metal Fabrications.
2. Wall Mounted: Measure mounting heights from center of mounting plate to finished floor or finished grade, whichever is applicable.
3. Pendant Mounted:
 - a. Provide swivel type hangers and canopies to match luminaires, unless otherwise noted.
 - b. Space single-stem hangers on continuous-row fluorescent luminaires nominally 48 inches apart.
 - c. Provide twin-stem hangers on single luminaires.
 - d. Measure mounting heights from bottom of luminaire to finished floor or finished grade, whichever is applicable.
4. Pole Mounted:
 - a. Provide cast-in-place concrete base.
 - b. Provide branch circuit in-line fuses in pole base handhole.

C. Swinging Type: Provide, at each support, safety cable capable of supporting four times vertical load from structure to luminaire.

D. Finished Areas:

1. Install symmetrically with tile pattern.
2. Locate with centerlines either on centerline of tile or on joint between adjacent tile runs.
3. Install recessed luminaires tight to finished surface such that no spill light will show between ceilings and sealing rings.
4. Combustible Low Density Cellulose Fiberboard: Provide spacers and mount luminaires 1-1/2 inches from ceiling surface or use fixtures suitable for mounting on low density ceilings.
5. Junction Boxes:
 - a. Flush and Recessed Luminaires: Locate minimum 1-foot from luminaire.
 - b. In concealed locations, install junction boxes to be accessible by removing luminaire.
6. Wiring and Conduit:
 - a. Provide wiring of temperature rating required by luminaire.
 - b. Provide flexible steel conduit.
7. Provide plaster frames when required by ceiling construction.
8. Independent Supports:
 - a. Provide each recessed fluorescent luminaire with two safety chains or two No. 12 soft-annealed galvanized steel wires of length needed to secure luminaire to building structure independent of ceiling structure.
 - b. Select chain or wire with tensile strength and method of fastening to structure adequate to support luminaire weight.
 - c. Fasten chain or wire to each end of luminaire.

E. Unfinished Areas: Locate luminaires to avoid conflict with other building systems or blockage of luminaire light output.

1. Fixture Suspension: Provide 1/4-inch threaded steel hanger rods. Scissor type hangers not permitted.
2. Attachment to Steel Beams: Provide flanged beam clips and straight or angled hangers.

F. Building Exterior: Flush-mounted back box and concealed conduit, unless otherwise indicated.

3.02 LAMPS

- A. Provide in each fixture, number and type for which fixture is designed, unless otherwise noted.

3.03 LIGHTING CONTROL

- A. Outdoor Luminaires: Photocells switch lights ON at dusk and OFF at dawn.
- B. Dimming Systems:
 - 1. Install in accordance with manufacturer's recommendations.
 - 2. Do not connect ballasts or equipment to dimming system unless acceptable to dimming system manufacturer.
- C. Occupancy Sensors: Locate and aim sensors in correct location required for complete and proper volumetric coverage within range of coverage(s) of controlled areas per manufacturer's recommendations. Provide 90 percent to 100 percent room coverage to accommodate all occupancy habits of single or multiple occupants at any location within room(s). Locations and quantities of sensors shown on the Drawings are diagrammatic and only indicate which rooms are to be provided with sensors. Provide additional sensors if required to properly and completely cover respective room.

3.04 POLES

- A. Electrical Installations: Conform to IEEE C2 and requirements specified herein.
- B. Pole Setting:
 - 1. Depth: As indicated on the Drawings or footing detail.
 - 2. Install poles in straight runs in a straight line.
- C. Aluminum: Install according to pole manufacturer's instructions.
 - 1. Cast-in-place.
 - 2. Provide branch circuit in-line fuses in pole base handhole.
- D. Photocell Switch Aiming: Mount and aim switch according to manufacturer's recommendations.
- E. Grounding: Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 26 05 26, Grounding and Bonding for Electrical Systems. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.05 FIELD FINISHES

- A. Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Paint as specified in Section 09 90 00, Painting and Coating.

3.06 FIELD QUALITY CONTROL

- A. Upon completion of installation, verify equipment is properly installed, connected, and adjusted. Conduct an operating test to show equipment operates in accordance with the requirements of this section.
- B. Coordinate lighting and controls installation and testing with commissioning as specified in Section 01 91 15, Total Building Commissioning.

3.07 MANUFACTURER'S SERVICES

- A. Provide manufacturer's services necessary to provide a Manufacturer's Certificate of Proper Installation per Section 01 79 00, Demonstration and Training.

3.08 CLEANING

- A. Remove labels and markings, except UL listing mark.
- B. Wipe luminaires inside and out to remove construction dust.
- C. Clean luminaire plastic lenses with antistatic cleaners only.
- D. Touch up painted surfaces of luminaires and poles with matching paint ordered from manufacturer.
- E. Replace defective lamps at time of Substantial Completion.

END OF SECTION

