

## SECTION 265100 - INTERIOR 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. Interior lighting fixtures with lamps and ballasts.
2. Lighting fixtures mounted on exterior building surfaces.
3. Emergency lighting units.
4. Exit signs.
5. Accessories, including fluorescent fixture dimmers and occupancy sensors .

- B. Related Sections include the following:

1. Division 13 Section "Lighting Controls" for manual or programmable control systems employing low-voltage control wiring or data communication circuits.
2. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.
3. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

#### 1.3 DEFINITIONS

- A. BF: Ballast factor. Ratio of light output of a given lamp(s) operated by the subject ballast to the light output of the same lamp(s) when operated on an ANSI reference circuit.
- B. CRI: Color rendering index.
- C. CU: Coefficient of utilization.
- D. LER: Luminaire efficiency rating, which is calculated according to NEMA LE 5. This value can be estimated from photometric data using the following formula:
  1. LER is equal to the product of total rated lamp lumens times BF times luminaire efficiency, divided by input watts.
- E. RCR: Room cavity ratio.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of fixture, including dimensions and verification of indicated parameters.
  - 2. Fluorescent and high-intensity-discharge ballasts.
  - 3. Air and Thermal Performance Data: For air-handling fixtures. Furnish data required in "Submittals" Article in Division 15 Section "Diffusers, Registers, and Grilles."
  - 4. Sound Performance Data: For air-handling fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 15 Section "Diffusers, Registers and Grilles."
  - 5. Lamps.
- B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
- C. Wiring Diagrams: Power, signal, and control wiring.
- D. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Structural members to which lighting-fixture suspension systems will be attached.
  - 3. Other items in finished ceiling, including the following:
    - a. Air outlets and inlets.
    - b. Speakers.
    - c. Sprinklers.
    - d. Access panels.
    - e. Fire alarm system.
  - 4. Perimeter moldings.
- E. Samples for Verification: For interior lighting fixtures designated for sample submission in the Interior Lighting Fixture Schedule.
  - 1. Lamps: Specified units installed.
  - 2. Ballast: 120-V models of specified ballast types.
  - 3. Accessories: Cords and plugs.
- F. Product Certificates: For each type of ballast for dimmer-controlled fixtures, signed by product manufacturer.
- G. Source quality-control test reports.
- H. Field quality-control test reports.

- I. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures and Operation and Maintenance Data," include the following:
  - 1. Catalog data for each fixture. Include the diffuser, ballast, and lamps installed in that fixture.
- J. Warranties: Special warranties specified in this Section.

#### 1.5 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 NFPA 70.
- C. FMG Compliance: Fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.
- D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.
- E. Mockups: Provide lighting fixtures for room or module mockups. Install fixtures for mockups with power and control connections.
  - 1. Obtain Architect's approval of fixtures for mockups before starting installations.
  - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

#### 1.7 WARRANTY

- A. Special Warranty for Fluorescent Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in

materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Refer to Light Fixture Schedule.

### 2.2 FIXTURES AND COMPONENTS, GENERAL

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.
- H. 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.
  4. Laminated Silver Metallized Film: 90 percent.
- I. Plastic Diffusers, Covers, and Globes:
  1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

- a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is scheduled.
  - b. UV stabilized.
2. Glass: Annealed crystal glass, unless otherwise indicated.
- J. Electromagnetic-Interference Filters: A component of fixture assembly. Suppress conducted electromagnetic-interference as required by MIL-STD-461D. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

### 2.3 LIGHTING FIXTURES

- A. Fixture: As shown on the fixture schedules.
- 1. Products: As required.
  - 2. Voltage: Verify.
  - 3. Mounting: As required.
  - 4. Nominal Dimensions: As shown.
  - 5. Lamps: As shown.
  - 6. Ballast Types and Features: Electronic.
  - 7. Lens: As shown.
  - 8. External Finish: As specified.
  - 9. Trim and Hardware: Spring-loaded door latches.
  - 10. Special Environmental Conditions: As required.
  - 11. Other Features: As shown.
  - 12. Submit Sample.
  - 13. Provide fixtures as needed for mockups.

### 2.4 FLUORESCENT LAMP BALLASTS

- A. Description: Include the following features, unless otherwise indicated:
- 1. Designed for type and quantity of lamps indicated at full light output.
  - 2. Externally fused with slow-blow type rated between 2.65 and 3.0 times the line current.
  - 3. Refer to light fixture schedule for additional requirements.
- B. Electronic ballasts for linear lamps shall include the following features, unless otherwise indicated:
- 1. Comply with NEMA C82.11.
  - 2. Ballast Type: Program Rapid Start, unless otherwise indicated.
  - 3. Programmed Start: Ballasts with two-step lamp starting to extend life of frequently started lamps.
  - 4. Sound Rating: A.
  - 5. Total harmonic distortion rating of less than 10 percent according to NEMA C82.11.
  - 6. Transient Voltage Protection: IEEE C62.41, Category A.
  - 7. Operating Frequency: 20 kHz or higher.
  - 8. Lamp Current Crest Factor: Less than 1.7.

9. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.
- C. Ballasts for compact lamps in recessed fixtures shall have the following features, unless otherwise indicated:
1. Type: Electronic .
  2. Power Factor: 90 percent, minimum.
  3. Flicker: Less than 5 percent.
  4. Lamp Current Crest Factor: Less than 1.7.
  5. Electronic Ballast Operating Frequency: 40 kHz or higher.
  6. Lamp end-of-life detection and shutdown circuit.
  7. Transient Protection: Comply with IEEE C62.41 for Category A1 locations.
  8. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
- D. Ballasts for Low-Temperature Environments:
1. Temperatures 0 deg F (Minus 17 deg C) and Higher: Electronic or electromagnetic type rated for 0 deg F Minus 17 deg C starting temperature.
  2. Temperatures Minus 20 deg F Minus 29 deg C and Higher: Electromagnetic type designed for use with high-output lamps.
- E. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.

## 2.5 HIGH-INTENSITY-DISCHARGE LAMP BALLASTS

- A. General: Comply with NEMA C82.4 and UL 1029. Shall include the following features, unless otherwise indicated.
1. Type: Constant-wattage autotransformer or regulating high-power-factor type.
  2. Minimum Starting Temperature: Minus 22 deg F Minus 30 deg C for single-lamp ballasts.
  3. Normal Ambient Operating Temperature: 104 deg F 40 deg C.
  4. Open-circuit operation that will not reduce average life.
- B. Auxiliary, Instant-On, Quartz System: Automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. Automatically turns quartz lamp off when high-intensity-discharge lamp reaches approximately 60 percent light output.
- C. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

## 2.6 FLUORESCENT LAMPS

- A. Alto lamps with green ends are not acceptable.

- B. Low-Mercury Lamps: Comply with Federal toxic characteristic leaching procedure test, and yield less than 0.2 mg of mercury per liter, when tested according to NEMA LL 1.
- C. T8 rapid-start low-mercury lamps, rated 32 W maximum, 2800 initial lumens (minimum), CRI of 75 (minimum), color temperature of 4100 K, and average rated life of 20,000 hours, unless otherwise indicated.
- D. T8 rapid-start low-mercury lamps, rated 17 W maximum, nominal length of 24 inches 610 mm, 1300 initial lumens (minimum), CRI of 75 (minimum), color temperature of 4100 K, and average rated life of 20,000 hours, unless otherwise indicated.
- E. Compact Fluorescent Lamps: CRI 80 (minimum), color temperature of 4100, average rated life of 10,000 hours at 3 hours operation per start, unless otherwise indicated.
  - 1. T4, Twin Tube: Rated 5 W, 250 initial lumens (minimum).
  - 2. T4, Twin Tube: Rated 7 W, 400 initial lumens (minimum).
  - 3. T4, Twin Tube: Rated 9 W, 600 initial lumens (minimum).
  - 4. T4, Twin Tube: Rated 13 W, 825 initial lumens (minimum).
  - 5. T4, Double-Twin Tube: Rated 13 W, 900 initial lumens (minimum).
  - 6. T4, Double-Twin Tube: Rated 18 W, 1200 initial lumens (minimum).
  - 7. T4, Double-Twin Tube: Rated 26 W, 1800 initial lumens (minimum).

## 2.7 HIGH-INTENSITY-DISCHARGE LAMPS

- A. Metal-Halide Lamps: ANSI C78.1372, wattage and burning position as scheduled, CRI 65 (minimum), and color temperature 4000.

## 2.8 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Common Work Results For Electrical " for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage.
- E. Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- H. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.9 FINISHES

- A. Fixtures: Manufacturers' standard, unless otherwise indicated.
  - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
  - 2. Metallic Finish: Corrosion resistant.

2.10 LIGHTING CONTROL DEVICES

- A. Dimming Ballast Controls: Sliding-handle type with on/off control; compatible with ballast and having light output and energy input over the full dimming range.
- B. Occupancy Sensors: Adjustable sensitivity and off delay time range of 5 to 15 minutes.
  - 1. Device Color:
    - a. Wall Mounted: By Architect.
    - b. Ceiling Mounted: White.
  - 2. Occupancy detection indicator.
  - 3. Ultrasonic Sensors: Crystal controlled with circuitry that causes no detection interference between adjacent sensors.
  - 4. Infrared Sensors: With daylight filter and lens to afford coverage applicable to space to be controlled.
  - 5. Combination Sensors: Ultrasonic and infrared sensors combined.

2.11 SOURCE QUALITY CONTROL

- A. Provide services of a qualified, independent testing and inspecting agency to factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.
- B. Factory test fixtures with ballasts and lamps; certify results for electrical ratings and photometric data.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
  - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.
  - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.

3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least two independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Fixture Support: As follows:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Continuous Rows: Suspend from cable.

3.2 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Verify normal operation of each fixture after installation.
- C. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.
- D. 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.
- E. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

3.4 COMMISSIONING

- A. The equipment and systems referenced in this section are to be commissioned per Section 010800 – Commissioning General Requirements and Section 260800 – Commissioning Electrical Systems. The contractor has specific responsibilities for scheduling, coordination, start-up, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION 265100