

SECTION 16511
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, lamps, and ballasts
 - 2. Exit signs
 - 3. Lighting fixture supports
- B. Related Sections include the following
 - 1. Section 16140 for manual wall-box dimmers for incandescent lamps
 - 2. Section 16145 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
- B. CRI: Color-rendering index
- C. CU: Coefficient of utilization
- D. HID: High-intensity discharge
- E. LER: Luminaire efficacy rating
- F. Luminaire: Complete lighting fixture, including ballast housing if provided
- G. RCR: Room cavity ratio

1.4 SUBMITTALS

- A. In accordance with Section 01340
- B. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following

1. Physical description of lighting fixture including dimensions
 2. Ballast
 3. Energy-efficiency data
 4. For substituted fixtures, provide photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project
- C. Field quality-control test reports
- D. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals
- E. 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: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG

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 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
 2. Warranty period for electromagnetic ballasts: Three years from date of Substantial Completion
- B. 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: One year(s) from date of Substantial Completion

1.8 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. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type
 - 3. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type
 - 4. Globes and guards: 1 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 the specified manufacturer, or an approved equivalent that matches the specified fixture in performance, dimensions, environmental rating, and photometrics

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- 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 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

- 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
- 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 0.156 inch minimum unless different thickness is indicated
 - b. UV stabilized
 - 2. Glass: Annealed crystal glass, unless otherwise indicated

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. Electronic Ballasts: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated
 - 1. Sound rating: A
 - 2. Total harmonic distortion rating: Less than 10 percent
 - 3. Transient voltage protection: IEEE C62.41, Category A or better
 - 4. Operating frequency: 20 kHz or higher
 - 5. Lamp current crest factor: 1.7 or less
 - 6. BF: 0.85 or higher
 - 7. Power factor: 0.98 or higher
- B. Ballasts for Low-Temperature Environments
 - 1. Temperatures 0 deg F and higher: Electronic type rated for 0 deg F starting and operating temperature with indicated lamp types

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

- A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
 - 1. Lamp end-of-life detection and shutdown circuit
 - 2. Automatic lamp starting after lamp replacement
 - 3. Sound rating: A
 - 4. Total harmonic distortion rating: Less than 20 percent
 - 5. Transient voltage protection: IEEE C62.41, Category A or better
 - 6. Operating frequency: 20 kHz or higher
 - 7. Lamp current crest factor: 1.7 or less
 - 8. BF: 0.95 or higher, unless otherwise indicated
 - 9. Power factor: 0.98 or higher

10. Ballast case temperature: 75 deg C, maximum

2.5 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction
- B. Internally Lighted Signs
 - 1. Lamps for AC operation: LEDs, 70,000 hours minimum rated lamp life

2.6 FLUORESCENT LAMPS

- A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1
- B. T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours, unless otherwise indicated
- C. T8 rapid-start low-mercury lamps, rated 17 W maximum, nominal length of 24 inches, 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours, unless otherwise indicated
- D. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours operation per start, unless otherwise indicated
 - 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum)
 - 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum)
 - 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum)
 - 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum)
 - 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum)
 - 6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum)

2.7 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Single-Stem Hangers: ½-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture
- B. Twin-Stem Hangers: Two, ½-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture
- C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage
- D. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage
- E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod

- F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
 - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners
 - 2. Support clips: Fasten to lighting 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 $\frac{3}{4}$ -inch metal channels spanning and secured to ceiling tees
 - 4. Install at least one 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 Lighting Fixture Support
 - 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
- D. Adjust aimable lighting fixtures to provide uniform lighting on intended target area
- E. Connect wiring according to Section 16120

3.2 FIELD QUALITY CONTROL

- A. 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

END OF SECTION