

SECTION 26 51 00
INTERIOR LIGHTING

SPEC WRITER NOTES: Use this section only for NCA projects. Delete between //----// if not applicable to project. Also, delete any other item or paragraph not applicable to the section and re-number the paragraphs. Coordinate with the LIGHTING FIXTURE SCHEDULE shown on the drawings.

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies the furnishing, installation, and connection of the interior lighting systems. The terms "lighting fixture", "fixture", and "luminaire" are used interchangeably.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that apply to more than one section of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- D. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

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. Product Data: For each type of lighting fixture (luminaire) designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of fixture designation, submit the following information.
 - a. Material and construction details include information on housing, optics system and lens/diffuser.
 - b. Physical dimensions and description.
 - c. Wiring schematic and connection diagram.

- d. Installation details.
 - e. Energy efficiency data.
 - f. Photometric data based on laboratory tests complying with the Illuminating Engineering Society North America (IESNA) Lighting Measurements, testing and calculation guides.
 - g. Lamp data including lumen output (initial and mean), color rendering index (CRI), rated life (hours) and color temperature (degrees Kelvin).
 - h. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts and total harmonic distortion (THD).
 - i. LED lighting fixtures including luminaire input voltage, total input wattage, lumens, color temperature (degrees Kelvin), CRI, lamp life (measured in accordance with IESNA standards), THD, driver life, and driver type.
2. Manuals:
- a. Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.
 - b. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the Resident Engineer/COR.
3. Certifications:
- a. Two weeks prior to final inspection, submit four copies of the following certifications to the Resident Engineer/COR:
 - 1) Certification by the Contractor that the equipment has been properly installed, adjusted, 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 designation only.
- B. American Society for Testing and Materials (ASTM):
 - C635/C635M-22.....Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
- C. Environmental Protection Agency (EPA):
 - 40 CFR, Part 261.....Identification and Listing of Hazardous Waste

- D. Federal Communications Commission (FCC):
- 47 CFR, Part 15.....Radio Frequency Devices
 - 47 CFR, Part 18.....Industrial, Scientific, and Medical Equipment
- E. Institute of Electrical and Electronic Engineers (IEEE):
- C62.41.1-02(R 2008).....Guide on the Surge Environment in Low Voltage
(1000V and less) AC Power Circuits
- F. Illuminating Engineering Society North America (IESNA):
- 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
 - LM-82-19.....Characterization of LED Light Engines and LED
Lamps for Electrical and Photometric Properties
as a Function of Temperature
- G. National Electrical Manufacturer's Association (NEMA):
- C78.43-17Standard for Electric Lamps - Single-Ended
Metal-Halide Lamps
 - C78.81-16(R 2022)Electric Lamps - Double-capped Fluorescent
Lamps Dimensional and Electrical
Characteristics
 - C78.901-16(R 2022).....Electric Lamps - Single Base Fluorescent Lamps
Dimensional and Electrical Characteristics
 - C82.1-04(R 2015).....Ballasts for Fluorescent Lamps - Specifications
 - C82.2-16.....Line Frequency Fluorescent Lamp Ballasts
 - C82.4-02(S 2021).....Ballasts for High-Intensity-Discharge and Low-
Pressure Sodium Lamps
 - C82.11-17.....High Frequency Fluorescent Lamp Ballasts
 - SSL 1-16.....Electronic Drivers for LED Devices, Arrays, or
Systems
- H. National Fire Protection Association (NFPA):
- 70-23.....National Electrical Code (NEC)
 - 101-21.....Life Safety Code
- I. Underwriter Laboratories, Inc. (UL):
- 496-17.....Safety Lampholders
 - 542-05.....Lampholders, Starters, and Starter Holders for
Fluorescent Lamps
 - 844-12.....Electric Lighting Fixtures for Use in Hazardous
(Classified) Locations

924-16.....	Emergency Lighting and Power Equipment
935-01.....	Fluorescent-Lamp Ballasts
1029-94.....	High-Intensity-Discharge Lamp Ballasts
1029A-06.....	Ignitors and Related Auxiliaries for HID Lamp Ballasts
1574-04.....	Standard for Track Lighting Systems
1598-21.....	Luminaires
2108-15.....	Standard for Low-Voltage Lighting Systems
8750-15.....	Light Emitting Diode (LED) Light Sources for Use in Lighting Products

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

- A. Shall be in accordance with ASTM, NEMA, NFPA, UL, as shown on drawings, and as specified.
- B. Sheet Metal:
 - 1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.
 - 2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
 - 3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
 - 4. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, latches shall function easily by finger action without the use of tools.
- C. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.
- D. Lamp Sockets:
 - 1. Fluorescent: Lampholder contacts shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542. Lamp holders for bi-pin lamps shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.
 - 2. High Intensity Discharge (HID): Shall have porcelain enclosures.

- E. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.
- F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
- G. Metal Finishes:
1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.
 2. Interior light reflecting finishes shall be white with a minimum of 85 percent reflectance, except where otherwise shown on the drawing.
 3. Exterior finishes shall be as shown on the drawings.
- H. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.
- I. Light Transmitting Components for Fluorescent Fixtures:
1. Shall be 100 percent virgin acrylic.
 2. Flat lens panels shall have not less than 3.2mm (1/8 inch) of average thickness. The average thickness shall be determined by adding the maximum thickness to the minimum unpenetrated thickness and dividing the sum by 2.
 3. Unless otherwise specified, lenses, diffusers and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.
- J. Lighting fixtures in hazardous areas shall be suitable for installation in Class and Group areas as defined in the NEC.
- K. Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballast integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures (not the lamp). Fixture shall be designed for lamps as specified.

2.2 BALLASTS

SPEC WRITER NOTES: Instant start ballasts shall be used in low ambient temperature environments, and shall not be used where controlled by occupancy sensors. Match ballast and lamp type.

- A. Linear Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V) electronic //instant-start// //programmed-start// //rapid-start// type, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated; including the following features:
1. Lamp end-of-life detection and shutdown circuit (T5 lamps only).
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: Class A.
 4. Total Harmonic Distortion Rating: 10 percent or less.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. Ballast Factor: 0.87 or higher.
 9. Power Factor: 0.98 or higher.
 10. Interference: Comply with 47 CFR 18, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 11. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
 12. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.

13. Dimming ballasts shall be as per above, except dimmable from 100% to // 5 // // // % of rated lamp lumens.
- B. Compact Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V), electronic-programmed rapid-start type, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated; including the following features:
1. Lamp end-of-life detection and shutdown circuit.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: Class A.
 4. Total Harmonic Distortion Rating: 10 percent or less.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. Ballast Factor: 0.95 or higher.
 9. Power Factor: 0.98 or higher.
 10. Interference: Comply with 47 CFR 18, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 11. Dimming ballasts shall be as per above, except dimmable from 100% to // 5 // // // % of rated lamp lumens.
- C. Ballasts for HID fixtures: Multi-tap voltage (120- 480v) electromagnetic ballast for high intensity discharge lamps. Include the following features unless otherwise indicated:
1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 2. Minimum Starting Temperature: Minus 30 deg C (Minus 22 deg F) for single-lamp ballasts.
 3. Rated Ambient Operating Temperature: 40 deg C (104 deg F).
 4. Open-circuit operation that will not reduce average life.
 5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- D. Electronic ballast for high intensity discharge metal-halide lamps shall include the following features unless otherwise indicated:
1. Minimum Starting Temperature: Minus 29 deg C (Minus 20 deg F) for single-lamp ballasts.
 2. Rated Ambient Operating Temperature: 54 deg C (130 deg F).

3. Lamp end-of-life detection and shutdown circuit.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: 20 percent or less.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Lamp Current Crest Factor: 1.5 or less.
8. Power Factor: 0.90 or higher.
9. Interference: Comply with 47 CFR 18, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
10. Protection: Class P thermal cut.

2.3 FLUORESCENT EMERGENCY BALLAST

- A. Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
 1. Emergency Connection: Operate //one// // // fluorescent lamp(s) continuously at an output of //1100// // // lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 5. Integral Self-Test: Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing LED.

2.4 EMERGENCY LIGHTING UNIT

- A. Complete, self-contained unit with batteries, battery charger, one or more local or remote lamp heads with lamps, under-voltage relay, and test switch. Comply with UL 924.
 1. Enclosure: Shall be //impact-resistant thermoplastic// //cast aluminum//, which will protect components from dust, moisture, and

oxidizing fumes from the battery. Enclosure shall be suitable for the environmental conditions in which installed.

2. Lamp Heads: Horizontally and vertically adjustable, mounted on the face of the unit, except where otherwise indicated.
3. Lamps: Shall be //sealed-beam MR-16 halogen rated not less than //12// // // watts at the specified DC voltage, or LED module rated as noted on the LIGHTING FIXTURE SCHEDULE shown on the drawing.
4. Battery: Shall be maintenance-free //nickel-cadmium// //lithium-ion//. Minimum normal life shall be //10// // // years.
5. Battery Charger: Dry-type full-wave rectifier with charging rates to maintain the battery in fully-charged condition during normal operation, and to automatically recharge the battery within 12 hours following a 1-1/2 hour continuous discharge.
6. Integral Self-Test/Self-Diagnostic: Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing indicator.

2.5 LAMPS

- A. Linear and U-shaped T5 and T8 Fluorescent Lamps:
 1. Except as indicated below, lamps shall be low-mercury energy saving type, have a color temperature between 3500° and 4100°K, CRI 80 (minimum), average rated life equal to or greater than 24,000 hours when used with an instant start ballast, and 30,000 hours when used with a programmed or rapid start ballast (based on 3 hour starts), and be suitable for use with dimming ballasts, unless otherwise indicated.
 2. Lamps shall comply with EPA Toxicity Characteristic Leachate Procedure (TCLP) requirements.
- B. Compact Fluorescent Lamps:
 1. T4, CRI 80 (minimum), color temperature 3500 K, and suitable for use with dimming ballasts, unless otherwise indicated.
- C. Long Twin-Tube Fluorescent Lamps:
 1. T5, CRI 80 (minimum), color temperature between 3500° and 4100°K, 20,000 hours average rated life.
- D. High Intensity Discharge Lamps:
 1. Pulse-Start, Metal-Halide Lamps: CRI 65 (minimum), and color temperature //4000// // //°K.

2. Ceramic, Pulse-Start, Metal-Halide Lamps: CRI 80 (minimum), and color temperature //4000// // //°K.

2.6 LED EXIT LIGHT FIXTURES

- A. Exit light fixtures shall meet applicable requirements of NFPA, and UL.
- B. Housing and Canopy shall be made of die-cast aluminum.
- C. Door frame shall be cast or extruded aluminum, and hinged with latch.
- D. Finish shall be satin or fine-grain brushed aluminum.
- E. There shall be no radioactive material used in the fixtures.

SPEC WRITER NOTES: Select between electric LED exit light or LED hybrid exit light.

F. Fixtures:

//1. Electric LED exit light: maximum fixture wattage shall be 1 watt or less. Maintenance free Nickel-Cadmium battery with self-test/self-diagnostic features shall be provided integral with the unit.//

//1. LED hybrid exit light: maximum fixture wattage shall be 1 watt or less. Service life shall be a minimum of 20 years. There shall be no radioactive or hazardous material used in the fixture.//

2. Inscription panels shall be cast or stamped aluminum a minimum of 2.25mm (0.090 inch) thick, stenciled with 150mm (6 inches) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass. The LED shall be rated minimum 20 years life.

3. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.

4. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

G. Voltages: Refer to Lighting Fixture Schedule.

2.7 LED LIGHT FIXTURES

A. General:

- 1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
- 2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.

3. LED light fixtures shall only be operated with LED drivers. LED drivers shall include the following features unless otherwise indicated:
 - a. Minimum efficiency: 85% at full load.
 - b. Operating Ambient Temperature range: -20° C. (-4° F.) to 50° C. (122° F.)
 - c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
 - d. Integral short circuit, open circuit, and overload protection.
 - e. Power Factor: ≥ 0.95
 - f. Total Harmonic Distortion: ≤ 20%.
 - g. Comply with FCC 47 CFR Part 15.
 - h. Drivers shall be accessible and serviceable from below the ceiling.
 - i. Where noted on the LIGHTING FIXTURE SCHEDULE or as shown on the drawings, provide with 0-10V dimming.
4. LED modules shall include the following features unless otherwise indicated:
 - a. Comply with IES LM-79 and LM-80 requirements.
 - b. Color Rendering Index (CRI): ≥ 80. Color Fidelity Index (IES Rf): ≥ 80.
 - c. Color temperature //3500°// // // K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
 - d. Minimum Rated Life: 50,000 hours per IES L70.
 - e. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.
 - f. Modules and optic system/reflectors/lens shall be accessible and serviceable from below the ceiling.
- B. LED Downlights:
 1. Housing, LED driver, and LED module shall be compatible and exchangeable if these components are from different manufacturers.
- C. LED Troffers:
 1. Housing, LED driver, and LED module shall be compatible and exchangeable if these components are from different manufacturers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, manufacturer's instructions, and as shown on the drawings or specified.
- B. Align, mount and level the lighting fixtures uniformly.

C. Lighting Fixture Supports:

1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.

SPEC WRITER NOTES: Use the following paragraphs 4 and 5 where seismic consideration is unnecessary.

//4. Hardware for recessed fixtures:

- a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.
 - b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structure at four points.
5. Hardware for surface mounting fluorescent fixtures to suspended ceilings:
- a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 6mm (1/4 inch) secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
 - b. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 6mm (1/4 inch) studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the

ceiling. In lieu of the above, 6mm (1/4 inch) toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.//

SPEC WRITER NOTES: Substitute for the above the following paragraphs 6 through 9 where seismic considerations are necessary. See Handbook H-08-8.

//6. Hardware for recessed lighting fixtures:

- a. All fixture mounting devices connecting fixtures to the ceiling system or building structure shall have a capacity for a horizontal force of 100 percent of the fixture weight and a vertical force of 400 percent of the fixture weight.
- b. Mounting devices shall clamp the fixture to the ceiling system structure (main grid runners or fixture framing cross runners) at four points in such a manner as to resist spreading of these supporting members. Each support point device shall utilize a screw or approved hardware to "lock" the fixture housing to the ceiling system, restraining the fixture from movement in any direction relative to the ceiling. The screw (size No. 10 minimum) or approved hardware shall pass through the ceiling member (T-bar, channel or spline), or it may extend over the inside of the flange of the channel (or spline) that faces away from the fixture, in a manner that prevents any fixture movement.

SPEC WRITER NOTES: Where applicable, the following paragraph must be modified to be compatible with any special architectural requirements for fire rated ceilings.

- c. In addition to the above, the following is required for fixtures exceeding 9kg (20 pounds) in weight.
 - 1) Where fixtures mounted in ASTM Standard C635-69 "Intermediate" and "Heavy Duty" ceilings and weigh between 9kg and 25kg (20 pounds and 56 pounds) provide two 12-gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.
 - 2) Where fixtures weigh over 25kg (56 pounds) they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.

- d. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
7. Surface mounted lighting fixtures:
- a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 6mm (1/4 inch) bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12-gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 25kg (56 pounds) shall be supported directly from the building structure.
 - b. Where ceiling cross runners are installed for support of lighting fixtures they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
 - c. Fixtures less than 6.8kg (15 pounds) in weight and occupying less than 600mm x 600mm (2 square feet) of ceiling area may, (when designed for the purpose) be supported directly from the outlet box when all the following conditions are met.
 - 1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.
 - 2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
 - 3) The outlet box is supported vertically from the building structure.
 - d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
8. Single or double pendant-mounted lighting fixtures:
- a. Each stem shall be supported by an approved outlet box, mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure.
9. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved

devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling. //

- D. Furnish and install the specified lamps for all lighting fixtures installed and all existing lighting fixtures reinstalled under this project.
- E. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.
- F. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- G. Exercise electronic dimming ballasts over full range of dimming capability by operating the control devices(s) in the presence of the Resident Engineer/COR. Observe for visually detectable flicker over full dimming range.
- H. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Government. Burn-in period to be 40 hours minimum, unless a lesser period is specifically recommended by lamp manufacturer. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage. Replace any lamps and ballasts which fail during burn-in.
- I. At completion of project, re-lamp/re-ballast fixtures which have failed lamps/ballasts. Clean fixtures, lenses, diffusers and louvers that have accumulated dust/dirt/fingerprints during construction. Replace damaged lenses, diffusers and louvers with new.

3.2 ACCEPTANCE CHECKS AND TESTS

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

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