

**SECTION 26 5100**  
**INTERIOR LIGHTING**

**PART 1 GENERAL**

1.1 SECTION INCLUDES

- A. Interior luminaires.
- B. Exit signs.
- C. Ballasts and drivers.
- D. Fluorescent emergency power supply units.
- E. Lamps.
- F. Luminaire accessories.

1.2 RELATED REQUIREMENTS

- A. Section 26 0537 - Boxes.
- B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.

1.3 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.
- C. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).
- D. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- E. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.
- F. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- H. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.
- I. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
- J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- L. NFPA 101 - Life Safety Code; 2015.
- M. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- N. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
  - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
  - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
  - 4. Notify Architect/Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

#### 1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
  - 2. Provide photometric calculations where luminaires are proposed for substitution upon request.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
  - 1. LED Luminaires:
    - a. Include estimated useful life, calculated based on IES LM-80 test data.
    - b. Include IES LM-79 test report upon request.
  - 2. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
  - 3. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
- D. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.
- E. Field Quality Control Reports.

- F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- G. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

#### 1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### 1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

#### 1.8 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

#### 1.9 WARRANTY

- A. See Section 01 3000 - Administrative Requirements, for additional warranty requirements.
- B. Provide five year manufacturer warranty for all LED luminaires, including drivers.
- C. Provide three year full warranty for fluorescent emergency power supply units.

### **PART 2 PRODUCTS**

#### 2.1 MANUFACTURERS - LUMINAIRES

- A. Acuity Brands, Inc: [www.acuitybrands.com](http://www.acuitybrands.com).
- B. Cooper Lighting, a division of Cooper Industries: [www.cooperindustries.com](http://www.cooperindustries.com).
- C. Hubbell Lighting, Inc: [www.hubbellighting.com](http://www.hubbellighting.com).
- D. Substitutions: See Section 01 6000 - Product Requirements, except where individual luminaire types are designated with substitutions not permitted.

#### 2.2 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

## 2.3 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Recessed Luminaires:
  - 1. Ceiling Compatibility: Comply with NEMA LE 4.
  - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
  - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- H. Fluorescent Luminaires:
  - 1. Provide ballast disconnecting means complying with NFPA 70 where required.
  - 2. Fluorescent Luminaires Controlled by Occupancy Sensors: Provide programmed start ballasts.
  - 3. Fluorescent Luminaires Controlled by Dual-Level Switching: Provide with stepped-dimming ballast.
- I. LED Luminaires:
  - 1. Components: UL 8750 recognized or listed as applicable.
  - 2. Tested in accordance with IES LM-79 and IES LM-80.
  - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- J. LED Luminaire Components: UL 8750 recognized or listed as applicable.
  - 1. Lumen Maintenance per Lumens-80-08 as determined by TM-21.
  - 2. Minimum 50,000 hours L70.
  - 3. Photometry per LM-79.
  - 4. RoHS compliant.
  - 5. Correlated Color Temperature (CCT): 4,100 K unless otherwise indicated.
  - 6. Color Rendering Index (CRI): Not less than 80.

7. Minimum luminaire warranty 5 years.
8. Luminous efficacy of at least 90.

#### 2.4 EXIT SIGNS

- A. Description: Exit signs and similar signs for special purpose applications such as area of refuge/rescue assistance.
- B. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
  1. Number of Faces: Single or double as indicated or as required for the installed location.
  2. Directional Arrows: As indicated or as required for the installed location.
- C. Self-Powered Exit Signs:
  1. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
  2. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
  3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
  4. Provide low-voltage disconnect to prevent battery damage from deep discharge.
  5. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101; provide indicator light(s) to report test and diagnostic status.

#### 2.5 BALLASTS AND DRIVERS

- A. Ballasts - General Requirements:
  1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
  2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- B. Fluorescent Ballasts:
  1. All Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
    - a. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
    - b. Total Harmonic Distortion: Not greater than 20 percent.
    - c. Power Factor: Not less than 0.95.
    - d. Ballast Factor: Normal ballast factor between 0.85 and 1.15, unless otherwise indicated.

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- e. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
  - f. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
  - g. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
  - h. Lamp Operating Frequency: Greater than 40 kHz, except as specified below.
    - 1) Do not operate lamp(s) within the frequencies from 30 kHz through 40 kHz in order to avoid interference with infrared devices.
  - i. Lamp Current Crest Factor: Not greater than 1.7.
  - j. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
  - k. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.
  - l. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
  - m. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class A, non-consumer application.
  - n. Provide high efficiency T8 lamp ballasts certified as NEMA premium.
  - o. Ballast Marking: Include wiring diagrams with lamp connections.
2. Bi-Level Stepped Dimming Linear Fluorescent Ballasts:
- a. Bi-Level Operation: Capable of being switched between full light output on all lamps, 50 percent of full light output on all lamps, and all lamps off .
  - b. Control Compatibility: Capable of being controlled by standard manual light switches or occupancy sensors unless otherwise indicated.
  - c. Lamp Starting Method: Programmed start unless otherwise indicated.
- C. Dimmable LED Drivers:
- 1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
  - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.
    - a. Wall Dimmers: See Section 26 2726.
    - b. Daylighting Controls: See Section 26 0923.
    - c. Network Lighting Controls: See Section 26 0943 - Network Lighting Controls - Lutron QS/Quantum.
    - d. Network Lighting Controls: See Section 26 0943 - Network Lighting Controls - Lutron Homeworks QS.
- D. LED Drivers: RoHS compliant, 120-277V input voltage, 0-10V dimming,

1. LED Driver is certified by UL Class 2 for use in dry or damp location.
2. LED Driver has a Class A sound rating.
3. LED Driver has a minimum operating ambient temperature of -40C.
4. LED Driver has a life expectancy of 50,000 hours at Tcase of  $\leq 70C$ .
5. LED Driver tolerates sustained open circuit and short circuit output conditions without damage.
6. LED Driver complies with FCC rules and regulations, as per Title 47 CFR Part 15 Non-Consumer (Class A).

## 2.6 FLUORESCENT EMERGENCY POWER SUPPLY UNITS

- A. Description: Self-contained fluorescent emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Compatibility:
  1. Ballasts: Compatible with electronic, standard magnetic, energy saving, and dimming AC ballasts, including those with end of lamp life shutdown circuits.
  2. Lamps: Compatible with low-mercury lamps.
- C. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the fluorescent emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- D. Battery: Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated.
- E. Emergency Illumination Output:
  1. Luminaires with F32T8 Lamps: Operate two lamp(s) at a minimum of 1350 lumens unless otherwise indicated with indicated illumination evenly divided between the lamps.
- F. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.
- G. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101; provide indicator light(s) to report test and diagnostic status and field selectable audible alert.
- H. Accessories:
  1. Provide compatible accessory remote combination test switch/indicator light.

## 2.7 LAMPS

- A. Lamps - General Requirements:
  1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
  2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.

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3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
  4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect/Engineer to be inconsistent in perceived color temperature.
- B. Linear Fluorescent Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.
1. Low Mercury Content: Provide lamps that pass the EPA Toxicity Characteristic Leaching Procedure (TCLP) test for characteristic hazardous waste.
  2. T8 Linear Fluorescent Lamps:
    - a. Correlated Color Temperature (CCT): 4,100 K unless otherwise indicated.
    - b. Color Rendering Index (CRI): Not less than 80.

## 2.8 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### 3.3 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA 500 (commercial lighting).



- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Suspended Ceiling Mounted Luminaires:
  - 1. Do not use ceiling tiles to bear weight of luminaires.
  - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
  - 3. Secure surface-mounted and pendant-mounted luminaires to building structure.
  - 4. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
  - 5. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
  - 6. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- F. Recessed Luminaires:
  - 1. Install trims tight to mounting surface with no visible light leakage.
  - 2. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- G. Suspended Luminaires:
  - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
  - 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
  - 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
  - 4. Unless otherwise indicated, support pendants from swivel hangers.
- H. Install accessories furnished with each luminaire.
- I. Bond products and metal accessories to branch circuit equipment grounding conductor.
- J. Fluorescent Luminaires Controlled by Dual-Level Switching: Connect such that each switch controls the same corresponding lamps in each luminaire.
- K. Exit Signs:
  - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- L. Fluorescent Emergency Power Supply Units:
  - 1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire.

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2. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal ballast(s) in luminaire. Bypass local switches, contactors, or other lighting controls.

**3.4 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Test fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect/Engineer.

**3.5 ADJUSTING**

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect/Engineer. Secure locking fittings in place.
- B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect/Engineer or authority having jurisdiction.

**3.6 CLEANING**

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

**3.7 CLOSEOUT ACTIVITIES**

- A. Just prior to Substantial Completion, replace all lamps that have failed .

**3.8 PROTECTION**

- A. Protect installed luminaires from subsequent construction operations.

**END OF SECTION 26 5100**