

## **SECTION 265100 - LIGHTING**

### **PART 1 - GENERAL**

#### **1.1 SUBMITTAL REQUIREMENTS**

##### **A. Product Data**

1. For each type include detailed product information, light source, color temperature, color rendering index, lumen outputs, life, driver manufacturer, model and type, ceiling connection details, integral controls as applicable, drawings of custom fixtures or components, wiring diagrams, warranty, etc. Arrange luminaire submittals in booklet form with separate sheets for each luminaire, assembled by luminaire "type" in alphabetical order.

#### **1.2 GENERAL**

- A. Provide all labor, materials, equipment, equipment, programming, services, etc. as required for complete and fully operational lighting and lighting control systems.

##### **B. Definitions:**

1. CCT: Correlated color temperature.
2. CRI: Color-rendering index.
3. LER: Luminaire efficacy rating.
4. Lumen: Measured output of lighting source, luminaire, or both.
5. Luminaire: Complete lighting unit consisting of lighting source or sources, and some or all of the following components as applicable: optical control devices, contacts, mechanical components to support or attach the luminaire, and electrical and electronic components to start, operate, dim or control and maintain the operation of lighting source, and driving and transformation components.
6. Lighting Source: LED boards or equivalent LED assembly.
7. THD: Total harmonic distortion

#### **1.3 QUALITY ASSURANCE**

- A. Obtain equipment and components from single manufacturer for luminaires of the same type and "family" style. Drawings indicate dimensions for typical equipment configurations including clearances between equipment and adjacent surfaces and other items. Ensure product complies with the layouts indicated in the drawings. Provide Components, Devices, and Accessories that are listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship

within specified warranty period. Provide warranty period of at least five years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining years.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL REQUIREMENTS FOR LUMINAIRES AND COMPONENTS**

- A. Products: Subject to compliance with requirements, provide products indicated on Drawings. Provide products of one of the manufacturers listed in this section for products that are not defined on the Luminaire Schedule. Provide specification grade luminaires that comply with minimum requirements as stated therein. If a particular "type" does not include basis of design manufacturer or model number, provide "pre-approved equivalent" manufacturer's and model numbers compliant with, and equivalent to: quality, performance, dimensions, and aesthetics as the respective basis of design for Design Professional review no less than five business days prior to bid due date.
- B. Luminaires designated by letters are defined as indicated on the Luminaire Schedule.
- C. Provide luminaires, of sizes, types and ratings indicated; complete with, but not limited to, housings, energy-efficient light sources, contacts, reflectors, wiring, etc. Ship luminaires factory-assembled, with components required for a complete operating installation.
- D. Recessed Luminaires:
  - 1. Comply with NEMA LE 4 for ceiling compatibility for recessed luminaires.
  - 2. Provide recessed luminaires with necessary gypsum board, plaster frames, and surface trim.
  - 3. Provide recessed luminaires that are constructed without rolled edges and that are post-painted.
  - 4. Provide door frames on troffer style luminaires with spring latches on door frames.
  - 5. Provide static air function for luminaires unless otherwise noted.
  - 6. Provide luminaires that are non-IC constructed unless otherwise noted.
  - 7. Provide junction boxes and serviceable components (driving and transformation component types, thermal protection devices, fuses, etc.) for recessed luminaires that are accessible for service and replacement from below the ceiling, without removing ceiling components.
  - 8. Where plaster frames are inferred for luminaires (either by narrative, or by catalog number, or by application) interpret the actual function to mean for mounting within gypsum board, wet plaster or similar type inaccessible ceiling system. Field verify related requirements and provide required accessories, such as frames, accordingly.
  - 9. Provide UL approved (listed and labeled) thermal protection per latest edition of NFPA/NEC for recess mounted luminaires.

- E. Surface Luminaires: Install surface mounted luminaires with air spaces between luminaire and surface per latest edition of NFPA/NEC. Provide factory luminaire wiring that is per NEC, #16 AWG minimum. Wire luminaires in accordance with the latest requirements of the National Electric Code.
- F. Review drawings and specifications of other trades to verify ceiling types, modules, and suspension systems appropriate to installation.
- G. Luminaires: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5, 5A, 5B, etc. as applicable.
- H. Metal Parts: Free of burrs and sharp corners and edges.
- I. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- J. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit replacing lighting source(s) without use of tools. Design to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during servicing and when secured in operating position. Fabricate luminaires with concealed hinges and catches, with metal parts grounded as common unit, and so constructed as to dampen generated noise.
- K. Diffusers and Globes: Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation, UV stabilized. Provide at least 0.125 inch minimum lens thickness unless otherwise indicated. Glass: Annealed crystal glass unless otherwise indicated.
- L. Factory-Applied Labels: Comply with UL 1598. Include recommended lighting sources, and driving and transformation components. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lighting sources are in place.
  - 1. Label shall include the following characteristics:
    - a. "USE ONLY" and include specific component type.
    - b. CCT and CRI for all luminaires.

## **2.2 EMERGENCY LED POWER UNIT**

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with light source driver(s)/board(s). Install remote from luminaire if so indicated on drawings, at accessible location and wired as directed by manufacturer. Comply with UL 924.
  - 1. Emergency Connection: Unless noted otherwise, operate light source continuously at full output. Connect unswitched circuit to battery-inverter unit and switched circuit, and/or control wiring as applicable, to luminaire.

2. “Nightlight” Connection: Operate at full output continuously.
3. Test Push Button and Indicator Light: Visible and accessible without opening luminaire 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: Pilot LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red pilot LED.
7. Provide Bodine Cold-Pak series or approved equivalent. Provide with temperature-control circuitry to fulfill both low-temperature and high-temperature operation. Provide with high-temperature, maintenance-free nickel cadmium battery, charger, and electronic circuitry contained in one nominal 14” x 3” x 1-1/2” red metal case. Provide solid-state charging indicator light to monitor the charger and battery, a test switch, and installation hardware. Provide unit capable of operating luminaire at full light output in the emergency mode for a minimum of 90 minutes. Provide unit that is suitable for use in damp locations and suitable for use in sealed & gasketed luminaires. Provide unit with storage and operating temperature range for the B50Cold-Pak of -20 degrees C to +55 degrees C. Provide unit UL listed for installation inside, on top of, or remote from the luminaire. Provide unit with full five-year warranty from the date of purchase.

### **2.3 EXIT SIGNS**

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  1. Lighting Source for AC Operation: LEDs, 50,000 hours minimum rated life for lighting source.
  2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    - c. Operation: Relay automatically energizes lighting source from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lighting source from battery, and battery is automatically recharged and floated on charger.

- d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
- e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
- f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

## **2.4 EMERGENCY LIGHTING UNITS**

### **A. General Requirements for Emergency Lighting Units:**

1. Self-contained units complying with UL 924.
2. Battery: Sealed, maintenance-free, lead-acid type.
3. Charger: Fully automatic, solid-state type with sealed transfer relay.
4. Operation: Relay automatically turns lighting source on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lighting source automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lighting source from battery, and battery is automatically recharged and floated on charger.
5. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
6. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

## **2.5 LIGHT EMITTING DIODE (LED) SYSTEMS**

### **A. Light Emitting Diode (LED) Systems**

1. LED Sources: Provide factory installed LED modules that are specifically designed for, and matched and mated to, the respective luminaire in which they are used. Provide LED modules that can easily be replaced in the field and are readily accessible for replacement. Provide color temperature as indicated in Luminaire Schedule.
2. LED Drivers; Provide factory installed driver(s) for the LED source utilized that are specifically coordinated to the LED source and luminaire in which they are used. Provide driver(s) having specific operating characteristics defined in the Luminaire Schedule. Provide driver(s) that can easily be replaced in the field and are readily accessible for replacement. Provide specification sheet for the specific driver as part of the Luminaire Submittal.
3. Total Harmonic Distortion (THD) Rating: Less than 20 percent. Provide factory-installed integral filtering system to ensure THD does not exceed 20 percent regardless of quantities and/or mixes with other manufactured LED systems.

## 2.6 LUMINAIRE SUPPORT COMPONENTS

- A. Support fixtures in compliance with NEC. Comply with Section 260529 "Hangers and Supports for Electrical Systems" 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 luminaire. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single luminaire. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod. Hook Hangers: Integrated assembly matched to luminaire and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- E. For open ceiling spaces where fixtures are suspended and subject to damage or impact, provide an additional air craft cable support securely fastened to luminaire and structure to act as a safety chain providing a redundant support. Select cable based on manufacturer's recommendations, accounting for weight of luminaire assembly, external forces that could be applied, minimum 200% factor of safety, etc. Decorative pendants in finished spaces are exempt from this requirement.

## 2.7 EMERGENCY REMOTE BATTERY INVERTERS (RBI)

- A. Provide remote battery inverters where indicated on the drawings. The self-diagnostic Emergency Remote Battery Inverter shall work in conjunction with respective luminaires to create an emergency lighting system. Provide in W/VA rating as indicated on drawings, allowing the connected luminaires to be on, off, switched or dimmed without affecting emergency operation. Provide sealed lead calcium battery, charger and electronic circuitry in one steel case. Provide power to the input side of the luminaire assembly.
  - 1. The unit shall be equal to Bodine-ELI, Evenlite INV, Dual-Lite, or approved equal.
  - 2. The unit shall be tested by Underwriters Laboratory in accordance with the standards set forth in UL 924, "Emergency Lighting and Power Equipment," and UL Listed for field installation. Emergency illumination exceeds the National Electrical Code (NEC) and Life Safety Code (NFPA-LSC) requirements.
  - 3. Upon failure of normal power, the unit shall instantly begin providing emergency power to the connected lighting load for a minimum of 90 minutes and will support lumen output at 91% of the rating of the lighting source throughout the 90-minute duration. A solid-state low voltage disconnect circuit shall protect the inverter battery from severe damage by deep discharge during prolonged power failures. When normal power is restored, the automatic, temperature-compensated, variable-rate float charger shall begin recharging the battery. The

- battery capacity shall be fully restored in 24 hours. A brownout sensing circuit shall ensure proper operation during low line conditions.
4. Provide self-diagnostic circuitry. This circuitry shall check different operating parameters during initial start-up, normal standby and diagnostic stages. If a fault is detected, the fault indicator shall flash to alert maintenance personnel.
  5. The self-diagnostic feature shall automatically initiate a 15-minute diagnostic cycle every 25 to 30 days to test emergency operation. The self-diagnostic circuitry shall not utilize the lighting load to cycle and test the unit battery. Instead, a built-in resistive load shall be used, thereby eliminating emergency luminaire illumination during diagnostic testing and saving lighting source life.
  6. The unit shall not affect normal fixture operation, may be used with a switched or un-switched luminaire, shall be designed for surface mounting, and may be installed up to 1000 feet from the emergency fixture.
  7. Provide inverters sized to supply the full load as indicated on the drawings and inverter schedules. Inverter sizes shall be based on 125% of the luminaire input wattage. Final inverter size selection shall be made by the manufacturer based on the final luminaire selections to ensure no overloads.
  8. Final inverter locations shall be determined in field. They shall be installed in an accessible location and per the manufacturer's requirements. Inverters may be installed above accessible ceilings. Ceiling tiles shall be neatly labeled to indicate locations.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Luminaires: Set level, plumb, and square with ceilings and walls unless otherwise indicated. Install lighting sources in each luminaire.
- B. Temporary Lighting: If it is deemed necessary, and permitted by Owner's Representative and Design Professionals, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is substantially complete, remove the temporary luminaires, disassemble, clean thoroughly, install new LED boards, and reinstall.
- C. Remote Mounting of Driving and Transformation Components: Distance between the driving and transformation components and luminaire shall not exceed that recommended by the luminaire and driving and transformation components manufacturer. Verify, with manufacturers, maximum distance between driving and transformation components and luminaire.
- D. Lay-in Ceiling Luminaires Supports: Unless required otherwise under other sections or unless project requirements and conditions require otherwise, grid may be used as a support element, subject to coordinating installations with ceiling system installer to ensure the ceiling system installer accounts for the weights of each luminaire and of all luminaires collectively, and installs specially marked and designated ceiling support components.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inches from luminaire corners.
  2. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
  3. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- E. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than 48 inches brace to limit swinging.
  2. Stem-Mounted, Single-Unit Luminaires: 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 luminaire chassis, including one at each end.
  4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- F. Install surface and recessed ceiling luminaires on grid and tile ceilings to agree with module of ceiling either displacing a tile, or unit on center of tile, or centered on grid lines. Install flush mounted luminaires properly to eliminate light leakage between luminaire frame and finished surface.
- G. Do not locate splice or tap within an arm, stem, or chain. Provide wiring continuous from splice in outlet box of the building wiring system to driving and transformation component terminals in luminaires.
- H. Provide Type MC Cable or wiring in minimum 1/2" diameter flexible metal conduit (with full parity sized green insulated equipment ground wire) for "drops" from building wiring system junction boxes to suspended ceiling mounted luminaires. Limit the length of these "drops" to 72". Install "drops" to luminaires in gypsum board, and similar inaccessible ceiling systems, from identified accessible junction boxes.
- I. Connect luminaires utilized for emergency egress lighting and exit signage ahead of switching and other controls. The only exceptions to this are photocell-only controls for outdoor emergency egress luminaires.
- J. Provide luminaires and luminaire outlet boxes with hangers to properly support luminaire weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by Owner's Representative and review by ceiling installer. Anchor luminaires installed in, or on, suspended ceiling systems in strict compliance with NEC, including advance coordination with the ceiling installer. Support surface mounted luminaires greater than 2 feet in length at a point in addition to the outlet box luminaire stud. Fasten electrical luminaires and brackets securely to structural supports. Install luminaires level and plumb.



- K. Where special mounting conditions are encountered, such as mounting to rounded columns or similar special circumstances, provide special custom factory-fabricated mounting means (i.e., brackets designed to conform with curvature of rounded columns, or to conform with similar special surfaces).
- L. Provide stems and chains for luminaires as designated by the Owner's Representative where deemed necessary by the Owner's Representative to achieve a functional and neat installation. Contact Owner's Representative to determine pendant, stem, and chain lengths if mounting height is not indicated.
- M. Provide plaster frames, or gypsum board frames, or similar kits for recessed luminaires installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.
- N. Wear clean white cotton gloves when handling the luminaires reflective and diffusing surfaces. Clean surfaces including dust, finger prints, paint, etc. with a clean dry cheesecloth after interior work has been completed. Remove plastic shipping bags from luminaires only after work in the respective area is complete.
- O. Where applicable, verify that measured illuminance values comply with respective isolux (or equivalent) plot diagram values.
- P. Provide full assembly for luminaires that are shipped with any loose components, regardless of who furnishes the luminaires.
- Q. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to emergency source and retransfer to normal.
- R. Make adjustments and perform settings/programming to lighting controls/systems so that all luminaires are fully operational compliant with design requirements and to the satisfaction of the Owner and Design Professionals, and of requirements of authorities having jurisdiction.
- S. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark. Adjust aimable luminaires in the presence of Owner's Representative and Design Professionals.
- T. Train Owner's maintenance personnel to adjust, operate, clean, and maintain equipment, devices, controls, instrumentation, and accessories.

**END OF SECTION 265100**