

## SECTION 16515 - LIGHTING

## PART 1 - GENERAL

## 1.1 SUMMARY:

- A. Extent, location, and details of lighting work are indicated on drawings and in schedules.
- B. Types of lighting in this section include the following:
  - 1. Fluorescent.
  - 2. High-intensity-discharge (HID):
    - a. Metal halide
    - b. High-pressure-sodium
  - 3. Incandescent

## 1.2 SUBMITTALS:

- A. Product Data: Submit manufacturer's product data and installation instructions on each type of luminaire and component.
- B. Shop Drawings: Submit layout drawings of lighting and their spatial relationship to each other. In addition, submit shop drawings in booklet form with separate sheet for each luminaire, assembled by "luminaire type" with proposed luminaire and accessories clearly indicated on each sheet. Submit details indicating compatibility with ceiling grid system. Submit shop drawings from manufacturers detailing luminaire dimensions, weights, methods of field assembly, components, features and accessories.
- C. Wiring Diagrams: Submit wiring diagrams for lighting showing connections to electrical power panels, switches, dimmers, controllers, and feeders. Differentiate between portions of wiring which are manufacturer-installed and portions which are field- installed.
- D. Samples: Submit one complete operating unit for each type of custom luminaire specified.
- E. Maintenance Data: Submit maintenance data and parts list for each luminaire and accessory; including "trouble-shooting" maintenance guide. Include that data, product data, and shop drawings in a maintenance manual; in accordance with general requirements of Division 1.

## 1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of lighting of sizes, types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects with lighting work similar to that required for this project.

## 1.4 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver lighting in factory-fabricated containers or wrappings, which properly protect luminaires from damage.

- B. Store lighting in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, laid flat and blocked off ground.
- C. Handle lighting carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

#### 1.5 SEQUENCING AND SCHEDULING:

- A. Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of lighting with other work.
- B. Sequence lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

#### 1.6 EXTRA MATERIALS:

- A. Lamps: Furnish stock or replacement lamps amounting to 15%, but not less than 4 lamps in each case, of each type and size lamp used in each type luminaire.
- B. Ballasts: Furnish stock or replacement ballasts amounting to 5%, but not less than 2 of each type used in each type luminaire.
- C. Lenses: Furnish stock or replacement lenses amounting to 3%, but not less than one, of each type and size used in each type luminaire.
- D. Deliver replacement stock as directed to Owner's storage space.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS:

- A. Luminaire Manufacturers: Subject to compliance with requirements, provide luminaires as listed in the luminaire schedule or elsewhere on the drawings or specification.
- B. Lamp Manufacturers:
  - 1. G E Lighting
  - 2. Osram Sylvania
  - 3. Philips Lighting Company
- C. Fluorescent Ballast Manufacturers:
  - 1. GE Ultramax or Equal
  - 2. Osram Sylvania
  - 3. Advance
  - 4. All other manufacturers shall request prior approval and supply test data from an independent testing laboratory and comparison report to substantiate compliance with specifications and specified equipment.

#### 2.2 EQUIPMENT:

- A. General: Provide lighting of sizes, types and ratings indicated; complete with, but not limited to, housings, energy-efficient lamps, lamp holders, reflectors, energy efficient ballasts, starters and wiring. Ship luminaires factory-assembled, with those components required for a complete installation. Design luminaire with concealed hinges and catches, with metal parts

grounded as common unit, and so constructed as to dampen ballast generated noise and as to disconnect ballast when door is opened for HQI lamps.

- B. Wiring: Provide electrical wiring within luminaire suitable for connecting to branch circuit wiring as follows:
1. NEC Type TFN for 120 and 277 volt and shall be minimum No. 18 AWG.
- C. Lamps:
1. Fluorescent: Provide fluorescent lamp types as specified in the luminaire schedule and types compatible with luminaires. Lamps shall be low mercury type. Provide 4,100°K color temperature lamps unless otherwise noted in schedules or on drawings.
  2. Incandescent: Provide incandescent lamp types as specified in the luminaire schedule and types compatible with luminaires. Provide frosted lamps unless otherwise noted.
  3. High Intensity Discharge: Provide Metal Halide or High Pressure Sodium lamp types as specified in the luminaire schedule and types compatible with luminaires. Lamps shall have burning position compatible with luminaire.
- D. Exterior Fluorescent Lamp Ballasts: Provide high power factor, rapid start, Type 1 Class P, sound rated A or B for minus 20 degrees C, with 80 percent light output within 5 minutes of starting and listed for use in outdoor luminaires.
- E. Interior Fluorescent Ballasts:
1. Provide high frequency programmed rapid start electronic ballasts for all fluorescent lamps with voltage as indicated on the plans and luminaire schedule. The ballast shall deliver normal lamp life and must be interchangeable with electromagnetic ballasts. The light output shall not vary in response to an input voltage variance of less than 10% rated voltage. Drive output shall be greater than 42 KHz with lamp flicker less than 2%.
  2. The ballast total harmonic distortion shall be less than 10% with the number of lamps as identified per luminaire type or as indicated in the luminaire schedule.
  3. The ballast shall have a crest factor of less than 1.5 and shall have transient protection which meets IEEE 587, Category A (ANSI C62.41) requirements.
  4. The ballast shall have a power factor of 0.98 or higher, and shall have a ballast efficiency of 90% or higher.
  5. The ballast shall be UL listed Class P and shall have a sound rating better than A.
  6. The ballast electromagnetic interference and radio frequency interference shall comply with FCC CFR 47, Part 18 requirements for both conducted and radiated EMI/RFI.
  7. The ballast shall contain no PCB's.
  8. Minimum lamp starting temperature of 0 degrees F.
  9. Provide ballast with color coded integral leads per ANSI C82.11
- F. Fluorescent Dimming Ballasts: Solid state type for smooth dimming over a range from 100% to 1%, 5% or 10% light output and listed for use with the specific fluorescent dimmers or

dimming system. Dimming ballasts shall be Lutron Hi-Lume for 1%, Lutron Hi-Lume compact or Tu-Wire for 5%, and Lutron Eco-10 for 10% dimming.

- G. High-Intensity-Discharge Lamp Ballasts: Provide multi-tap HID lamp ballasts, of ratings, types and makes as recommended by lamp manufacturer, which properly mates and matches lamps to electrical supply by providing appropriate voltages and impedances for which lamps are designed. Design ballast to operate lamp within the lamp's power trapezoid requirements. Minimum starting temperature of minus 30 degrees C. for exterior applications. Ballasts shall be constant wattage high power factor type.
- H. Auxiliary Instant-On Quartz System: Automatically switches quartz lamp when the fixture is initially energized and when momentary power outages occur. Turn quartz lamp off automatically when HID lamp reaches approximately 60 percent light output. Ballasts have internal components independent of the incoming line voltage.
- I. All exterior high-intensity discharge lighting (security and parking lot lighting, etc.) shall utilize high pressure sodium lamps.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION:

- A. Examine areas and conditions under which lighting is to be installed, and substrate for supporting lighting. Notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

#### 3.2 INSTALLATION:

- A. Install lighting at locations and heights as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fulfills requirements.
- B. Provide luminaires and/or 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 Architect.
  1. Luminaires shall be positively attached to the suspended ceiling system. The attachment device shall have a capacity of 100% of the luminaire weight acting in any direction.
  2. When intermediate systems are used, No. 12 gauge hangers shall be attached to the grid members within 3" of each corner of each luminaire.
  3. When heavy-duty systems are used, supplemental hangers are not required if a 48" modular hanger pattern is followed. When cross runners are used without supplemental hangers to support luminaires, these cross runners shall provide the same carrying capacity as the main runner.
  4. Luminaires weighing less than 56 pounds shall have, in addition to the requirements above, two No. 12 gauge hangers connected from the luminaire housing to the structure above. These wires may be slack.
  5. Luminaires weighing 56 pounds or more shall be supported directly from the structure above by four No. 12 gauge hangers connected from the luminaire housing to the structure above. These wires may be slack.

- C. Install flush mounted luminaires properly to eliminate light leakage between frame and finished surface.
- D. Provide plaster frames for recessed luminaires installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.
- E. For air supply type troffers, retain side slot closures in place for adjustment by Balancing Contractor.
- F. Fasten luminaires securely to structural supports; and ensure that pendant luminaires are plumb and level. Provide individually mounted pendant luminaires longer than 2 feet with twin stem hangers. Provide stem hanger with ball aligners and provisions for minimum one inch vertical adjustment. Mount continuous rows of luminaires with an additional stem hanger greater than number of luminaires in the row.
  - 1. Pendant hung luminaires shall be supported directly from the structure above with No. 9 gauge wire or approved alternate support without using the ceiling suspension system for direct support.
- G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with torque values specified in UL 486A and B.
- H. Support surface mounted luminaires greater than 2 feet in length at a point in addition to the outlet box stud.
- I. Set units plumb, square, level and secure according to manufacturer's written instructions and shop drawings. Refer to specification section 16503, "Poles and Standards" for other requirements.

### 3.3 FIELD QUALITY CONTROL:

- A. Replace defective and burned out lamps for a period of one year following the Date of Substantial Completion.

OR

- B. At Date of Substantial Completion, replace lamps in lighting which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Architect.
  - 1. Refer to Division-1 sections for the replacement/ restoration of lamps in lighting where used for temporary lighting prior to Date of Substantial Completion.

### 3.4 ADJUSTING AND CLEANING:

- A. Clean lighting of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses and reflectors.
- B. Protect installed luminaires from damage during remainder of construction period.
- C. Adjust aimable luminaires to provide required light intensities.

### 3.5 GROUNDING:

- A. Provide equipment grounding connections for lighting as indicated. Tighten connections to comply with torque values specified in UL Std 486A to assure permanent and effective grounds.
- B. Ground luminaires according to Section 16452, "Grounding," and Section 16503, "Poles and Standards."

### 3.6 WARRANTY

- A. The Contractor shall guarantee all equipment including ballasts, lamps, luminaires, wiring, etc. free from inherent mechanical and electrical defects. Warranty period shall be from date of acceptance as set forth in the general conditions with periods as follows:
  - 1. Lamps - Per Paragraph 3.3
  - 2. Luminaires, wiring, etc. - 1 year
  - 3. Ballasts - The manufacturer shall provide a full five year warranty beginning at time of substantial completion. The manufacturer shall replace any and all failed ballasts within 48 hours of notification. The manufacturer shall provide the labor for warranty replacements.

### 3.7 DEMONSTRATION:

- A. Upon completion of installation of lighting and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 16515