

INTERIOR LIGHTING

SECTION 16510

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

- A. The Electrical Contractor shall furnish and install the following:
 - 1. Interior luminaires with lamps, drivers, and ballasts, as required.

1.2 DEFINITIONS

- A. CRI: Color-rendering index
- B. HID: High-intensity discharge
- C. LED: Light emitting diode
- D. Luminaire: Complete lighting fixture, including ballast housing if provided

1.3 REFERENCES

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- A. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
- B. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
- C. Uniform Building Code (UBC).
- D. Underwriters Laboratories, Inc. (UL):
 - 1. 595, Standard for Safety Marine-Type Electric Lighting Fixtures.
 - 2. 844, Standard for Safety Electric Lighting Fixtures for Use in Hazardous (Classified) Locations.
 - 3. 924, Standard for Safety Emergency Lighting and Power Equipment.

1.4 SUBMITTALS

- A. Product Data: For each luminaire and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters
 - 2. Details of attaching luminaires and accessories
 - 3. Details of installation and construction
 - 4. Luminaire materials

5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - a. Photometric data shall be certified by a qualified independent testing agency.
 6. Drivers/ballasts, including energy-efficiency data.
 7. Lamps, including life, output, and energy-efficiency data.
 8. Materials, dimensions, and finishes.
 9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 10. Means of water proofing light fixture enclosure and conduit penetrations.
- B. Qualification Data: For agencies providing photometric data for lighting fixtures.
- C. Field quality-control test reports
- D. Operation and Maintenance Data
- E. Shop Drawings:
1. Interior Luminaires:
 - a. Catalog data sheets and pictures
 - b. Luminaire finish and metal gauge
 - c. Lens material, pattern, and thickness
 - d. Candle power distribution curves in two or more planes
 - e. Candle power chart 0 to 90 degrees
 - f. Lumen output chart
 - g. Coefficients of utilization for zonal cavity calculations
 - h. Mounting or suspension details
 2. Lamps:
 - a. Voltages
 - b. Colors
 - c. Approximate life (in hours)
 - d. Approximate initial lumens
 - e. Lamp type and base
 3. Drivers/Ballasts:
 - a. Type
 - b. Wiring diagram

- c. Nominal watts and input watts
 - d. Input voltage and power factor
 - e. Starting current, line current, and restrike current values
 - f. Sound rating
 - g. Temperature rating
 - h. Efficiency ratings
 - i. Low temperature characteristics
4. Photo-Time Control:
- a. Wiring diagram
 - b. Contact ratings
5. Photocells:
- a. Voltage and power consumption
 - b. Capacity
 - c. Contacts and time delay
 - d. Operating levels
 - e. Enclosure type and dimensions
 - f. Temperature range

1.5 ALTERNATES

- A. Where the Electrical Contractor proposes to utilize lighting fixtures other than those specified on the drawings, he/she shall provide all of the following:
1. Full color catalog cuts or the actual proposed fixture for the Owner and the Engineer to evaluate.
 2. An item-by-item checkoff of the physical construction features of the substitute versus the specified unit as follows:
 - a. Material type and thickness.
 - b. Dimensions (depth of troffers, depth of downlights, etc.)
 - c. Reflectance
 - d. Finish (interior and exterior)
 - e. Lens material, thickness, and pattern
 - f. Driver/Ballast
 3. An item-by-item comparison of the photometrics of the substitute versus the specified unit as follows:
 - a. Total efficiency
 - b. Coefficient of utilization at RCR 1 through 5 and reflectance of C-50%, W-50%, F-20%.
 - c. Space to mounting height ratio.

- d. IES format photometric data in electronic format for the proposed lighting fixtures.
- e. A point by point-maintained foot-candle layout on the specific area plans at the drawing scale. Foot-candle (FC) points shall be at the floor elevation. All fixtures shall be located as shown on the drawings.

1.6 UL COMPLIANCE

- A. Materials manufactured within scope of Underwriters Laboratories shall conform to UL Standards and have an applied UL listing mark.

1.7 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- B. 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.
- C. The proposed manufacturers shall be qualified and specialized in the manufacture and assembly of lighting fixtures for at least ten (10) years.
- D. Comply with IEEE C2, "National Electrical Safety Code."
- E. Comply with NFPA 70.

1.8 WARRANTY

- A. Warranty Period for Luminaires: Five years from date of Substantial Completion.
- B. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion

1.9 SPARE PARTS

- A. Extra Materials: Furnish, tag, and box for shipment and storage the following spare parts:
 - 1. Where applicable, two spare ballasts of each type
 - 2. Where applicable, Two spare lamps of each type

PART 2 – PRODUCTS

2.1 LUMINAIRES

- A. Specific requirements relative to execution of work of this section is located in the “Lighting Fixture Schedule” on Drawings.
- B. Feed-through type, or separate junction box.
- C. Where applicable, Ballasts: Two-lamp when possible.
- D. Where applicable, tandem wired for three-lamp, fluorescent fixtures.
- E. Wire Leads: Minimum 18 AWG.
- F. Component Access: Accessible and replaceable without removing luminaire from ceiling.
- G. Emergency Lighting:
 - 1. Power Pack: Self-contained, 120/277-volt dual voltage transformer, inverter/charger, sealed lead acid battery, and indicator switch in accordance with UL 924.
 - 2. Lighted, push-to-test indicator.
 - 3. Capable of providing full illumination for 1-1/2 hours in emergency mode.
 - 4. Capable of full recharge in 24 hours, automatically upon resumption of normal line voltage.
 - 5. Capable of protecting against excess charging and discharging.
- H. Hazardous Classified Areas:
 - 1. UL or FM labeled for the area designation.
 - 2. Fixture Enclosure and Fittings: Copper-free, cast aluminum in accordance with UL Standard 844.

2.2 LAMPS

- A. Where applicable, provide lamps of a wattage and voltage as indicated in the lighting fixture schedule on the drawings. All Fluorescent lamps shall be cool white.
- B. Manufacturers:
 - 1. General Electric
 - 2. Sylvania

3. Phillips

2.3 BALLASTS

A. General:

1. Meet requirements for fixture light output, reliable starting, radio interference, total harmonic distortion, electromagnetic interference, and dielectric rating.
2. Certified by electrical testing laboratories to conform to Certified Ballast Manufacturer's specifications.
3. For use in exterior located ballasts to produce reliable starting of lamps at minus 20 degrees F at 90 percent of nominal line voltage.

2.4 LED FIXTURES

A. LED fixtures shall be UL or ETL listed as a whole assembly.

B. Only LED chips from the following manufacturers shall be acceptable:

1. Philips
2. Osram
3. GE
4. Nichia
5. Cree
6. Hitachi
7. Xicato

C. Submittal documents for LED fixtures must include the manufacturer's LM80 chip test results and LM79 fixture tests results.

D. Fixture correlated color temperatures (CCT) shall be 3000K-5000K. Higher color temperatures are not acceptable.

E. The color rendering index (CRI) shall be a minimum of 70 for outdoor fixtures and 82 for indoor fixtures.

2.5 LIGHTING CONTROL SYSTEM

A. Where indicated, install a lighting control system consisting of relay/contacter panel(s), control switches, occupancy sensors, photocells, and other controlling devices. The devices shall be connected by low voltage and line voltage wiring. The general operation of lighting and controlled loads shall include:

1. Interior lighting: Manual switch and occupancy sensor control on/off with automatic time scheduled shut off.
2. Scheduled on/off loads: Time on, time off by automatic time schedule with after hour override capability and shutoff.
3. Exterior lighting: Photocell or astronomic on/time off, time on/photocell or astronomic off.
4. Exterior security lighting: Photocell or astronomic on, photocell or astronomic off.

B. Submittals

1. Shop Drawings: Submit dimensional drawings of all lighting control system components and accessories.
2. One Line Diagram: Submit a one-line diagram of the proposed system configuration if it differs from that included in the contract drawings.
3. Typical Wiring Diagrams: Submit typical wiring diagrams for all components including, but not limited to, lighting control panels, relays, contactors, photocells, switches, occupancy sensors and daylighting controls.

C. Relay Panels

1. Lighting Control Panels shall be UL listed and consist of the following:
 - a. Enclosure/Tub: NEMA Type 1.
 - b. Cover: Surface or Flush as required, hinged, lockable and shall restrict access to line voltage section.
 - c. Interior: Barrier for separation of high voltage (class 1) and low voltage (class 2) wiring. It shall include intelligence boards, power supply and control relays. Clock display and keypad shall be mounted on interior cabinet door for easy user access and programming.
 - d. Panel shall accept up to eight single pole relays. Relays shall be individual latching relays with 20 Amp load contacts for ballast (including HID, magnetic, or electronic type ballasts), tungsten and general-purpose loads. Provide isolated auxiliary contacts for pilot light switching. Relays shall use quick connectors and be individually replaceable to facilitate ease of use.
 - e. Where indicated, panels shall provide space within the high voltage section of the enclosure to accommodate up to 12 multi-pole contactors. Two sections of DIN rail mounting shall be provided as standard. No field drilling or fabrication shall be required for mounting contactors or other accessories within the enclosure.
 - f. The lighting control panel shall provide a stagger up delay, override push buttons, pilot light outputs, and LED status light indicators for each relay or contactor control channel.

- g. The clock shall have a backlight display, user keypad and shall provide 8 channels of time or astronomical control. Preprogrammed lighting control scenarios shall include: scheduled on/off, manual on/scheduled off, manual on/automatic switch sweep off, astronomic or photocell on/off and astronomic or photocell control with scheduled on/off. Time clock shall provide up to 42 holidays, automatic daylight savings adjustment, astronomic coordinates by major cities, and help screens. Program memory shall be non-volatile, and clock shall retain time keeping during power outages for at least 48 hours.
- h. The panel shall have 8 universal switch inputs that are low voltage, self-configuring and shall not require programming to accept momentary on/momentary off switch, push button switch (cycling), maintained switch or 24VDC signals from occupancy sensors, photocells, or other interfacing devices.
- i. Occupancy sensor and time control shall be integrated to allow occupancy sensor control after hours with hold on of lighting during occupancy scheduled time. During occupied time, control scenarios shall be selectable for time schedule of lighting on or occupancy sensor detection of lighting on initially and then hold on of lighting during occupied hours. Control shall provide selectable occupancy sensor blink warning prior to shut off and adjustable occupancy sensor time delay from the time clock keypad.
- j. After-hour interior lighting shut off control shall provide a full duration override time of 1 to 240 minutes with a warning blink five minutes prior to shutting the lighting off. An impending shut off will be cancelled and the override period re-initialized through the operation of any assigned switch input.
- k. After-hour interior lighting shut off control may be by line voltage power interrupt control to automatic control switches. The lighting control relay panel shall provide a warning blink signal to automatic control switches, thus allowing a five-minute delay prior to shutting off lighting. The lighting shut off event may be cancelled by pressing the automatic control switch push button. The lighting control panel time clock shall provide periodic lighting sweep signals to shut off automatic control switches.

2. Approved Manufacturers

- a. Watt Stopper/Legrand
- b. Or Equal

PART 3 – EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Provide all ballasts, sockets, brackets, channels, and other devices as required for proper installation, operation, and support of all fixtures. Fixtures shall be installed and supported in accordance with manufacturer's recommendations.

- B. The Electrical Contractor shall install new wiring and/or junction boxes as needed for the proper installation of all fixtures.
- C. All fixture enclosures shall be grounded.
- D. All fixtures shall have lamps (where applicable) installed. Lamps that fail prior to final acceptance by the Owner shall be replaced with new lamps. Lamps that fail after final acceptance by the Owner shall be warranty items.

3.2 LUMINAIRES

A. General:

1. Install in accordance with manufacturer's recommendations.
2. Provide proper hangers, pendants, and canopies as necessary for complete installation.
3. Provide additional ceiling bracing, hanger supports, and other structural reinforcements to building required to safely mount.
4. Install plumb and level.
5. Mounting heights shown for wall mounted or pendant mounted luminaires are measured from bottom of luminaire to finished floor or finished grade, whichever is applicable.
6. Install each luminaire outlet box with galvanized stud.

B. Pendant Mounted:

1. Provide swivel type hangers and canopies to match luminaires, unless otherwise noted.
2. Space single-stem hangers on continuous-row fluorescent luminaires nominally 48 inches apart.
3. Provide twin-stem hangers on single luminaires.

C. Finished Areas:

1. Install symmetrically with tile pattern.
2. Locate with centerlines either on centerline of tile or on joint between adjacent tile runs.
3. Install recessed luminaires tight to finished surface such that no spill light will show between ceilings and sealing rings.
4. Combustible Low-Density Cellulose Fiberboard: Provide spacers and mount

luminaires 1-1/2 inches from ceiling surface or use fixtures suitable for mounting on low density ceilings.

5. Junction Boxes:

- a. Flush and Recessed Luminaires: Locate minimum 1 foot from luminaire.
- b. In concealed locations, install junction boxes to be accessible by removing luminaire.

6. Wiring and Conduit:

- a. Provide wiring of temperature rating required by luminaire.
- b. Provide flexible steel conduit.

7. Provide plaster frames when required by ceiling construction.

8. Independent Supports:

- a. Provide each recessed luminaire with two safety chains or two No. 12 soft-annealed galvanized steel wires of length needed to secure luminaire to building structure independent of ceiling structure.
- b. Tensile strength of chain or wire, and method of fastening to structure shall be adequate to support weight of luminaire.
- c. Fasten chain or wire to each end of luminaire.

D. Unfinished Areas: Locate luminaires to avoid either conflict with other building systems or blockage of luminaire light output.

1. Fixture Suspension: Provide 3/8-inch threaded steel hanger rods.

2. Attachment to Steel Beams: Provide flanged beam clips and straight or angled hangers.

3.3 LAMPS, where applicable

- A. Provide in each fixture, the number and type for which the fixture is designed, unless otherwise noted.

3.4 BALLASTS, where applicable

- A. Install in accordance with manufacturer's recommendations.
- B. Utilize all ballast mounting holes to fasten securely within luminaire.
- C. Replace noisy or defective ballasts.

3.5 CLEANING FOLLOWING CONSTRUCTION

- A. Remove all labels and other markings, except UL listing mark.

- B. Wipe luminaires inside and out to remove construction dust.
- C. Clean luminaire plastic lenses with antistatic cleaners only.
- D. Touch up all painted surfaces of luminaires and poles with matching paint ordered from manufacturer.
- E. Replace all defective lamps, if applicable, at time of Substantial Completion.

END OF SECTION

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