

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies the furnishing, installation and connection of the interior lighting systems.

1.2 DEFINITIONS

- A. Emergency Lighting Unit: A fixture with integral emergency battery power supply and the means for controlling and charging the battery.
- B. Fixture: A complete lighting unit, exit sign. Fixtures include lamps and parts required to distribute the light, position and protect the lamps, and connect lamps to the power supply.
- C. Luminaire: Fixture.
- D. Average Life, Fluorescent: The time after which 50 percent will have failed and 50 percent will have survived under normal conditions.
- E. Rated Life, LED: The time at which the output of the luminaire is 70 percent of the initial output.

1.3 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): 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.

1.4 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.5 SUBMITTALS

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following. Submit Consolidated Table, Shop Drawings, Product Data, and Samples (where required) concurrently:
- B. Format: Provide binder and with tabs, and electronic file with directory structure as follows:

1. Tab 1: Consolidated Table. Include spares for each ballast and lamp type.
 2. Tab 2: Shop drawings. Identify by lighting fixture type. Include ballast manufacturer and model number in product identification code.
 3. Tab 3: LED driver or lamp ballast product data: Submit product data for each LED driver or ballast used in this project.
 - a. Identify each ballast by the lighting fixture types the ballast will be used. Do not submit identical ballasts multiple times.
 4. Tab 4: Lamp product data: Submit product data for each lamp used in this project. Identify each lamp by the lighting fixture types the lamp will be used. Do not submit identical lamps multiple times.
 5. Incomplete submittals, and/or improperly assembled submittals may result in the submittal returned to the Contractor for correction and resubmission. Partial submittals will not be considered for approval. Incomplete or incorrectly prepared submittals may be returned without review.
- B. Consolidated Table: Submit luminaire information in table format, including in separate columns: Fixture manufacture name and model number; lamp quantity, manufacturer name and model number; ballast manufacturer name and model number; and ANSI input watts.
1. Electrical supplier bill of material is not an acceptable substitute for Consolidated Table.
 2. Sample Consolidated Table:

LUMINAIRES				
LUMINAIRE		LAMP	BALLAST	ANSI
TYPE	MANUFACTURER AND CATALOG NUMBER	MANUFACTURER AND MODEL NUMBER	MANUFACTURER AND MODEL NUMBER	INPUT WATTS
A2	LITHONIA 2SP8-G-232-FW-A12125-MVOLT	PHILLIPS (2)-F32T8/ADV835/ALTO	ADVANCE IOP-2S32-SC	56
H4	SIMKAR ADJUST-454-S12-UNV/AWG4/CAB472	PHILLIPS (4)-F54T5/ADV841HOEA49W/ALTO	ADVANCE IOP-4PSP542-LSG	208

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

4. Installation details.
 5. Energy efficiency data.
 6. Photometric data based on laboratory tests complying with IESNA Lighting Measurements, testing and calculation guides
- D. Product Data: For each type of LED driver, ballast and lamp provided with lighting fixtures (luminaires) designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of fixture designations, submit the following information.
1. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours) and color temperature (degrees Kelvin). Identify by lighting fixture type(s) for intended use.
 2. LED driver or lamp ballast data including driver manufacturer and type, lamp ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts and total harmonic distortion (THD). Identify by lighting fixture type(s) for intended use.
- E. Manuals:
1. Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.
 2. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the COR.
- F. Certifications: Two weeks prior to final inspection, submit four copies of the following certifications to the COTR, Certification by the Contractor that the equipment has been properly installed, adjusted, and tested.

1.6 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. Institute of Electrical and Electronic Engineers (IEEE):
C62.41-91.....Guide on the Surge Environment in Low Voltage
(1000V and less) AC Power Circuits
- C. National Fire Protection Association (NFPA):
70.....National Electrical Code (NEC)

101.....Life Safety Code

D. National Electrical Manufacturer's Association (NEMA):

C82.1-97.....Ballasts for Fluorescent Lamps - Specifications

C82.2-02.....Method of Measurement of Fluorescent Lamp
Ballasts

C82.4-02.....Ballasts for High-Intensity-Discharge and Low-
Pressure Sodium Lamps

C82.11-02.....High Frequency Fluorescent Lamp Ballasts

E. Underwriters Laboratories, Inc. (UL):

496-96.....Edison-Base Lampholders

542-99.....Lampholders, Starters, and Starter Holders for
Fluorescent Lamps

844-95.....Electric Lighting Fixtures for Use in Hazardous
(Classified) Locations

924-95.....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

1598-00.....Luminaires

1574-04.....Standard for Track Lighting Systems

2108-04.....Standard for Low-Voltage Lighting Systems

8750-08.....Light Emitting Diode (LED) Light Sources for
Use in Lighting Products

F. Federal Communications Commission (FCC):

Code of Federal Regulations (CFR), Title 47, Part 18

1.7 QUALITY ASSURANCE

A. Coordination of Fixtures with Ceiling: Coordinate fixtures mounting hardware and trim with the ceiling system.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 EXTRA MATERIALS: NOT USED.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES (LUMINAIRES)

- A. Manufacturers: As indicated per Lighting Fixture Schedule on Drawings.
 - 1. Substitutions: Refer to Division 1 requirements.
 - 2. Where the term "Approved Equal" is used, substitution request shall be submitted for review during the Bidding Period.
- B. Shall be in accordance with NFPA 70 and UL 1598, as shown on drawings, and as specified.
- C. 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.
- D. 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.
- E. Lamp Sockets: Fluorescent lamp holder 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.
- F. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.
- G. 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.

H. 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 not less than 90 percent reflectance, except where otherwise shown on the drawing.
3. Specification Grade: Where indicated "Specification Grade", paint after fabrication.
4. Exterior finishes shall be as shown on the drawings.

I. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

J. Light Transmitting Components for Fluorescent Fixtures:

1. Shall be 100 percent virgin acrylic.
2. Flat lens panels shall have not less than 1/8 inch [3.2mm] of average thickness, or greater thickness where indicated on schedules. 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.

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). Fixtures shall be designed for lamps as specified.

2.2 BALLASTS

- A. All ballasts shall be electronic type unless noted otherwise.
- B. Low Temperature Ballasts: Minus 20 deg C minimum starting temperature.
- C. Conform to UL 935, "Fluorescent-Lamp Ballasts."

1. Certification: By Electrical Testing Laboratory (ETL).
 2. Labeling: By Certified Ballast Manufacturers Association (CBM).
 3. Sound Rating: A rating, except as indicated otherwise.
 4. Voltage: Match connected circuits.
- D. Linear Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V) electronic, solid-state, complying with UL 935 and with ANSI C 82.11, 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. Performance: Ballasts for T8 lamps shall be qualifying products for High Performance T8 Systems, manufacturer and model number on the approved list at Consortium for Energy Efficiency: www.cee1.org.
 2. Lamp Starting: Programmed start.
 - a. Instant start for low temperature applications.
 3. Minimum Power Factor: 98 percent.
 4. Lamp Wiring: Series wired lamps.
 5. Minimum Operating Frequency: 40-50 kHz, without visible flicker.
 6. Total Harmonic Distortion: Less than 10 percent.
 7. Lamp Current Crest Factor: Less than 1.7.
 8. Lamp end-of-life detection and shutdown circuit (T5 and compact fluorescent lamps only).
 9. Automatic lamp starting after lamp replacement.
 10. Sound Rating: Class A.
 11. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 12. Interference: Comply with 47 CFT 18, Ch.1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 13. 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 an additional 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.

14. Ballast Factor for T8 Lamps: As indicated by ballast type per lighting fixture schedule on drawings.
 - a. Programmed start, low ballast factor (PS-LBF): BF=0.71.
 - b. Programmed start, normal ballast factor (PS-NBF): BF=0.88.
 - c. Programmed start, high ballast factor (PS-HBF): BF = 1.04.
 15. ANSI C82.2 Input Wattage for F25T8 Lamps:
 - a. As indicated on Table at Consortium for Energy Efficiency.
- E. Compact Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V), electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, 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 unless otherwise indicated.
 9. Power Factor: 0.98 or higher.
 10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 11. Dimming ballasts shall be as per above, except dimming range 5-100% of rated lamp lumens.

2.3 LAMPS

- A. Linear T8 Fluorescent Lamps:
1. Rapid start fluorescent lamps shall comply with ANSI C78.1; and instant-start lamps shall comply with ANSI C78.3.
 2. Chromacity of fluorescent lamps shall comply with ANSI C78.376.
 3. Lamps shall be low-mercury energy saving type, otherwise indicated. Low mercury lamps shall have passed the EPA Toxicity Characteristic Leachate Procedure (TCLP) for mercury by using the lamp sample preparation procedure described in NEMA LL 1.
 - a. T8 type:

- 1) All 48 inch linear T8 lamps shall be qualifying products for High Performance T8 Systems, manufacturer and model number on the approved list at Consortium for Energy Efficiency:
www.cee1.org
- 2) Lamp temperature: 3500 degree Kelvin, unless noted otherwise.
- 3) Color rendering index: Not less than 82.
- 4) Average rated life: 48 inch linear: 30,000 hours at 3 hours per start, programmed start. 24 inch linear: 30,000 hours at 3 hours per start, programmed start.
- 5) Nominal wattage: 48 inch linear: 25 watts. 24 inch linear: 17 watts.
- 6) Luminous intensity - Initial lumens: 48 inch linear: 2,500 lumens. 24 inch linear: 1450 lumens.
- 7) Products: 48 inch linear: Philips 25W T8. 24 inch linear: Philips F17T8ADV835ALTO.
- 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: T5, CRI 80 (minimum), color temperature between 3500° and 4100°K, 20,000 hours average rated life.

2.4 EXIT LIGHT FIXTURES

- A. Exit light fixtures shall meet applicable requirements of NFPA 101 and UL 924.
- B. Housing and Canopy:
 1. Shall be made of die-cast aluminum.
 2. Steel housing shall have baked enamel over corrosion resistant, white.
- C. Door frame shall be cast or extruded aluminum, and hinged with latch.
- D. Finish shall be white.
- E. There shall be no radioactive material used in the fixtures.
- F. Fixtures:
 1. Maximum fixture wattage shall be 5 watts or less.
 2. Inscription panels shall be cast or stamped aluminum a minimum of 0.090 inch [2.25mm] thick, stenciled with 6 inch [150mm] 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 25 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: 120-277 volts, unless noted otherwise on Lighting Fixture Schedule on Drawings.

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. Individual light fixtures are to be connected by a whip no longer than 6' originating in an electrical junction box. Boxes can be shared among fixtures as long as they are strategically placed allowing for the 6' whip. The whip can be either FMC or HCF MC. No 'daisy chaining' light fixtures.

C. Align, mount and level the lighting fixtures uniformly.

D. 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.

4. Hardware for recessed fluorescent 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.

- c. 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.
- 5. 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.
- E. Furnish and install the specified lamps for all lighting fixtures installed and all existing lighting fixtures reinstalled under this project.
- F. 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.
- G. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

3.2 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.
- C. Exercise electronic dimming ballasts over full range of dimming capability by operating the control devices(s) in the presence of the COR. Observe for visually detectable flicker over full dimming range.
- D. 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.

- E. At completion of project, relamp/reballast 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.
- F. Dispose of lamps per requirements of Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- G. Emergency Lighting Tests: Simulate power outage by turning power off to the circuit providing normal power to the light fixture.
 - 1. Provide a report for each room or space that has emergency lighting installed. Indicate the following for each space:
 - a. Date of test.
 - b. List each type of emergency power transfer device/unit(s) and quantity of each installed.
 - c. Verification that each unit is in working order.
 - d. Verification that lamps have been aimed properly, for units that require aiming.
 - e. Duration of supply.
 - 2. Repeat tests for deficient items. Simulate power outage by turning power off to the circuit providing normal power to the light fixture. Provide a cover sheet listing all deficient items. Provide new test report for each deficient item. Indicate the following:
 - a. Date of test.
 - b. Deficiency and corrective action taken.
 - c. Repeat tests/verifications in the original test report.

3.3 ADJUSTING

- A. Aim and adjust directional luminaires as directed, in the field, by the Engineer.
- B. Position exit sign directional arrows as indicated.

3.4 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosures.
- C. Clean finishes and touch up damage.

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