

**READ THIS FIRST**

Notice to the Design Engineer, this document is part of Facilities and Infrastructure standards for Electrical Systems. Designers are advised to NOT use this template (\*.doc) document as part of any project contract documents. Designers shall use the Port of Seattle MasterSpec specifications from the following link:

<https://www.portseattle.org/page/guide-specifications>

Designers shall edit the corresponding Port's MasterSpec specification to meet the F&I Electrical Standard outlined in this specification. Note that Port's MasterSpec specifications contain specifications and languages for both Aviation and Maritime Divisions. F&I Standards are strictly for Aviation Division, and any Maritime related specs or languages should be removed from the project specifications.

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY AND NOTES TO DESIGNER**

- A. Section Includes:
  - 1. Interior lighting fixtures.
  - 2. Emergency lighting units.
  - 3. Exit signs.
  - 4. Lighting fixture supports.
  - 5. Retrofit kits for fluorescent lighting fixtures.
- B. See lighting design requirements in Electrical Systems Design Principles. All light fixtures serving areas that can also be illuminated by day lighting shall be capable of continuous dimming. Premium efficiency fixtures shall be used and shall also comply with IEEE 519 power quality standards. Finishes for such fixtures shall be water based and low VOC. No lead or zinc coatings allowed.
- C. Battery Powered emergency lighting units and battery powered exit signs are allowed in tenant spaces only, or in Port spaces where generator back-up power is not available.
- D. Fixture installation shall allow for maintenance of equipment without the use of specialized equipment, such as scaffolding. Fixture maintenance should be possible with a ladder only. Fixtures accessible by scissor lift are acceptable with approval of AV Maintenance. Architectural and structural components must be examined to ensure that a scissor-lift can be used in areas where light fixtures are not accessible by ladder.
  - 1. Design requiring scaffolding for fixture maintenance allowed with written F&I approval only. The lighting designer shall submit an operations and maintenance

procedures for each lighting fixture in the lighting schedule(s) to be mounted above 15 feet above finished floor for approval.

E. Light fixture selection:

1. Subject to compliance with the project illumination requirements.
2. All products shall be UL listed and labeled for the condition of use.
3. Fixtures shall be LED unless otherwise specifically approved. All non-LED fixtures designs shall be submitted to F&I for review and approval.
4. Fixtures with replaceable lamps shall only use lamps currently stocked by the electrical shop unless approved by F&I.
5. Lighting design is the primary element of an electrical design that affects system efficiency. Evaluate available light fixtures on a life cycle cost basis to determine the most appropriate technology for each application.
6. All materials used for lighting equipment must be capable of being recycled. Use of water based coatings, recyclable plastics, ceramics and metals are required. (Due to liability, it is not allowed that such materials be reused by third parties.)
7. All wiring must use lead-free jacketing. This applies to communication equipment, printed circuit boards, monitors and PLC based control systems.
8. All material taken from the site for disposal shall be through certified recyclers (county or state).

F. The use of custom or foreign products is not desirable but will be allowed where required with F&I approval.

G. Color Temperature:

1. LED:
  - a. Office Areas: 3500K (warm white).
  - b. Public and Tenant Areas: 3500K (warm white)
  - c. All Areas: 4000K allowed on a case-by-case basis with F&I approval.

H. Coordination Drawings: Lighting designer shall submit the following for F&I review during the design phase:

1. Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - a. Lighting fixtures.
  - b. Suspended ceiling components.
  - c. Partitions and millwork that penetrate the ceiling or extends to within 12 inches of the plane of the luminaires.
  - d. Ceiling-mounted projectors.
  - e. Structural members to which suspension systems for lighting fixtures will be attached.
  - f. Cove lighting.
  - g. Other items in finished ceiling including the following:
    - 1) Air outlets and inlets.
    - 2) Speakers.
    - 3) Sprinklers.
    - 4) Smoke and fire detectors.

- 5) Occupancy sensors.
- 6) Access panels.

### **1.3 DEFINITIONS**

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. LER: Luminaire efficacy rating.
- D. Lumen: Measured output of lamp and luminaire, or both.
- E. Luminaire: Complete lighting fixture, including ballast housing if provided.

### **1.4 SUBMITTALS**

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of lighting fixture including dimensions.
  - 2. Emergency lighting units including battery and charger.
  - 3. Energy-efficiency data.
  - 4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for luminaires.
  - 5. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for drivers, and accessories identical to those indicated for the lighting fixture as applied in this Project.
    - a. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Installation instructions.
- D. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
- E. Product Certificates: For each type of driver for bi-level and dimmer-controlled fixtures, from manufacturer.
- F. Warranty: Sample of special warranty.

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**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

**1.6 QUALITY ASSURANCE**

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories or independent testing agency that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products or that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.
- D. Mockups: If required by F&I, provide interior lighting fixtures for room or module mockups, complete with power and control connections.
  - 1. Obtain Architect's approval of fixtures for mockups before starting installations.
  - 2. Remove mockups when directed.

**1.7 COORDINATION**

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

**1.8 WARRANTY**

- A. 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.
  - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

F&I require all new and retrofit (where possible) fixtures to be type LED. Non-LED type fixtures shall be submitted to F&I for review and approval.

- A. Luminaires: Luminaire manufacturers shall be submitted for approval to F&I during the design phase and shall be indicated in the specification or in the drawings.
- B. Emergency Exit Lights with Battery pack – for use in tenant spaces only:
  - 1. Dual Lite
  - 2. Lithonia Quantum Series
  - 3. Surelites
- C. LED Luminaires
  - 1. Eaton Lighting
  - 2. Acuity Brands
  - 3. Axis Lighting
  - 4. F&I approved equal

**2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS**

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Metal Parts: Steel or aluminum with powder coat finish, brushed aluminum with baked acrylic clear lacquer finish, or stainless steel with a brushed finish. Paint shall be water based with low VOC. Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during maintenance and when secured in operating position.
- E. Each fixture assembly shall have a disconnecting mean to disconnect power to that fixture without interrupting the power to other fixtures on the same circuit.
- F. Provide thermal protection via a replaceable cartridge fuse and fuse holder that encloses the fuse. Comply with disconnect switch requirements integral with the fixture.
- G. Provide frames or flanges as appropriate for recessed lighting fixtures mounted in other than T-Bar.

- H. Hangers for pendant fixtures shall be rigid type; with not less than five-threaded engagement turns at each end. A safety factor of 4 shall be used in sizing anchors and hangers.
- I. Recessed LED downlights shall have cones, which are low brightness, low iridescence, and self-flanged type.
- J. Diffusers and Globes:
  - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    - a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
    - b. UV stabilized.
  - 2. Glass: Annealed crystal glass unless otherwise indicated.
- K. Light fixtures that contain lamps which require protective shielding shall be furnished with a tempered glass lens or approved unbreakable lens which is UL, CSA or ETL listed for the application.
- L. Factory-Applied Labels: Comply with UL 1598. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles.
- M. Provide luminaires with quick-connect devices such as "Ideal PowerPlug", to allow for maintenance of luminaires without shutting down entire circuits.
- N. Provide luminaires with replaceable LED modules and drivers, from manufacturers that track LED boards for the ability to match lumen output and color temperature in the future.

## **2.3 LED DRIVERS**

- A. LED drivers shall be part of packaged lamps and driver system.
- B. Class 1, constant current
- C. Power factor > 90% at full load
- D. THD < 20%
- E. Integral surge protection in accordance with ANSI C62.41.2
- F. Minimum 5-year non-prorated warranty. Provide certificate of warranty; start of warranty period shall be date of substantial completion.

## **2.4 LED EXIT SIGNS**

- A. General Requirements for Exit Signs: Comply with UL 924. Comply with Authorities Having Jurisdiction for sign colors, visibility, luminance, and lettering size.

B. Internally Lighted Signs:

1. Lamps for AC Operation: Green LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type) – for use in tenant spaces only: 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 lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps 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. Automatic test feature shall verify battery voltage and lamp continuity, and shall illuminate lamps and discharge battery for minimum 3 minutes every 30 days. Test failure is annunciated by an integral audible alarm and a flashing red LED.

## **2.5 EMERGENCY LIGHTING UNITS**

- A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924. For use in tenant spaces only.
1. Battery: Sealed, maintenance-free, lead-acid type.
  2. Charger: Fully automatic, solid-state type with sealed transfer relay.
  3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
  5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
  6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Automatic test feature shall verify battery voltage and lamp continuity and shall illuminate lamps and discharge battery for minimum 3 minutes every 30 days. Test failure is annunciated by an integral audible alarm and a flashing red LED.

## **2.6 LIGHTING FIXTURE SUPPORT COMPONENTS**

- A. 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 fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage minimum, or per manufacturer's recommendations.
- E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

## 2.7 **FINISHES**

- A. Fixtures: Manufacturer's standard, unless otherwise indicated.
- B. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
- C. Metallic Finish: Corrosion resistant.

## **PART 3 - INSTALLATION**

### 3.1 **FIXTURE INSTALLATION**

- A. Lighting fixtures:
  - 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
  - 2. Coordinate fixture placement and installation with ceiling construction and other trades.
  - 3. Verify that each luminaire is operating properly.
- B. Fixture installation shall comply with seismic zone 3 requirements.
- C. Provide all accessories required for a complete and operational system.
  - 1. For recessed fixtures, other than T-Bar, provide plaster frames and flanges suitable for ceiling.
  - 2. Provide plates, barriers, or rings to cover any exposed ceiling material between fixture canopy or pan and outlet box
- D. Remote Mounting of drivers, where necessary: Distance between the driver and fixture shall not exceed that recommended by the luminaire manufacturer. Verify maximum distance between driver and fixture with luminaire manufacturer. Remote drivers shall be coordinated for approval with F&I during design and construction.



- E. Fixtures shall be supported by separate means such as wire or chains from the building structure and not from the ceiling system, ductwork, piping, or other systems, with the exception of fixture types to be installed in suspended ceilings. See NEC Article 314-23.
- F. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
  - 1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches from lighting fixture corners.
  - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with seismic clips that are UL listed for the application.
  - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
  - 4. Wires or chains shall also separately support recessed fixtures. Comply with NEC Article 410-36b.
  - 5. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- G. Suspended Lighting Fixture Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Fixtures: 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 fixture chassis, including one at each end.
  - 4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
- H. Aimable or focusing fixtures shall be adjusted in a manner to provide the desired effect. Contract documents shall indicate the party responsible for final fixture adjustments.
- I. Manufacturer labels or monograms shall not be visible after fixture installation is complete.
- J. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
  - 1. Do not use fixtures as a raceway for circuit conductors except for the single branch circuit supplying the fixtures. Branch circuit wiring shall not pass through an outlet box that is an integral part of an incandescent fixture unless the fixture is identified for the purpose.
  - 2. Wiring within fixtures shall be neatly arranged and protected from damage.
- K. Flush and recessed fixtures without an integral outlet box shall have a tap connection conductor, with insulation rated for 90°C, run from fixture terminal connection to an outlet box at least 1-foot from the fixture.
- L. Fixture whips shall be between 4' and 6' long.
- M. Mount remote LED drivers in accessible ceiling space as close as possible to fixture.

1. Where ceiling is not accessible, mount in nearest electrical closet or service space provided that manufacturer's distance requirements are not exceeded.
- N. Mount LED fixtures to allow adequate air circulation around fixture cooling fins. Do not mount in a location where ambient temperature will exceed 40°C.

### **3.2 IDENTIFICATION**

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### **3.3 FIELD QUALITY CONTROL**

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Verify that self-luminous exit signs, where used, are installed according to their listing and the requirements in NFPA 101.
- C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

### **3.4 ADJUSTING**

- A. Occupancy Adjustments: When requested within 6 weeks of date of Substantial Completion, but prior to final acceptance, 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.
  1. Adjust aimable luminaires in the presence of Architect or lighting designer.

END OF SECTION 265100