

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. Exterior luminaires.
 - 2. Luminaire-mounted photoelectric relays.
 - 3. Poles/support structures and accessories.
 - 4. Luminaire lowering devices.
- B. Lighting Fixtures:
 - 1. Subject to compliance with project illumination requirements.
 - 2. Products must be UL listed and labeled for condition of use.
 - 3. Fixtures shall be LED unless otherwise noted. All non-LED fixtures designs shall be submitted to F&I for review and approval.
- C. 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 of each application.
- D. The airport is a semi-industrial facility. Specify fixtures that are constructed of durable materials, with shatterproof lenses and sealed and gasketed to prevent penetration of dust borne by jet blast.
- E. Specify vandal resistant fixtures where warranted by specific application.

- F. Color Temperature: 3500K – 5500K based on specific project parameters.
- G. All material 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 material be reused by third parties.) All wiring must now use lead free jacketing. This will apply to communication equipment printed circuit boards, monitors and PLC based control systems. All material taken from the site for disposal shall be through certified recyclers (county or state).

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. LER: Luminaire efficacy rating.
- D. Luminaire: Complete lighting fixture.
- E. Pole: Luminaire support structure, including tower used for large area illumination.
- F. Standard: Same definition as "Pole" above.

1.4 ACTION SUBMITTALS

- A. Product Data: For each luminaire, pole, 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 modifications and accessories.
 - a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
 - 6. Photoelectric relays.
 - 7. Luminaire life, output, CCT, CRI, lumens, and energy-efficiency data.
 - 8. Materials, dimensions, and finishes of poles.
 - 9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 - 10. Anchor bolts for poles.
- B. Shop Drawings: 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. Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.5 INFORMATIONAL SUBMITTALS

- A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.
- B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.
- C. Field quality-control reports.
- D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

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.
- 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 IEEE C2, "National Electrical Safety Code."
- D. Comply with NFPA 70.
- E. Comply with UL requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

- C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 - 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
 - 2. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

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: Luminaires shall be selected by the lighting designer, with approval by F&I electrical and architectural.
- B. Acceptable Manufacturers
 - 1. Luminaires
 - a. Cree
 - b. Philips
 - c. General Electric
 - d. Musco Lighting
 - e. F&I approved equal.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
 - 1. Comply with AASHTO LTS-3 for pole or other support structures, brackets, arms, appurtenances, base, anchorage and foundation.
 - 2. Minimum IP65 ingress protection rating.
- B. Wind Load Strength of Support Assembly: Wind load strength of support assembly: Adequate to carry support assembly plus luminaires at indicated heights above grade

without failure, permanent deflection, or whipping in steady winds of 100 mph (160 km/h) with a gust factor of 1.3.

- C. Luminaires that contain lamps which require protective shielding shall be furnished with a tempered glass lens, or approved unbreakable lens, UL or ETL listed for the application.
- D. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- E. Pole mounted luminaires shall be classified as "cut-off" as defined by the IESNA.
- F. Metal Parts: Corrosion resistant aluminum, free of burrs and sharp corners and edges.
- G. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
- H. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- I. 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. Doors shall be removable for cleaning or replacing lenses.
- J. Exposed Hardware Material: Stainless steel.
- K. Hangers for pendant fixtures are to 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.
- L. Recessed downlights shall have cones, which are low brightness, low iridescence, and self-flanged type. UL listed and labeled for damp OR wet location as required.
- M. Light Shields, where required: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- N. Reflecting surfaces which are painted shall be baked white enamel or manufacturer standard color, two coats minimum with an average reflectance of 90% or greater.
- O. Lenses, Diffusers, Covers, and Globes; High resistance to yellowing and other changes due to aging, UV stabilized. 100% virgin acrylic plastic or annealed crystal glass.
- P. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- Q. Luminaire Finish: Painted parts shall be water-based coatings or F&I approved and shall be low VOC. Manufacturer's standard paint applied to factory-assembled and -

tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

- R. Factory-Applied Finish for Aluminum luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
 - 3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 - 4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - a. Color: as specified by architect or lighting designer.
- S. 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 when lamps are in place.

2.3 LED LUMINAIRES

- A. Class 1, constant current
- B. Power factor >90% at full load
- C. THD <20%
- D. Integral surge protection in accordance with ANSI C62.41.2
- E. Minimum 5 year warranty
- F. Color temperature: As indicated on light fixture schedule.
- G. CRI: Minimum 80
- H. Lumens per watt: Minimum 70
- I. Minimum 50,000 hour life at above 70% rated light output.

2.4 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

- A. Structural Characteristics: Comply with AASHTO LTS-3.

- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 - 1. Materials: Shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
 - 3. Anchor-Bolt Template: Plywood or steel.
- D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.
- E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural calculations performed by a structural engineer licensed in the State of Washington.
- F. Breakaway Supports: Provide frangible breakaway bases/bolts, tested by an independent testing agency acceptable to authorities having jurisdiction, where poles are not adjacent to pedestrian traffic. Comply with WSDOT specification requirements.

2.5 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
 - 1. Capable of withstanding 100 mph wind gust.
 - 2. Shape: Round, tapered.
 - 3. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- B. Steel Mast Arms: Continuously welded to pole attachment plate. Material and finish same as pole.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - 1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with galvanized-steel bolts.
 - 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
 - 3. Match pole material and finish.
- D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- E. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed

for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

- F. Finish: Anodized Bronze.
- G. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.
- H. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - INSTALLATION

3.1 LUMINAIRE INSTALLATION

- A. Fixture shall be level, in straight lines, aligned, and coordinated with ceiling construction and other trades.
- B. Verify that each luminaire is operating properly.
- C. Provide fuses mounted in fuse holder. Where fixed fuse holder is not provided standard by manufacturer, provide in-line fuse holder such as Bussman HFB accessible through standard handhole and furnish with enough slack wire to extract the fuseholder for servicing.
- D. Fasten luminaire to indicated structural supports.
 - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- E. Adjust luminaires that require field adjustment or aiming.

3.2 POLE INSTALLATION

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
 - 1. Pole fixtures shall be installed plumb to true vertical to the satisfaction of the Port.
 - 2. Poles shall be in rows to align in both directions.
- B. Provide handhole at base of each pole. See section 260533 "Raceways and Boxes for Electrical Systems" and Section 260543 "Underground Ducts and Raceways for Electrical Systems."
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
 - 1. Use heavy duty galvanized anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 - 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 - 3. Install base covers unless otherwise indicated.
 - 4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
 - 5. Plumb standards using a nut above and below each base plate.
- E. Pack 3000 psi rated non-shrink grout between base plate and concrete base and provide a hole below base plate to allow drainage.
- F. Provide cover for nuts exposed above base plate. Covers to be painted to match pole finish.
- G. Raise and set poles using web fabric slings (not chain or cable).
- H. Label poles with number per Port Standard.

3.3 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

- A. Install on concrete base. Coordinate top elevation of base with landscape architect and with other project parameters. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.4 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 GROUNDING

- A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.6 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
 - 1. Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guides as required by specific project parameters:
 - a. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
 - b. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
 - c. IESNA LM-64, "Photometric Measurements of Parking Areas."
 - d. IESNA LM-72, "Directional Positioning of Photometric Data."
- D. 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.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.

END OF SECTION 265600