

**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.
- B. Related Sections:
  - 1. 260513 – Medium Voltage Cables for medium voltage cable color coding requirements
  - 2. 260519 – Low Voltage Electrical Power Conductors and Cables for 600V cable color coding requirements.
  - 3. 260536 – Cable Trays for Electrical Systems for cable tray identification requirements
  - 4. 262416 – Panelboards for panelboard directory requirements. Nameplates and labels shall identify equipment according to Port of Seattle standard nomenclature, Coordinate with Port Resident Engineer prior to installation.

**1.2 SUMMARY AND NOTES TO DESIGNER**

- A. Section Includes:
  - 1. Identification for raceways, junction boxes, cabinets and enclosures
  - 2. Identification of power and control cables.
  - 3. Identification for conductors.
  - 4. Underground-line warning tape.
  - 5. Warning labels and signs.
  - 6. Instruction signs.
  - 7. Equipment identification labels.
  - 8. Miscellaneous identification products.

- B. Contract drawings shall include schedule showing complete text for all phenolic label required on project for all switchboards, distribution boards, circuit breakers panelboards, transformers, ATSeS, lighting cabinets, MCCs, meter cabinets and meters on project.
- C. Contract drawings shall include text for all medium voltage cable tags on project.

### **1.3 SUBMITTALS**

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

### **1.4 QUALITY ASSURANCE**

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with requirements of Authority Having Jurisdiction
- F. Comply with Port of Seattle standards for electrical equipment identification attached to these criteria.
- G. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

### **1.5 COORDINATION**

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## **PART 2 - PRODUCTS**

### **2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
  - 1. Black letters on a white field.
  - 2. Legend: Indicate panel name and circuit number(s).
  - 3. Label may be handwritten with permanent marker on conduits that are not exposed in finished spaces.
- C. Colors for Raceways Carrying Circuits at More Than 600 V:
  - 1. Black letters on a yellow field.
  - 2. Legend: "HIGH VOLTAGE." Indicate feeder number.
- D. Plastic Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

### **2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- C. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.
- D. Tags for Medium Voltage Cables: Engraved plastic melamine laminate flat stock, 1/16 inch minimum thickness for sizes up to and including 15 square inches, 1/8" thick for larger than 15 square inches. White background with black letters for normal power, red background with white letters for emergency power. Holes in each corner to allow for ty-rapping to cable.

### **2.3 CONDUCTOR IDENTIFICATION MATERIALS**

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around conductor it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

### **2.4 FLOOR MARKING**

- A. Coordinate with the Port Electric shop for painting working clearances on the floor in front of equipment.

### **2.5 UNDERGROUND-LINE WARNING TAPE**

- A. Tape:
  - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
  - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
  - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
  - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
  - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
  - 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.
- C. Tag: "CAUTION: BURIED ELECTRIC LINE BELOW"
  - 1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
  - 2. Thickness: 4 mils.
  - 3. Width: 6 inches minimum.
  - 4. Tensile strength of 1750 psi.
- D. Tag: "CAUTION: MEDIUM VOLTAGE ELECTRICAL LINE BELOW":

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils.
3. Width: 6 inches minimum.

## **2.6 WARNING LABELS AND SIGNS**

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Cable Tray Warning Labels: Factory-printed, multicolor, flexible, pressure-sensitive vinyl adhesive labels, conforming to OSHA "Danger" and "Caution" standards. Label shall read: "WARNING! DO NOT USE AS A WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL – CABLES ADDED AFTER INITIAL INSTALLATION REQUIRE POS/ISG APPROVAL".
- C. Baked-Enamel Warning Signs:
  1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
  2. 1/4-inch grommets in corners for mounting.
  3. Nominal size, 7 by 10 inches by 0.04 inch minimum thickness.
- D. Warning label and sign shall include, but are not limited to, the following legends:
  1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

## **2.7 INSTRUCTION SIGNS**

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
  1. Engraved legend with black letters on white face.
  2. Punched or drilled for mechanical fasteners.
  3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## **2.8 EQUIPMENT IDENTIFICATION LABELS**

- A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.
- C. Self-Adhesive, Engraved, Melamine Label: Adhesive backed, with white letters on a black background, or white letters on a red background for emergency power systems. 1/16 inch thick minimum. Labels larger than 3 by 5 inches shall be 1/8 inch thick minimum. Minimum letter height shall be 3/8 inch.
- D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a black background or white letters on a red background for emergency systems. 1/16 inch thick minimum. Labels larger than 3 by 5 inches shall be 1/8 inch thick minimum. Minimum letter height shall be 3/8 inch.
- E. Stenciled Legend: In nonfading, waterproof, paint color and formulation appropriate for material and location. Minimum letter height shall be 1 inch.

## **2.9 CABLE TIES**

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
  - 1. Provide UV stabilized cable ties for use in applications where exposed to sunlight.
  - 2. Provide plenum-rated cable ties where required.

## **2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS**

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, blunt-ended stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers. Sheet metal screws are not acceptable.

# **PART 3 - INSTALLATION**

## **3.1 LABEL AND NAMEPLATE INSTALLATION**

- A. Verify identity of each item before installing identification products.
  - 1. Labeling abbreviations not permitted without F&I approval.
  - 2. Temporary markings allowed only if removable without damage to equipment or enclosure finish.

- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Install labels and nameplates parallel to equipment lines.
- D. Apply identification devices to surfaces that require finish after completing finish work.
- E. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- G. System Identification Color-Coding Bands for Raceways: Each color-coding band shall completely encircle cable, conduit, or conduit couplers. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 25-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
  - 1. 208/120V Blue
  - 2. 480/277V Yellow
  - 3. Controls Black
  - 4. Emergency Red
- H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
  - 2. In Spaces Handling Environmental Air: Plenum rated.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- J. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

### **3.2 IDENTIFICATION SCHEDULE**

- A. Panelboard Schedules:
  - 1. Panelboard schedules shall utilize the POS standard panel schedule in Microsoft Excel format which has provision for totaling all loads and performing demand calculations by load category.
  - 2. Electronic copies of schedules are available from the Facilities and Infrastructure department. The STIA standard template is available on the Port of Seattle internet site, included with the STIA Electrical Standards.

<http://www.portseattle.org/Business/Construction-Projects/Airport-Tenants/Pages/Reference-Documents.aspx>.

3. This schedule shall be updated with as-built information upon the completion of the project. The contractor shall post a hard copy of the revised panel schedule in any panel modified and submit an electronic copy of the panel schedule in Port standard excel format showing accurate as-built information to F&I.
- B. Medium Voltage Raceways: Provide 5/8 inch high stenciled or manufactured letters noting "HIGH VOLTAGE", black letters on yellow background on all exposed feeder conduits where entering or leaving switchboards and along conduit runs at 25 feet on center.
- C. Accessible Raceways, More Than 600 V: Self-adhesive vinyl labels. Install labels at all conduit penetrations and along length of exposed conduit run at 25-foot maximum intervals.
- D. Accessible Raceways within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage.
  1. Provide labels on all raceways, junction and pull boxes indicating panel designation and circuit number for all circuits in raceway or box, and conduit destination.
    - a. Conduit Label Example: B2-P4-23G-1/1,3,5, B-2601-9.
    - b. Provide labels at all locations where conduit penetrates walls, floors and ceilings, on both sides of penetration.
    - c. Provide labels at all ends or breaks in conduit runs such as electrical rooms, junction boxes, pull boxes, cabinets, maintenance holes, fire penetrations, etc.
    - d. Provide labels on each conduit entering junction or pull box within 12" of junction or pull box.
    - e. Provide labels at 25-foot maximum intervals along conduit runs.
    - f. Provide labels on all junction and pullboxes, including in accessible ceiling spaces and exposed in unfinished areas. Refer to specification sections for identification requirements for systems contained within.
    - g. Install labels parallel to equipment lines.
    - h. Labels in unfinished locations, including in accessible ceiling spaces and exposed unfinished areas shall be machine printed vinyl adhesive tape, minimum 1/2 inch high, white with black lettering.
    - i. Labels in finished locations shall be adhesive-backed plastic machine printed labels, minimum 3/8 inch high, white with black letters.
    - j. Lettering shall be a minimum of 1/4" high.
    - k. In finished locations, provide labels on inside of junction or pull box cover.
    - l. Provide red lettering when served by an emergency source.
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.



1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for feeder and branch-circuit conductors.
    - a. Provide colored insulation when available, typically for wire sized #8 AWG and smaller.
    - b. Provide minimum 2 inch wide band of colored plastic tape at all terminations and splices (where allowed). Scotch No. 35 Electrical Color Coding Tape or approved equal.
    - c. Colors for 480/277V 3Ø, 4-wire systems:
      - 1) Phase A (left or top): Brown.
      - 2) Phase B (center): Orange
      - 3) Phase C (right or bottom): Yellow
      - 4) Neutral: Gray
      - 5) Ground: Green
    - d. Colors for 208/120V, 3Ø, 4-wire systems:
      - 1) Phase A (left or top): Black
      - 2) Phase B (center): Red
      - 3) Phase C (right or bottom): Blue
      - 4) Neutral: White
      - 5) Ground: Green
      - 6) Isolated Ground: Green with yellow or orange stripe
    - e. 575V, 3Ø, 4-wire systems
      - 1) Phase A (left or top): Brown with purple stripe
      - 2) Phase B (center): Orange with purple stripe
      - 3) Phase C (right or bottom): Yellow with purple stripe
      - 4) Neutral: Gray with purple stripe
      - 5) Ground: Green
    - f. Colors for 120/240V, 1Ø, 3-wire systems: (non-standard)
      - 1) Phase A: Black
      - 2) Phase B: Red
      - 3) Neutral: White
      - 4) Ground: Green
    - g. For 240-delta systems (obsolete) the color of the high leg (approximately 200 volts to ground) shall be red. Label interior of all equipment "CAUTION: HIGH LEG IS OVER 120V TO GROUND. DO NOT USE FOR 120V CIRCUITS".
    - h. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
  2. Provide wire markers on each conductor in panelboards, gutters, pull boxes, outlet and junction boxes and at the load connection. Identify with branch circuit or feeder number for power and lighting circuits.
    - a. Install conductor labeling in panelboards and enclosures to ensure labels are visible.
- F. Power-Circuit Conductor Identification, Medium Voltage: Provide labeling at all accessible locations including each termination or interconnection of wiring, and in

vaults, pull and junction boxes, manholes, and handholes. Identify conductors with cloth type, split sleeve or tubing type wire and cable markers.

1. Label each cable with phase designation, operating voltage and circuit number.
  2. Color Coding for Phase:
    - a. 4160Y/2400V AC 3Ø, 4-wire:
      - 1) Phase A: Black/Pink
      - 2) Phase B: Red/Pink
      - 3) Phase C: Blue/Pink
      - 4) Neutral: White/Pink
    - b. 4160V Delta AC, 3Ø, 4-wire
      - 1) Phase A: Black/Brown
      - 2) Phase B: Red/Brown
      - 3) Phase C: Blue/Brown
    - c. 12,470V Delta AC, 3Ø, 4-wire
      - 1) Phase A: Black/Orange
      - 2) Phase B: Red/Orange
      - 3) Phase C: Blue/Orange
  3. Provide write-on tags or nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.
- G. Install instructional sign including the color code for grounded and ungrounded conductors using adhesive-film-type labels.
- H. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
1. Provide wire markers on each conductor in wire gutters, pull boxes, outlet and junction boxes and at the equipment connection. Identify with control wire number as indicated on schematics and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.
- I. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted tubes with the conductor designation.
- J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- K. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- L. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- M. Warning Labels: Provide warning, caution and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Provide OSHA standard text where approved. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location. Mount permanently in an appropriate location. Comply with ANSI A13.1 standard color and design.
- N. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- O. Emergency Operating Signs: Provide engraved laminate signs, red background with white text 3/8-inch high where required for emergency instructions upon power transfer, load shedding and other emergency operations.
- P. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
  - a. Provide engraved laminated phenolic plastic or melamine label for equipment as noted below. Securely attach engraved labels with blunt end, self-tapping stainless steel screws with blunt ends. Sheet metal screws are not allowed. Provide white letters on black background for normal power, white letters on red background for emergency power.
    - 1) Provide 5/8 inch minimum height letters on the following:
      - a) Panelboards- Provide labels and warning signs as indicated in detail drawing 262416-02. Secure nameplates to inside surface of door where panel is recessed in finished locations.
      - b) Switchboards/Distribution Centers
      - c) Motor Control Centers and Power Centers
      - d) Padmounted Transformers
      - e) Secondary Feeder Breakers in Distribution Equipment.
      - f) Automatic and Manual Transfer Switches. Labels shall include both normal and emergency source and load.
      - g) Special equipment housed in cabinets, on outside door.
      - h) Terminal junction boxes and data gathering panels.

- i) Cable trays.
- j) UPS equipment.
- 2) Provide ¼ inch minimum height letters on the following equipment:
  - a) Disconnects and starters for motors on fixed appliances and starters in MCCs.
  - b) Motor controllers and VFDs.
  - c) Enclosed switches and circuit breakers
  - d) Local control panels
  - e) Low voltage transformers
  - f) Feeder circuit breakers in switchboards, switchgear and distribution panelboards. Circuit breakers shall be labeled with destination panel name or load.
- b. Provide self-adhesive tape labels on all receptacle cover plates. Labels shall be machine printed with black lettering on white or clear background.
  - 1) Include source panel name and circuit number.
  - 2) Provide red lettering on white or clear background for devices on emergency circuit.
  - 3) Where receptacle faceplate is dark color, provide white letters on clear background.
- c. Instrumentation Labels:
  - 1) All field mounted instruments, transmitters, pressure gauges and control valves shall have a permanent type nameplate or tag affixed which bears the proper identification number and service description.
  - 2) Provide a 3-inch by 1-inch aluminum or stainless steel tag stamped with the instrument loop number designation and the calibrated range.
- d. Outdoor Equipment: Engraved, laminated acrylic or melamine label, to comply with requirements listed above. Provide panel schedule printed on 8.5x11 paper in Port standard format in each panelboard. Insert folded schedule in schedule holder on inside of panel door. Posted panel schedule shall be updated to reflect all new work in panel. Include project completion date on schedule.

END OF SECTION 260553

Except as noted below:  
Labeling Guidelines 260553a  
Standard Details 260553-01 through -14  
Detail 262416f