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

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Receptacles with integral surge-suppression units.
4. Isolated-ground receptacles.
5. Weather-resistant receptacles.
6. Snap switches and wall-box dimmers.
7. Solid-state fan speed controls.
8. Wall-switch occupancy sensors.
9. Pendant cord-connector devices.
10. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Controlled receptacles shall be clearly etched in dark prints with the correct symbol per NFPA 70 and with the word “CONTROLLED” for each outlet.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
2. Provide 20 ampere, duplex industrial specification grade receptacles only. 15 AMPERE RATED RECEPTACLES ARE NOT ACCEPTABLE.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crouse Hinds
   b. Appleton
   c. Killark

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
2. Provide 20 ampere rated industrial grade only.
3. Color: Orange, or white with an orange triangle.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crouse Hinds
   b. Appleton
   c. Killark

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through or non-feed-through type. All receptacles downstream from a feed-through type GFCI receptacle shall be labeled “GFCI Protected”.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. 5mA trip is standard.
4. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hubbell
   b. Arrow Hart
   c. Leviton
   d. Bryant

2.5 TVSS RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 1449, and FS W-C-596, with integral TVSS in line to ground, line to neutral, and neutral to ground.

1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 V and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex TVSS Convenience Receptacles:

1. Description: Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crouse Hinds
   b. Appleton
   c. Killark

C. Isolated-Ground, Duplex Convenience Receptacles:

1. Description:
   a. Straight blade, 125 V, 20 A; NEMA WD 6 Configuration 5-20R.
   b. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crouse Hinds.
   b. Appleton.
   c. Killark

2.6 TWIST-LOCKING RECEPTACLES

A. Use NEMA type with rating equal to source circuit.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crouse Hinds
   b. Appleton
   c. Killark.

B. Temporary Generator Connection Receptacles: Use Crouse Hinds Posi-lok power distribution system 400A rated female receptacle assembly.

2.7 WELDING RECEPTACLE/PLUG

A. 60A, 3 phase, 3 wire, 480V grounding type (4-pole) with companion plug is standard.

B. UL, CSA or ETL label required.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Crouse Hinds
2. Appleton
3. Killark.

2.8 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA configuration to match source circuit. Heavy-duty grade.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.9 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.
4. UL, CSA or ETL label required.
5. Strain relief suitable for application.

2.10 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Provide industrial grade, quiet operation for all locations.

C. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide products by one of the following:
   a. Cooper.
   b. Hubbell
   c. Leviton.
   d. Pass & Seymour

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide products by one of the following:
   a. Cooper
   b. Hubbell
   c. Leviton
   d. Pass & Seymour
2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.11 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

D. 600 W; dimmers shall require no derating when ganged with other devices. Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

E. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lutron
2. Leviton
3. Wattstopper

2.12 WALL PLATES

A. Single and combination types shall match corresponding wiring devices or as otherwise required by Architect.

1. Utilize brushed stainless steel in public areas such as restrooms.
2. Utilize galvanized steel in unfinished areas such as utility tunnels, bagwells and warehouse spaces.
3. Plate-Securing Screws: Metal with head color to match plate finish.
4. Material for Damp Locations: Thermoplastic or cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof in-use Cover Plates: NEMA 250, complying with Type 3R, weather-resistant**,** die-cast aluminum with lockable cover.

2.13 FLOOR SERVICE OUTLET ASSEMBLIES

A. Type: Modular, flush-type, dual-service or single service units suitable for wiring method used. UL, CSA or ETL label required.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, die-cast aluminum, finish per architect.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Per communications standards.

2.14 POKE-THROUGH ASSEMBLIES

A. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. UL, CSA or ETL label required.
4. Service-Outlet Assembly: Recessed type with up to four simplex receptacles and space for four RJ-45 jacks complying with requirements in POS communications standards.
5. Size: Selected to fit nominal 6-inch or 8 inch cored holes in floor and matched to floor thickness.
6. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of two four-pair cables that comply with requirements in Section 271500 "Communications Horizontal Cabling."

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiremold/Legrand 6AT or 8AT series.
2. Hubbell S1R Series
3. Or F&I approved equal.

2.15 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Description:

1. Two-piece surface metal raceway, with factory-wired multioutlet harness.
2. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

B. Raceway Material: Metal with finish as selected by architect.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Wiremold/Legrand.
3. Thomas and Betts.

D. Multioutlet Harness:

1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
2. Receptacle Spacing: per project requirements.
3. Wiring: No. 12 AWG solid, Type THHN copper, [single circuit or two circuit, connecting alternating receptacles as required by project parameters.

2.16 SERVICE POLES

A. Standard only in remodel and retrofit areas where underfloor wiring is impractical.

B. UL Label required.

C. Description:

1. Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
2. Poles: Minimum 2.5-inch square cross section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
3. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
4. Finishes: Finish to match architectural requirements.
5. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, four-pair, Category 3 or Category 5 voice and data communication cables.
6. Power Receptacles: NEMA rated specification grade duplex, 20-A, straight-blade receptacles complying with requirements in this Section.
7. Voice and Data Communication Outlets: Per POS communications standards.

2.17 FINISHES

A. Device Color:

1. Standard color for all receptacles is gray and white, subject to architect's special requirements.
2. Public Areas: gray with brushed stainless steel faceplate, subject to architect's special requirements.
3. Office Areas: White with plastic matching faceplate, subject to architect's special requirements.

4. Wiring Devices Connected to Emergency Power System: Red, no exceptions.
5. Isolated-Ground Receptacles: Orange or white with orange triangle on face.

PART 3 - INSTALLATION

3.1 DEVICE INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Standard Mounting Heights:

1. Wall Switches: 48”
2. Convenience Outlets: 18”
3. Above Counter height Outlets: 48” or 6” above counter surface.
4. Telephone/data Outlets: 18”
5. Wall Phone Outlets: 54”
6. Thermostats: 60”

C. Provide according to NEMA designations for number of poles, voltage and amperage required.

D. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

E. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

F. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

G. Grounding:

1. All standard, TVSS and GFCI receptacles shall be grounded via a separate green equipment ground wire connected to the panelboard ground bus. Metallic raceway shall not be used as the sole equipment ground current path.
2. All isolated ground receptacles shall be grounded via a separate green ground conductor with yellow or orange stripe to the panelboard isolated ground bus.
3. Maintain consistent polarity for power and common terminals on all receptacles. Verify by actual test.
4. Test GFCI receptacles per manufacturer’s recommendations.

H. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

I. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

J. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

K. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates. Located telecom devices within 6” of power receptacles.

L. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

C. For duplex receptacles on UPS power, provide label that reads “UPS”.

D. For common receptacles protected by an upstream GFCI receptacle, provide label that reads “GFCI Receptacle”.

E. For tamper proof receptacles, provide yellow tape label with black text that reads “TAMPER PROOF.”

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262726