READ THIS FIRST

Notice to the Design Engineer, please refer to the Port of Seattle, Facilities and Infrastructure standards for reference before editing this specification.

This Project Spec Document may need additional modifications to suit your project. It is recommended that you proofread each section, paying attention to any “Notes” boxes such as this one--you should remove these “Notes” sections as you go. Also, do a search for all bracket characters “ [ ] “ as they are used to show you areas containing options or project specific details (you can use Microsoft Word’s Find feature {Ctrl-F} to jump to an open bracket “ [ “ character quickly). Again, these bracket characters should be removed.

It is important that every paragraph be numbered to allow for easy referencing. If you use the document’s built in styles and formatting your outline should be fine (turn on the formatting toolbar by going to View > Toolbars > Formatting). Most paragraphs will use the style “Numbered Material” and can be promoted (Shift) or demoted (Shift-Tab).

You should not have to manually enter extra spaces, carriage returns or outline characters such as A, B, C, or 1.01, 1.02; the formatting will do this for you. The entire document is 11 pt. Arial. If you paste items in, you may need to reapply the “Numbered Material” format.

1. GENERAL
   1. SUMMARY OF WORK
      1. The extent and location of “Raceways and Boxes for Electrical Systems” Work is shown in the Contract Documents. This section includes the following:

Edit lists below to suit Project.

* + - 1. Metal conduits, tubing, and fittings.
      2. Nonmetal conduits, tubing, and fittings.
      3. Metal wireways and auxiliary gutters.
      4. Nonmetal wireways and auxiliary gutters.
      5. Surface raceways.
      6. Pull and Junction Boxes
  1. GOVERNING CODES, STANDARDS AND REFERENCES
     1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated
     2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated
     3. ANSI C80.5 - Rigid Aluminum Conduit
     4. NECA (National Electrical Contractors Association) - National Electrical Installation Standards
     5. NEMA (National Electrical Contractors Association)
     6. NEMA FB 1 (National Electrical Manufacturers Association) - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing (EMT) and Cable.
     7. NEMA TC 3 (National Electrical Manufacturers Association) - PVC Fittings for Use with Rigid PVC Conduit and Tubing
     8. NEMA TC 14 - Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
     9. NEMA RV3 - Application and Installation Guidelines for Flexible and Liquidtight Flexible Metal and Nonmetallic Conduits
     10. NEMA 250 (National Electrical Manufacturers Association) - Enclosures for Electrical Equipment (1000 Volts Maximum)
     11. NFPA 70 (National Fire Protection Association) - National Electrical Code
     12. UL (Underwriters Laboratory)
     13. UL 5 – Standard for Surface Metal Raceways and Fittings
     14. UL 5A - Nonmetallic Surface Raceways and Fittings
     15. UL6 - Electrical Rigid Metal Conduit - Steel
     16. UL6A - Electrical Rigid Metal Conduit – Aluminum, Red Brass, and Stainless Steel
     17. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations
     18. UL 360 – Liquid-Tight Flexible Metal Conduit
     19. UL 514 B - Conduit, Tubing, and Cable Fittings
     20. UL 514 C - Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
     21. UL 651 – Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
     22. UL 797 - Electrical Metallic Tubing – Steel
     23. UL 1203 – Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations
  2. SUBMITTALS
     1. Submit materials data in accordance with Section 01 33 00 - Submittals. Furnish manufacturers’ technical literature, standard details, product specifications, and installation instructions for all products.
     2. Submittals shall include the following:
        1. Product Data: For surface raceways, conduit, wireways and fittings, floor boxes, hinged-cover boxes.
        2. Shop Drawings: For custom boxes. Include plans, elevations, sections, and attachment details.

Designer shall delete Coordination Drawings paragraph where not required by the Project.

* + - 1. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
         1. Structural members in paths of conduit groups with common supports.
         2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
      2. Seismic Qualification Certificates: For conduit racks, boxes and their mounting provisions, including internal components, from manufactures.
         1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
         2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
         3. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
         4. Qualification Data: for Professional Engineer certifying installation, licensed in the state of Washington.
  1. QUALITY ASSURANCE
     1. Listing and Labeling: Provide raceway and boxes that are Listed and Labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authority Having Jurisdiction, and marked for intended use for the location and environment in which they are installed.
     2. Comply with NECA’s “National Electrical Installation Standards.”
     3. Comply with NFPA 70, as adopted and administered by the Authority Having Jurisdiction.
  2. COORDINATION
     1. Raceway and boxes are shown on drawings in approximate locations unless dimensioned. Locate raceway and boxes as shown and at other locations where required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access, and to complete the wiring system.

1. PRODUCTS

A. If only one product is acceptable (single or sole source product), obtain an approved Competition Waiver and submit to the CPO Construction, Contract Administrator. The language shall read as: “Manufacturer Name, Product # XXXXX, No Equal.” Refer to CPO-6 Competition Waiver Policy for more information.

B. If a Competition Waiver is not approved or more than one product is acceptable, this section must list a minimum of 2 products plus the language “Or Approved Equal,” along with salient characteristics. Refer to CPO Construction’s Salient Characteristics Guidelines for more information.

* 1. MANUFACTURERS
     1. Subject to compliance with requirements, provide products by one of the following:
        1. Metal Conduits, Tubing, and Fittings:
           1. Allied Tube & Conduit.
           2. O-Z/Gedney.
           3. Republic Conduit.
           4. Southwire Company.
           5. Thomas & Betts Corporation.
           6. Western Tube and Conduit Corporation.
           7. Wheatland Tube Company.
           8. Or Approved Equal.
        2. Nonmetallic Conduits, Tubing and Fittings
           1. Thomas and Betts/Carlon CANTEX Inc.
           2. JM Eagle
           3. Southern Pipe
           4. Hubbell/Raco
           5. Or Approved Equal.
        3. Fiberglass Conduits and Fittings:
           1. Champion Fiberglass
           2. United Fiberglass of America
           3. Or Approved Equal.
        4. Metal Wireways and Auxiliary Gutters
           1. Cooper B-Line, Inc.
           2. Hoffman.
           3. Square D.
           4. Or Approved Equal.
        5. Nonmetallic Wireways and Auxiliary Gutters
           1. Allied Molded Products, Inc.
           2. Hoffman.
           3. Thomas and Betts/ Carlon Electrical Products.
           4. Or Approved Equal.
        6. Surface Raceways
           1. Hubbell Wiring Systems
           2. Panduit Corp.
           3. Wiremold / Legrand.
           4. Or Approved Equal.
        7. Boxes
           1. Cooper Technologies Company; Cooper Crouse-Hinds.
           2. EGS/Appleton Electric.
           3. FSR Inc.
           4. Hoffman.
           5. Hubbell Incorporated.
           6. O-Z/Gedney.
           7. RACO; Hubbell.
           8. Thomas & Betts Corporation.
           9. Wiremold / Legrand.
           10. Or Approved Equal.
        8. Terminal Blocks
           1. Cooper Technologies Company; Cooper Crouse-Hinds.
           2. EGS/Appleton Electric.
           3. FSR Inc.
           4. Hoffman.
           5. Hubbell Incorporated.
           6. O-Z/Gedney.
           7. RACO; Hubbell.
           8. Thomas & Betts Corporation.
           9. Wiremold / Legrand.
           10. Or Approved Equal.
  2. METAL CONDUIT AND TUBING
     1. Rigid Metallic Conduit (RMC):
        1. Galvanized Rigid Steel Conduit (GRC): ANSI C80.1. and UL6

Remove if no 400Hz systems.

* + - 1. Aluminum Rigid Conduit (ARC): ANSI C80.5. and UL 6A For use with 400Hz systems only.
    1. PVC-Coated Steel Conduit: Comply with NEMA RN 1.
       1. Coating Thickness: 0.04 inch minimum
    2. Electrical Metallic Tubing (EMT): ANSI C80.3 and UL 797.
    3. Intermediate Metallic Conduit (IMC) is not allowed.
    4. Flexible Metal Conduit (FMC): Zinc-coated steel, full wall. Reduced wall flexible conduit is not allowed.
    5. Liquidtight Flexible Metal Conduit (LFMC): Flexible steel conduit with PVC jacket complying with UL 360.
    6. Fittings for Metal Conduit: NEMA FB 1 and UL 514B; compatible with conduit/tubing materials.
       1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70 (NEC).
       2. Fittings for EMT: Steel compression fittings only. SET-SCREW TYPE WILL NOT BE ALLOWED.
       3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
       4. PVC-Coated Conduit Fittings: Coating thickness 0.04 inch minimum, with overlapping sleeves protecting threaded joints.
    7. Joint Compound for GRC: compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.
  1. NONMETALLIC CONDUIT AND TUBING
     1. Rigid Nonmetallic Conduit (RNC/PVC): NEMA TC 2 and UL 651, Schedule 40 or 80 PVC.
     2. RNC Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.
     3. Extra Heavy Wall Fiber glass conduit and fittigs / Reinforced Thermosetting Resin Conduit (RTRC) UL Type XW: NEMA TC 14
  2. METAL WIREWAYS
     1. Material: Sheet metal, size and shape as indicated on drawings. Comply with UL 870 and NEMA 250, Type 1 unless otherwise indicated.
        1. Metal wireways installed outdoors shall be NEMA [3R]
        2. Metal wireways installed outdoors marine and waterfront environment shall be NEMA 4X 316 stainless steel
     2. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.
     3. Select features, where not indicated, as required to complete wiring system.
     4. Wireway Covers: Hinged type unless otherwise indicated.
     5. Finish: Manufacturer’s standard enamel finish, ANSI 61 gray color.
  3. NONMETALLIC WIREWAYS
     1. Description: Fiberglass polyester, extruded and fabricated to required size and shape. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets. No hole or knockout.
        1. Fiberglass wireways installed under warfs piers and docks shall be NEMA 4X.

Select paragraph above or below.

* + 1. Description: PVC plastic extruded and fabricated to size and shape indicated. No holes or knockouts, with snap-on cover and mechanically coupled connections using plastic fasteners.
    2. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.
    3. Select features, unless otherwise indicated, as required to complete wiring system.
  1. SURFACE RACEWAYS
     1. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Finish with manufacturer’s standard rust inhibiting prime coating and standard enamel finish in color selected by Architect.
     2. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
  2. OUTLET AND DEVICE BOXES
     1. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
     2. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover and threaded hubs.
     3. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
     4. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb. shall be listed and marked for the maximum allowable weight.
     5. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
     6. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.
  3. FLOOR BOXES
     1. Metal Floor Boxes – for new concrete floors:
        1. Material: Cast metal.
        2. Type: Fully adjustable.
        3. Shape: Rectangular.
  4. PULL AND JUNCTION BOXES
     1. Small Sheet Metal Boxes: NEMA OS 1, galvanized steel.
     2. Cast-Metal Boxes: NEMA FB 1, ferrous alloy, with gasketed cover, ground flange and stainless steel cover screws.

Fiberglass Enclosures for Marine locations only.

* + 1. Fiberglass Enclosures: NEMA 4X
    2. Comply with UL 50 and NEMA 250, Type 1 for interior applications and NEMA 3R, or as indicated in contract documents.
    3. Comply with UL 50 and NEMA 250, Type 4X 316 stainless steel for exterior airfield, marine and waterfront applications or as indicated in contract documents.
    4. Sheet Steel Gauge Requirements (Any Direction):
       1. Less than 24”: 14 USS gauge.
       2. 24” to 36”: 12 USS gauge.
       3. 36” or larger: 10 USS gauge.
    5. Pull and Junction Boxes larger than 24” x 24” shall have 110° Swing Opening Cover.
       1. Indoor: cover shall have continuous hinge with flush latch unless otherwise indicated.
       2. Outdoor: cover shall have three-point hinge with flush latch.
  1. TERMINAL BLOCKS
     1. Minimum 600-volt rating for 480-volt circuits
     2. Clamp or screw terminals sized for maximum conductor size

1. EXECUTION
   1. GENERAL
      1. Examine surfaces to receive raceways and boxes for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

Engineer shall coordinate with other disciplines to ensure Section 09 97 13 Special Coating - Metal is included in the contract documents.

* + 1. Galvanized materials exposed to rainwater and installed over hard surfaces, such as but not limited to pavement and roofs, shall be prepared, primed and painted per Section 09 97 13 Special Coating - Metal. Coating application as part of the manufacturing process is preferred over painting in the field.

Delete this article if existing construction is not affected or if there is none on the project. Edit to meet project requirements.

* 1. EXISTING WORK
     1. Ensure access to existing boxes and other installations which remain active and which require access. Modify installation or provide access panel as appropriate.
     2. Extend existing raceway and box installations using materials and methods as specified.
     3. Clean and repair existing raceway and boxes which remain or are to be reinstalled.
  2. WIRING METHODS

Edit materials and methods to suit Project. Coordinate with Section 26 05 19 - 600 Volt or Less Wire and Cable.

* + 1. Outdoors: Use the following wiring methods:
       1. Exposed: Rigid steel conduit (RMC).
          1. Use of aluminum RMC is limited to 400 Hz, grounding, and special applications.
          2. PVC Coated Ridged Conduit – for hazardous locations
       2. Underground: See Section 26 05 43 – Underground Ducts and Raceways for Electrical Systems.
       3. Below Piers, Warfs, and Docks: RTRC Type XW Extra Heavy Wall Fiberglass conduit rated for hazardous industrial environment.
       4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): Liquidtight flexible metal conduit (LFMC).

Modify box types for the specific project environments. NEMA 3R shall be used in non-corrosive, non-dusty outdoor environments at Aviation properties. NEMA 4 shall be used in interior or exterior dusty or dirty environments. NEMA 4X shall be used in interior and exterior corrosive or marine environments. Fiberglass is acceptable for below Piers, Wharfs, and Docks.

* + - 1. Boxes: Type shall be as specified in the drawings.
         1. NEMA 3R in non-corrosive, non-dusty outdoor locations at Aviation properties. Not acceptable at Maritime and Waterfront properties.
         2. NEMA 4 in interior or exterior dusty or dirty locations at Aviation properties. Not acceptable at Maritime and Waterfront properties.
         3. NEMA 4X in interior and exterior corrosive locations.
    1. Indoors, protected from exposure to weather: Use the following wiring methods:

Delete paragraph below if no high-frequency installation.

* + - 1. Aluminum RMC limited to 400Hz, grounding and special applications. Aluminum conduit, boxes or fittings shall not come in contact with concrete. Provide non-metallic sleeve where aluminum conduit passes through concrete structure.
      2. Exposed: Rigid steel conduit (RMC) or electrical metallic tubing (EMT).
         1. Rigid steel conduit shall be used up to 12 feet above finish floor in traffic areas subject to damage, such as in the conveyor, shop and ramp areas.
      3. Concealed: Rigid steel conduit (RMC) or electrical metallic tubing (EMT).
         1. Use EMT in sizes 3/4” to 1-1/2” only, except larger EMT may be used for communications wiring such as telephone or fire alarm systems.
         2. Power raceways 2-inches and larger shall be rigid steel conduit.
      4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): Flexible metal conduit (FMC), except in wet or damp locations, use liquidtight flexible metal conduit (LFMC).
      5. Damp or Wet Locations: Rigid steel conduit (RMC).

Some editing to that noted in paragraph and subparagraphs is acceptable with F & I approval.

* + - 1. Boxes: NEMA 250, Type 1, except as follows:
         1. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.
         2. Indoor Dusty Locations: NEMA 12
         3. Damp or Wet and Corrosive Locations: NEMA 250, Type 4X, stainless steel.
         4. Hazardous Locations: NEMA 250, Type 7.
  1. INSTALLATION
     1. Install raceways and boxes as indicated, according to manufacturer’s written instructions. Use raceway fittings compatible with raceways and suitable for use and location.
     2. Clip type conduit fasteners are not allowed. All fasteners and clamps for conduit and raceway support shall be bolted mechanical hardware type.
     3. Raceways:
        1. Minimum Raceway Size:
           1. 3/4” trade size for electrical.
           2. 1” trade size for communications.
        2. Cut conduit square using a saw or pipe cutter and ream to remove burrs.
        3. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2-inch size.
        4. Conceal conduit, unless otherwise indicated, within finished walls, ceilings, and floors.

Remove below paragraph if not passing through a conveyor area.

* + - 1. Conveyor areas should be considered a NEMA 12 installation because of dust. Conduit shall be RMC up to 12’ AFF or within a 10’ radius of conveyors.
         1. Device and pull boxes within 10’ of conveyors shall be gasketed.
      2. Conduits shall not be supported from ducts, pipes or other systems foreign to the electrical installation. The entire electrical installation shall be kept independent from any other trade.
      3. Provide separate conduits for 480/277V, 208/120V and low voltage and controls cabling.
      4. Planning: the layout of all raceways shall be carefully planned by the Contractor to ensure an installation which is neatly done and workmanlike. Any Work showing improper care in planning will be ordered removed by the Construction Manager, and shall be replaced in a neat and proper manner, without any additional cost to the Port.
      5. Run concealed raceways with a minimum of bends, in the shortest practical distance considering type of building construction and obstructions. Install no more than the equivalent of four 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
      6. Install raceways parallel and perpendicular to structure and at proper elevations. Group multiple conduit runs and neatly rack and support from the structure. Provide adequate headroom.
         1. Maintain 6-inches minimum clearance between raceways and mechanical piping and 12-inches minimum to heat sources such as flues, steam piping and heating appliances. Install horizontal raceway runs above water and steam piping.
         2. Give right of way to raceways and piping systems installed at a required slope.
         3. Keep electrical conduits free from contact with other dissimilar metals.
      7. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 1-inch concrete cover.
         1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
         2. Space raceways laterally to prevent voids in concrete.
         3. Run conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement.
         4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit or rigid steel conduit at all bends and before rising above floor.
      8. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment.
         1. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
         2. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor.
         3. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor.
         4. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.
      9. Flexible Conduit and Connections: Comply with NEMA RV3
         1. Use a maximum of 6 feet of flexible conduit for recessed and semi-recessed lighting fixtures. Use a maximum of 18” for equipment subject to vibration, noise transmission or movement, and for all motors and transformers. Use liquidtight flexible conduit in wet or damp locations.
         2. Install a separate external ground connector across flexible connections. See Section 26 05 26 – Grounding and Bonding for Electrical Systems. Wrap flex conduit with ground wire, connected to steel fittings at either end of flex.
         3. Expansion-Joints:

Provide Liquid tight flex conduit at expansion joints with sufficient slack to accommodate seismic movement, unless Structural Engineer requires expansion joint fitting.

* + - 1. Sleeves: Install for cable and raceway penetrations of concrete slabs and walls, except where core-drilled holes are used. Install for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
      2. Seal all conduits which pass through the building roof, through outside walls of the building above or below grade, and through floor slabs on grade. Seal on the end inside the building using a pliable duct-sealing mastic, non-hardening compound packed around the wire in the conduit. Compound shall be a type specially designed for such service on electrical wiring systems, shall be non-combustible and shall have the approval of the code-enforcing agency.
         1. Seal the inside of spare conduits on both sides with conduit plugs, water plugs, or duct sealer to prevent water, vapors, or gases from entering the building.
      3. Install raceways to preserve the fire resistance rating of partitions and other elements using materials and methods as specified in Section 07 84 00 - Firestopping. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies as required to reestablish the original fire-resistance rating.
      4. Avoid moisture traps. Provide junction box rated for the environment in which it is installed, with drain fitting at low points in conduit system.
      5. Install raceway sealing fittings according to manufacturer’s written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
         1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
         2. Where otherwise required by NFPA 70 (NEC).
      6. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box.
         1. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
      7. Use temporary closures to prevent foreign matter from entering raceways.
      8. Complete raceway installation before starting conductor installation.
      9. In public areas, exposed raceways shall be painted to match surroundings.
      10. Pull ropes:
          1. Power raceways: Install pull-ropes in empty raceways.

Use #14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength.

Leave at least 12 inches of slack at each end of the pull wire.

* + - * 1. Communication raceways: Install pull cord from end to end in every conduit, cable tray and/or innerduct.

The pull cord shall be new polypropylene over polyester rope with a minimum 1700 lb. tensile strength.

The Contractor shall leave at least 18” of pull cord accessible at both ends of the conduit, cable tray, or innerduct.

Provide measured pull line in 12” increments in each empty conduit.

The pull cord shall be continuous with no knots or splices for the length installed.

* + - 1. Surface Conduits: Install a separate, green, ground conductor in conduits from junction box supplying the conduits to receptacle or fixture ground terminals.
         1. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy.
         2. Where a surface raceway is used to supply a lighting fixture having central-stem suspension with a backplate and a canopy (with or without extension ring), no separate outlet box is required.
         3. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each lighting fixture having end-stem suspension.
         4. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed, no additional surface-mounted outlet box is required. Provide a backplate slightly smaller than the fixture canopy.
      2. Communication Raceways
         1. Floor, roof and structural ceiling penetrations: Use rigid steel conduit. Extend through floor, roof and structural ceiling to at least 4 inches above and below penetration.
         2. Conceal conduit where possible, otherwise route tight to building structure.
         3. Provide an insulating press fit bushing on all telecommunications conduits including interconnecting nipples and stub to distribution system. Bushings must be rated to be used in an environmental air handling space (Plenum).
         4. To prevent conflicts with other cables or conduits to cable tray, the conduit shall be stubbed not less than 6" above or below conduit/cable tray center line. Where space permits, every effort shall be made to bend conduits down such that the flow of installed cables promotes the minimum length back to the Communication Space and the least amount of bends in the cables.
         5. 90 degree communication pulling elbows shall meet TIA requirements for communication wiring bend radius minimums.
         6. Do not include more than two 90 degree bends between pulling points when installing conduit runs. If the path of the conduits requires more than 180 degrees of total bends, installation of an appropriate sized junction box is required. Place an appropriate sized junction box in each individual conduit run that exceeds 100’ in length.
         7. Incoming Conduits

Terminate entrance conduits entering communication Equipment Rooms (ER) from below grade to extend 4" above finished floor. Location of entrance conduits shall be within 12” of room corners.

Terminate entrance conduits entering communications equipment rooms from above ceiling height to extend 4" below finished ceiling or 12” above cable tray.

Terminate entrance conduits entering an equipment room from below ceiling height to extend 4" into the room.

Entrance conduits shall be continuous into the building and to the communication equipment room.

* + 1. Outlet Box Installation:
       1. Use recessed outlet boxes in finished areas.
          1. Do not install boxes back-to-back in walls.
          2. Provide 6-inch minimum separation; 24-inch in acoustic rated walls.
       2. Provide knockout closures for unused openings.
       3. Where receptacle boxes and telecom devices are adjacent to one another, install receptacles not closer than 6” to and not greater than 12” from telecom device.
       4. Support boxes independently of raceway. Mount device boxes to wall studs using blocking material behind the box to ensure that the box will remain square to the finished wall surface.
       5. Outlet and device boxes mounted in masonry walls shall be set at the bottom or top of a masonry unit course.
       6. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes.
       7. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
       8. Use cast outlet boxes in exterior or wet location. Conduit shall not enter the top or sides of exterior wall outlet boxes. Conduit shall enter bottom only.
       9. Coordinate location and mounting height of outlets mounted above counters, benches, and backsplashes.
       10. Mount outlets and devices per NECA 130 unless otherwise noted on drawings.
    2. Pull and Junction Box Installation:
       1. Locate so that covers are accessible at all times.
       2. Support boxes independently of raceway. See Section 26 05 29 Hangars and Supports for Electrical Systems.
    3. Floor Box Installation:
       1. Set metal floor boxes level and adjust to finished floor surface.
       2. Use cast iron floor boxes for installations in slab on grade.
  1. TERMINAL BLOCKS
     1. Separate connection point for each conductor
     2. 10% spare terminal points
     3. Individual identification for each terminal block
     4. Phenolic block separators or barriers shall be used to isolate low-voltage and control terminations from analog and DC circuits.
  2. GROUNDING
     1. Provide grounding connections for raceway, boxes, and components as specified in Section 26 05 26 - Grounding and Bonding for Electrical Systems.
  3. SUPPORT
     1. Support raceways and boxes as specified in Section 26 05 48 – Structural Loading Controls for Electrical and Communication Work, and Section 26 05 29 - Hangars and Supports for Electrical Systems.
  4. IDENTIFICATION
     1. Provide labels for raceway, boxes, and components as specified in Section 26 05 53 - Electrical Identification.
  5. PROTECTION
     1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure coatings and finishes are without damage or deterioration at the time of Substantial Completion.
        1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
        2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.
  6. CLEANING
     1. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes, including chips, scratches, and abrasions.

1. MEASUREMENT AND PAYMENT
   1. GENERAL
      1. No separate measurement or payment will be made for the Work required by this section. The cost for this portion of the Work will be considered incidental to, and included in the payments made for the applicable bid items in the [Schedule of Unit Prices] [Lump Sum price bid for the Project].

End of Section

Revision History:

05/01/2014 Conversion to 2004 CSI Numbering System

10/15/2014 Added Sole Source and Salient Characteristics Note to Part 2 and revisions

09/27/2019 Revised Per F&I Standards

10/08/2025 Added information for communication raceways, and general revisions