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 (Tab) 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
      1. The extent and location of “Pathways for Communications Systems” Work is shown in the Contract Documents. The Contractor shall furnish and install cable pathways as shown in the Drawings and specified herein. Pathways shall include, but not be limited to, solid-trough cable trays with solid covers, metallic conduit, plastic innerduct, pull boxes, structural supports, and seismic bracing.
      2. The Contractor shall provide and install all hardware, fasteners, or other materials required to install and support cable trays as shown on the drawings.
      3. All conduit and cable tray assemblies shall be accordance with Section 26 05 48 – Seismic Controls for Electrical and Communication Work.
      4. Cable pathways should also include open form cable trays for horizontal cable, in addition to other types of flexible cable trays.
      5. The use of aluminum cable tray is allowed.
      6. Section Includes:
         1. Section 26 05 33 – Raceways and Boxes.
         2. Section 26 05 36 – Cable Trays.
   2. GOVERNING CODES, STANDARDS AND REFERENCES
      1. ANSI/TIA-569 – Telecommunications Pathways and Spaces
      2. ANSI/TIA-606 – Administration Standard for Telecommunications Infrastructure
      3. ANSI/TIA-607 – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
      4. ANSI/UL-1666 Standard for Test For Flame Propagation Height of Electrical And Optical-Fiber Cables Installed Vertically In Shafts
      5. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
      6. ASTM A1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Ally, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
      7. ASTM A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable
      8. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process
      9. ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
      10. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
      11. NEMA VE 1 – Metal Cable Tray Systems
      12. BICSI – Telecommunications Distribution Methods Manual
      13. NEMA VE2 - Cable Tray Installation Guidelines
      14. NFPA 70, National Electrical Code (NEC)
      15. NFPA 70B - Recommended Practice for Electrical Equipment Maintenance
      16. Underwriters Laboratory (UL)
      17. NFPA 262 - Test for Fire and Smoke Characteristics of Wires and Cables
      18. UL 2024 - Standard for Cable Routing Assemblies and Communications Raceways
      19. Washington State Department of Labor and Industries.
   3. SUBMITTALS
      1. Submit materials data in accordance with of Section 01 33 00 - Submittals. Furnish manufacturers’ technical literature, standard details, product specifications, and installation instructions for all products.
      2. Submit manufacturer’s instructions for storage, handling, protection, examination, preparation, operation, and installation of products. Include application conditions or limitations of use stipulated by any product testing agency.
      3. Submittals shall include the following:
         1. Layout Drawings: Submit layout drawings of cable tray and conduits where field conditions require deviation from routes indicated on the drawings and where additional bends or vertical transitions are needed.
         2. Submittal Drawings: Submit drawings of typical cable tray and accessories including clamps, brackets, hanger rods, splice plate connectors, expansion joint assemblies, and fittings, showing accurately scaled components.
         3. Product Data: Submit manufacturer’s data on cable tray including, but not limited to, types, materials, finishes, inside depths, and fitting radii. For side rails, submit cross sectional properties including Section Modulus (Sx) and Moment of Inertia (Ix).
   4. QUALITY ASSURANCE
      1. Manufacturers: Firms regularly engaged in manufacture of cable trays and fittings of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
      2. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
         1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of an RCDD, or BICSI Installer 2 Copper, or BICSI Installer 2 Fiber, or BICSI Technician.
         2. Installation Supervision: Installation shall be under the direct supervision of BICSI Technician, BICSI Installer 2 Copper or BICSI Installer 2 Fiber, who shall be present at all times when Work of this Section is performed at Project site.
         3. Field Inspector: Currently registered by BICSI as RCDD, or BICSI Installer 2 Copper to perform the on-site inspection.
      3. 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.
      4. Comply with ANSI/TIA-569-C.
      5. Comply with TIA/EIA-606-A.
      6. Cable tray shall be listed and labeled by Underwriters Laboratories (UL) as required or Washington State Labor and Industry recognized for their intended use.
      7. NEMA Compliance: Comply with NEMA standards publication number VE1, “Cable Tray Systems.”
      8. NEC Compliance: Comply with NEC, as applicable to construction and installation of conduit, innerduct, cable tray and cable channel systems (Article 318, NEC).
      9. NFPA Compliance: Comply with NFPA 70B, “Recommended Practice for Electrical Equipment Maintenance” pertaining to installation of cable tray systems.
   5. DRAWINGS
      1. The Drawings indicate the general route of the cable trays and conduits. Data presented on the Drawings are as accurate as preliminary surveys and planning can determine. Accuracy is not guaranteed and field verification of all dimensions and routing is required.
      2. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions. The Contractor shall make field surveys as part of his Work. Deviations from indicated routes, additional bends, and vertical transitions shall be submitted to the Construction Manager for approval prior to installing cable trays or conduits.
   6. PROJECT CONDITIONS
      1. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and work above ceilings is complete.
   7. COORDINATION
      1. Coordinate layout and installation of communications pathways with the other trades installing equipment in the ceiling.
2. 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. PATHWAYS FOR COMMUNICATIONS SYSTEMS
     1. All pathways for communications systems shall comply with ANSI/TIA-569-C and BICSI Telecommunications Distribution Methods Manual, 12th Ed.
     2. Comply with the requirements of Sections 26 05 36 – Cable Trays, 26 05 29 – Hangers and Supports for Electrical Systems, and 26 05 33 – Raceways and Boxes.
  2. COMMUNICATION CABLE TRAYS
     1. General: The Contractor shall furnish and install a complete cable tray system to support innerduct and cable as indicated on the drawings or included in the scope of Work.
     2. Manufacturer: Cable tray systems shall be as manufactured by:
        1. Cooper B-Line
        2. Chatsworth Products, Inc.
        3. Or Approved Equal.
     3. Cable Tray Sections and Components:
        1. General: Provide metal cable trays of types, classes, and sizes indicated within the scope of Work; with splice plates, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
        2. Cable tray for distribution of backbone and horizontal cabling outside the telecommunications room.
        3. Provide metal cable trays of types, classes, and sizes indicated within the scope of Work; with splice plates, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
        4. Special accessories shall be furnished as required to protect, support, and install the cable tray system. Accessories shall consist of, but are not limited to, ground-bonding jumpers, blind-end plates, clamps, hangers, brackets, conduit adapters, installation hardware, and other appurtenances as required for a complete installation. Provide cable drop outs to maintain proper bend radius for cables leaving the tray.
        5. Cable Tray Material: Metal, suitable for indoors, and protected against corrosion by use of aluminum material (6063-T6 alloy).
        6. Provide enclosed cable tray (NOT solid bottom, bendable or thru cable tray) with cover for distribution of backbone and horizontal cabling. Enclosed cable tray material shall be metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472” (0.012 mm) thick. Cable tray size as shown on the floor plans.
        7. Supports: Cable tray supports shall be placed so that the support spans do not exceed the maximum span indicated on the Drawings or as recommended by the cable tray manufacturer. Supports shall be as shown on the Structural plan.
        8. Where specifically shown on plans, continuous, rigid, welded steel or stainless steel wire mesh construction capable to support min 70 lb/ft for a 12” width and 100 lb/ft at 24” width, for distribution of horizontal cabling, as indicated on drawings.
        9. Provide all fittings and accessories required to protect, support and install a cable tray support system.
        10. Provide bottom to conceal cables in the color that has been coordinated previously with architect to match the area color theme.
        11. Provide cable runaway radius drop at cable transitions from tray to racks.
        12. Provide bonding and grounding clamps and #6 AWG ground wire between metallic cable tray and nearest telecommunications grounding bus bar (TGB).
        13. Accessories: Special accessories shall be furnished as required to protect, support, and install the cable tray system. Accessories shall consist of, but are not limited to, ground-bonding jumpers, blind-end plates, clamps, hangers, brackets, conduit adapters, installation hardware, and other appurtenances as required for a complete installation.
        14. NEC compliance: Cable trays shall be manufactured, to meet requirements of NEC Article 392 – Cable Trays. Bonding and grounding shall meet the requirements specified in Section 26 05 26 – Grounding.
  3. CONDUIT REQUIREMENTS
     1. Size conduit for wires and cables as noted on Drawings. Typical Port minimum applications noted:
        1. From Entrance Facility to Outside Plant (OSP) shall be (4) 4” conduits.
        2. From (if no cable tray is present) Equipment Room (ER) to ER shall be (4) 4” conduits.
     2. Conduit penetrations into a new Equipment Room (ER) for Horizontal and Tenant Backbone infrastructure shall run to a minimum of one 36”x36”x16” Pull box (meet-me-box) with (4) 4” conduits into the ER.
     3. OSP ductbanks

Select and/or revise item 1 and 2 as required.

* + - 1. Minimum accepted; (2) 4” from each Maintenance Hole (MH)
      2. Typical; (4) 4” from each Maintenance Hole (MH).
      3. Refer to Innerduct for proper fill of backbone conduits.
    1. Tenant Demarcation conduit; One 2” conduit is placed from Destination Equipment location to the Port of Seattle ER that is within 90m.
    2. Horizontal Data and Voice information outlet locations shall be 1” conduit to a 4x4 box, reducer to 1-gang.
    3. 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. Sleeves for raceways and cables shall meet requirements specified in Section 26 05 33 – Raceways and Boxes.
    4. The Contractor shall provide all metal conduits with threaded plastic bushings and pull cords.
    5. Routing of any metallic media cabling such as voice, data or coaxial in the same conduit as power conductors is not allowed.
    6. Continuous conduit runs shall not exceed 100’ or have more than two 90 degree bends without using appropriately sized pull boxes.
    7. Maximum conduit pathway capacity shall not exceed a 40% fill.
    8. The intent of the installation of the raceway is as follows:
       1. Where ceilings are accessible, the raceway and entrance end fitting shall extend above the ceiling and the conduits installed above the ceiling in the room to the nearest hallway distribution system.
       2. Where ceilings are partially accessible, or if the Drawings and/or Specifications indicate installation of access panels, the raceway shall extend above the ceiling and the conduits installed above the ceiling in the room to the nearest hallway distribution system.
       3. Where ceilings are inaccessible or no ceilings exist, the raceway shall extend up as close to the ceiling as practical to allow installation of conduits as high as possible to the nearest hallway distribution system.
    9. Station Conduits
       1. Station conduit is defined as conduit that originates at the TO and rises within the walls or is exposed from a raceway and extends up into the drop ceiling or over to the hallway distribution system.
       2. Provide station conduits from TOs to above the drop ceiling or extend over to the hallway distribution systems consisting of 1” EMT minimum or appropriate size as shown on the Drawings or as specified herein for installation of telecommunications cables.
       3. Provide an insulating press fit bushing on all telecommunications conduits including interconnecting nipples and stub to distribution system. 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 station conduits down such that the flow of installed cables promotes the minimum length back to the TR and the least amount of bends in the cables. Bushings must be rated to be used in an environmental air handling space (Plenum).
       4. Manufacturer of insulating bushing on all telecommunication conduits shall be Arlington Or Approved Equal.
       5. Provide measured pull line in 12” increments in each empty conduit to hallway distribution system.
       6. Routing of any metallic media cabling such as voice, data or coaxial in the same conduit as power conductors is not allowed.
       7. Indelibly mark station conduit at hallway distribution end with Room # that conduit serves.
       8. The use of 90 degree electrical pulling elbows is prohibited.
       9. Do not include more than two 90 degree bends between pulling points when installing station conduit runs. If the path of the station 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 station conduit run that exceeds 100’ in length.
       10. The use of a third bend in a conduit is only acceptable if:
           1. The total conduit run is reduced by 15%.
           2. The conduit size is increased to the next trade size.
           3. One of the bends is located within 12” of the cable feed end.
    10. Incoming Conduits
        1. Incoming IMC conduits shall be installed from the nearest manhole outside of the building as shown on the Drawings. Terminate entrance conduits entering EF/LAN Telco rooms from below grade to extend 4" above finished floor. Location of entrance conduits shall be within 12” of room corners.
        2. Terminate entrance conduits entering EF/LAN Telco rooms from above ceiling height to extend 4" below finished ceiling or 12” above cable tray.
        3. Terminate entrance conduits entering an ER rooms from below ceiling height to extend 4" into the room.
        4. Entrance conduits shall be continuous into the building and to the EF/LAN Telco room. Securely fasten all entrance conduits to the building to withstand any cable placing operation. Do not include more than two 90 degree bends between pulling points when installing entrance conduits.
        5. On exterior wall penetrations, seal both sides of the wall around outside of conduit with hydraulic cement to prevent water from entering the building. Seal the inside of the conduit on both sides with conduit plugs, water plugs, or duct sealer to prevent water, vapors, or gases from entering the building.
    11. Pathway Requirements for Entrance Conduits
        1. If the entrance conduits exceeds the 180 degree of total bends limitation, an appropriate sized junction box, manhole, or hand hole is required.
        2. As-built drawings of entrance conduit path required to be submitted to Owner’s Representative before covered with soil.
    12. Riser Conduits
        1. Riser conduits shall only be used when noted on the Construction Documents for special applications only. Riser conduits are not required as a general rule for the riser system when rooms are stacked (sleeves and vertical cable trays will be used instead).
        2. Conduits entering ER and TR rooms shall be reamed or bushed and terminated not more than 4" from entrance wall and within 12” of room corners.
        3. Conduits entering ER and TR rooms from below floor shall be terminated not more than 4" above finished floor.
        4. Conduits for riser cables shall be continuous and separate from all other conduit or enclosed raceway systems. Do not include more than two 90 degree bends between pulling points when installing riser conduits. Where junction boxes are required, locate in accessible areas, such as above suspended ceilings in hallways.
        5. Conduits shall not be less than 4" trade size and be equipped with a measured pull line at 12” increments rated at a minimum 1200 lb. test.
        6. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction. Fire-rated construction to be verified with authorities having jurisdiction.
        7. Provide an insulating press fit bushing on all telecommunications riser conduits. Bushings must be rated to be used in an environmental air handling space (Plenum).
        8. Manufacturer of insulating bushing on all telecommunication conduits shall be Arlington Or Approved Equal.
        9. Riser conduits shall not be used for the distribution of horizontal cables.
  1. Telecom Outlets (TO)
     1. Pathway at TO consists of one (1) 4-11/16" square by 2-1/8" deep flush mounted box. Each outlet box shall have a EMT conduit stubbed above the drop ceiling or extended into the hallway cable tray. Conduits size is as follows:
        1. For Outlets with (3) or less cables, use a 1” EMT conduit.
        2. For Outlets with (3) to (6) cables, use a 1-1/4” EMT conduit.
        3. For all other sizes, calculate fill ratio at 40% for proper sized conduit.
  2. Cable Support:
     1. Provide all manufacturer’s approved and supplied fittings and accessories required to protect, support and install a cable tray support system.
     2. NRTL labeled for support of Category 6 and 6A cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
     3. Support brackets with cable tie slots for fastening cable ties to brackets.
     4. Lacing bars, spools, J-hooks, and D-rings.
     5. Velcro, straps and other devices.
  3. Ladder Rack
     1. Used for cabling distribution inside the telecommunications rooms.
     2. Provide all fittings and accessories required to protect, support and install the cable tray system. Provide cable drop outs to maintain proper bend radius for cables leaving the tray.
     3. Cable Tray Material: Metal, suitable for indoors, and protected against corrosion by use of aluminum material (6063-T6 alloy).
     4. Cable tray size as shown on the floor plans.
     5. Rung spacing 9”.
     6. Acceptable manufacturers:
        1. CPI
        2. Panduit
        3. Hubbell
        4. Or Approved Equal
     7. Provide all fittings and accessories required to protect, support and install a ladder rack support system.
     8. Provide cable runaway radius drop at cable transitions from tray to racks.
     9. Provide bonding and grounding clamps and #6 AWG ground wire between metallic cable tray and nearest telecommunications grounding bus bar (TGB).
  4. J-Hooks
     1. Hanger/brackets with fasteners.
     2. Support the cables utilizing J-hooks where cable tray is not shown, but an accessible finished ceiling exists.
     3. Provide J-hooks at a maximum of every 4’.
     4. Acceptable manufacturer:
        1. Panduit – J-Mod
        2. Or Approved Equal
  5. Innerduct

Note: Riser-rated innerduct may be used for fiber optic cables placed in closed cable trays.

* + 1. Used to protect the fiber in the cable tray and conduit and to facilitate future cable installation in pathways connecting the various structures on site.
    2. Specifications: Multi celled textile innerduct.
       1. MaxCell
       2. Or Approved Equal
    3. For 4” conduit install (3) 3” 3-cell fabric innerduct. Each cell shall be rated for 1” or larger diameter cables. For 2” conduits, install (1) 3” 3-cell fabric innerduct.
    4. Color: Use three unique colors, use one color per 3-pack (color shall be in stitched spine or on fabric material).
    5. Use product where innerduct will meet Port of Seattle cable infrastructure growth requirements in 2” and above backbone conduit runs.
    6. Fabric innerduct shall not be used in cable trays.
    7. Pull Tape: Provide tape per fabric Innerduct.
    8. Specifications: Non-fabric duct
       1. Pyramid
       2. Carlon
       3. Or Approved Equal
    9. Color: Orange
    10. Construction: Corrugated
    11. Pull Tape: Preinstalled, with footage markings
    12. UL: UL 910 and/or 2024 list with tags or marking and for cables listed under ANSI/UL-1666 (1997) or Washington State Labor and Industries recognized.
    13. National Electrical Code (NEC) Compliance: Comply with NEC as applicable.
    14. Flexible fabric innerduct

Note to Designers: Provide 4” conduit for high use fiber optic raceways. Confirm fill calculations for each conduit per project.

* + - 1. For 4” conduit install (3) 3” 3-cell fabric innerduct. Each cell shall be rated for 1” or larger diameter cables. For 2” conduits, install (1) 3” 3-cell fabric innerduct.
      2. Color: Use three unique colors, use one color per 3-pack (color shall be in stitched spine or on fabric material)
      3. Use product where innerduct will meet Port of Seattle cable infrastructure growth requirements in 2” and above backbone conduit runs.
      4. Fabric innerduct shall not be used in cable trays
      5. Pull Tape: Provide tape per fabric innerduct.
      6. UL: UL 910 and/or 2024 list with tags or marking and for cables listed under ANSI/UL-1666 (1997) or Washington State Labor and Industries recognized.
      7. National Electrical Code (NEC) Compliance: Comply with NEC as applicable.
    1. Air Blown Fiber bundled tube duct system

Note to Designers: Consideration may be given to Air Blown Fiber (ABF) applications where projects fit a scalable need over time or technology demands an adaptable install such as ICT Data Centers. Confirm usage with Facilities and Infrastructure.

* + - 1. Manufacturer shall have a certified ABF installer program; installers shall have valid certification from ABF Manufacturer. Installed Fiber shall provide a minimum 20 year warranty.
      2. Color: Orange or black
      3. Construction: Individual tube ducts within a solid smooth walled outer duct.
      4. UL: UL 910 and/or 2024 list with tags or marking and for cables listed under ANSI/UL-1666 (1997) or Washington State Labor and Industries recognized.
      5. National Electrical Code (NEC) Compliance: Comply with NEC as applicable.
    1. Fittings: Non-metallic couplings suitable for the application as recommended by the innerduct manufacturer.
  1. Sleeves for Pathways and Cables
     1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends, with plastic bushings.
     2. Sleeves for Rectangular Openings: Galvanized sheet steel. Minimum Metal Thickness:
        1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16” (400 mm), thickness shall be 0.052” (1.3 mm).
        2. For sleeve cross-section rectangle perimeter equal to, or more than, 50” (1270 mm) and (1) or more sides equal to, or more than, 16” (400 mm), thickness shall be 0.138” (3.5 mm).
     3. Refer to Section 27 05 00 – Common Work Results for Communications.
  2. Fire Stopping
     1. In all buildings, floor/ceiling assemblies, stairs, and elevator penetrations must be sealed with a 2-hour fire stop assembly at a minimum, unless otherwise noted.
     2. Contact Owner’s Representative to identify walls which are fire-rated construction. Walls must be sealed with a 2-hour fire stop assembly at a minimum.
     3. Communication pathways requiring fire stopping shall utilize removable/re- usable fire stopping putties for ease of Moves, Adds, and Changes.
     4. All fire stopping penetrations shall conform to the recommended practices listed in UL1479 or ASTM.
     5. Refer to Section 27 05 00 – Common Work Results for Communications for more information.
  3. Pull Cord
     1. The pull cord shall be new polypropylene over polyester rope with a minimum 1700 lb. tensile strength.
     2. The Contractor shall leave at least 18” of pull cord accessible at both ends of the conduit, cable tray, or innerduct.
     3. The pull cord shall be continuous with no knots or splices for the length installed.
  4. Grounding
     1. Comply with requirements in Section 27 05 26 – Grounding and Bonding for Communications Systems
     2. Comply with ANSI-J-STD-607-A.
  5. SUPPORTS, IN ADDITION TO STRUCTURAL SEISMIC SUPPORTS AND BRACING
     1. Structural supports and seismic bracing for cable trays shall be as shown in the design drawings and details. Seismic control shall meet requirements specified in Section 26 05 48 – Seismic Controls for Electrical and Communication Work.
  6. GROUT
     1. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

1. EXECUTION
   1. GENERAL
      1. Comply with NECA 1.
      2. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
      3. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
      4. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
      5. All installation shall be in accordance with manufacturer’s published recommendations.
      6. Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
      7. Right of Way: Give to piping systems installed at a required slope.
   2. PATHWAYS
      1. Cable Trays: Comply with NEMA VE 2 and ANSI/TIA-569-C.
      2. Cable pathways will follow the corridors of the building whenever possible.
      3. Where cable tray or conduit is not specified, a continuous pathway of independent supports shall be provided. The distance between supports shall not exceed 48” and shall be fastened to building structure.
      4. All metallic pathways will be bonded to complete continuity to building ground.
      5. Cable trays will be installed in accordance to NFPA 70, Article 392.
      6. Cable trays should not extend more than 12“ inside of the TR.
      7. Enclosed pathways will be provided with pull string rated at 200 lbs.
      8. Coordinate installation of cable tray with other trades to allow a minimum of 12” above, 18” in front, and 12” below of clearance from piping, conduits, ductwork, etc. Allowance must be provided for access to the tray with reasonable room to work. Obstructions to the tray must be minimized and cannot block more than 6’ of the tray at any point in the run.
      9. Cable trays will be installed to allow technician/installer adequate access and working clearances.
      10. Maintain the following distances for EMI sources:
          1. Comply with TIAEIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
          2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
             1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5”.
             2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12”.
             3. Electrical Equipment Rating More Than 5 kVA: A minimum of 24”.
          3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
             1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2”.
             2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6”.
             3. Electrical Equipment Rating More Than 5 kVA: A minimum of 12”.
          4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
             1. Electrical Equipment Rating Less Than 2 kVA: No requirement.
             2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3”.
             3. Electrical Equipment Rating More Than 5 kVA: A minimum of 6”.
          5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or higher: A minimum of 48”.
          6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5”.
      11. Coordinate with the architect the color scheme for the trays and other pathways in the open spaces to be inconspicuous.
      12. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Section 27 11 00 – Communications Room Equipment Fittings. Drawings indicate general arrangement of pathways and fittings.
      13. Comply with ANSI/TIA-569-C for pull-box sizing and length of conduit and number of bends between pull points.
      14. Comply with requirements in Section 26 05 33 – Raceways and Boxes for installation of conduits and wireways.
      15. Install manufactured conduit sweeps and long-radius elbows whenever possible.
   3. INSTALLATION OF PULL STRINGS
      1. The conduit/pathway installing contractor shall be responsible for installing a pull cord and true tape from end to end in every conduit, cable tray, and/or innerduct.
      2. Pull strings shall be left in place.
      3. In existing conduits or cable tray with existing pull strings, the Contractor shall replace used pull strings with new pull strings.
      4. Pull strings are not required where conduit or innerduct fill is greater than 33% after installation of cable.
   4. PATHWAY INSTALLATION IN COMMUNICATIONS EQUIPMENT ROOMS:
      1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
      2. Install cable trays to route cables if conduits cannot be located in these positions.
      3. Secure conduits to backboard when entering room from overhead.
      4. Extend conduits 3” (76 mm) above finished floor.
      5. Install metal conduits with bonding and grounding bushings and connect with bonding and grounding conductor to bonding and grounding system in compliance with ANSI/TIA-607-B and ANSI/NECA/BICSI-607.
   5. SUPPORTS AND BRACING
      1. Install in accordance with applicable codes and regulations and as shown on the structural plans and details.
      2. Fasten support channels, hanger rods, raceway clamps, and outlet and junction boxes to building structure using expansion anchors, beam clamps, metallic brackets, supports and bolts and spring steel clips.
      3. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports as called out in the plans and details. Provide additional supports on each side of bends.
      4. Use metallic toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; metallic expansion anchors or preset inserts in solid masonry walls; sheet metal screws in sheet metal studs and wood screws in wood construction; and channel supports clamped or bolted to joists, purlins, steel angles and beams.
      5. Do not fasten supports to piping, ductwork, mechanical equipment, or raceway.
      6. Do not use powder-actuated anchors.
      7. Do not drill holes or weld attachments to beams and other structural members without prior written approval from the Engineer.
      8. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
      9. Do not use nylon or plastic tie wraps, wood or plastic expansion inserts or adhesives as principal or secondary support means.
      10. Install enclosures and panel-boards with minimum of four anchors.
      11. Do not support raceway from ceiling wire supports.
      12. Where multiple runs of conduit can be run grouped together, run conduit in racks supported from the building structure. Form racks from strut-channel supported by at least two threaded rods, secured to the structure above.
      13. Cap top of open channel and pipe supports to prevent ingress of moisture and dirt.
   6. SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS
      1. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
      2. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
      3. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
      4. Each pipe sleeve, horizontal or vertical, shall have a plastic type “end-bushing” on both ends to protect cables from abrasion when pulled through sleeves. The “end-bushing” shall be installed prior to install cables through sleeve.
      5. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
      6. Cut sleeves to length for mounting flush with both surfaces of walls with respect to plastic “end-bushings”. The plastic “end-bushing” shall be plenum rated if applied in plenum space.
      7. Extend sleeves installed in floors 2” above finished floor level with respect to plastic “end-bushings”. The plastic “end-bushing” shall be plenum rated if applied in plenum space.
      8. Size pipe sleeves to provide 1/4” annular clear space between sleeve and pathway or cable, unless indicated otherwise.
      9. Seal space outside of sleeves with grout for penetrations of concrete and masonry. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
      10. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint.
      11. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Section 07 84 00 – Firestopping.
      12. Roof-Penetration Sleeves: Weather seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing Work.
   7. SLEEVE-SEAL INSTALLATION
      1. Install to seal exterior wall penetrations.
      2. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals, and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
      3. Provide sleeves for new conduit and cable penetrations of building construction.
         1. Openings to accept sleeves in new building construction will be formed in building construction by the Contractor for General Construction Work. Openings to accept sleeves in existing building construction shall be provided under this division of the Specifications. Refer to Article, CUTTING AND PATCHING in this section.
         2. Use galvanized rigid conduit sleeves for penetrations through exterior masonry/concrete walls and foundations, concrete floor slabs on grade and above grade, and concrete-filled decks.
         3. Use only fire-rated listed assemblies for the type of sleeve being installed through CMU walls or gypsum walls for communications penetrations. Sleeve type shall be galvanized rigid conduit.
      4. Where conduits are installed before building construction being penetrated, install sleeves loose around conduits. Split, fit, and weld steel sleeves over existing conduits, with respect to anything flammable in the surrounding environment.
      5. Secure sleeves firmly in place using filling and patching materials (grout) that match with surrounding construction.
      6. In floor penetrations, extend sleeve 4 inches above finished floor unless noted otherwise. In wall penetrations, cut sleeves flush with wall surface and use metal escutcheon plates in finished interior areas.
      7. Seal voids between sleeves and building construction with joint sealants. Make allowances for and coordinate the Work with installation of firestopping, conduit insulation, and waterproofing as applicable.
      8. The Contractor shall be fully responsible for final and correct location of sleeves. Sleeves which are omitted or incorrectly located in existing building construction, shall be corrected and provided by the Contractor, at no additional costs to the Port.
   8. PENETRATION OF BUILDING SURFACES
      1. Above Grade Level or Non-waterproof Areas
         1. Seal each annular space between conduits or cable and building surfaces. Pack space with Oakum, other rope packing, or backer rod materials and cover with fire-resistant sealant or other protection materials.
         2. Provide sleeves as specified in Article, SLEEVE-SEAL INSTALLATION in this section for conduit and cable penetrations. Seal each space between conduit or cable and sleeve. Sealing shall be as specified in above paragraph.
      2. Waterproof Areas (Above and Below Grade)
         1. In new and existing construction for penetrations through concrete below grade, ground water level, or in other waterproof areas, provide through-wall and floor seals having galvanized fittings, sealing assemblies, and sleeves as specified.
         2. In existing construction when core bore drilled openings are used for conduit penetrations below grade, ground water level, or in other waterproof areas, provide sealing.
      3. Fire-resistant Areas
         1. Provide through-penetration firestop systems for penetrations through fire-rated walls, floors, and other partitions of building construction. Comply with requirements in Section 07 84 00 – Firestopping.
         2. In walls or partitions with 2-hour or less fire ratings, provide only metallic outlet or device boxes installed per UL Fire Resistance Director, NEC, and other national building code requirements.
   9. TESTING
      1. Test cable trays to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. Refer to Section 26 05 26 – Grounding for testing and test methods.
      2. Manufacturer shall provide test reports witnessed by an independent testing laboratory of the “worst case” loading conditions outlined in this specification and performed in accordance with the latest version of NEMA VE-1.
   10. CUTTING AND PATCHING
       1. Provide openings, cutting, coring, and patching of openings in existing building construction as required.
       2. Perform cutting as not to impair structural stability of the building system. Do not drill holes or weld attachments to beams and other structural members without prior written approval from the Engineer.
       3. When penetrating fire walls, a UL listed, Or Approved Equal, fire stopping method shall be used at the penetration to maintain the fire rating of the wall.
2. 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

01/29/2015 Revised References

10/11/2018 Updated Specification to current standards and renamed

09/11/2020 Updated Specification per current F&I standards