

PART 1 GENERAL

1.01 SUMMARY OF WORK

- A. The extent and location of “Communication Pathways” 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, ladder rack cable tray, metallic conduit, plastic and fabric innerduct, pull boxes, structural supports, seismic bracing, handholes and boxes for exterior underground cabling.
- B. The Contractor shall provide and install all hardware, fasteners, or other materials required to install and support cable trays as shown on the drawings.
- C. All conduit and cable tray assemblies shall be rated for Seismic Zone 4.
- D. Cable pathways should also include open form cable trays for horizontal cable, in addition to other types of flexible cable trays.
- E. The use of aluminum cable tray is allowed.

1.02 RELATED REQUIREMENTS

- A. Electrical Standard 26 05 43 – Underground Ducts and Raceways for Electrical Systems.
- B. Electrical Standard 26 05 33 – Raceways and Boxes for Electrical Systems.

1.03 GOVERNING CODES, STANDARDS AND REFERENCES

- A. American National Standards Institute (ANSI)
- B. ANSI/UL-1666(1997) Test For Flame Propagation Height Of Electrical And Optical-Fiber Cables Installed Vertically In Shafts
- C. American Society for Testing and Materials (ASTM) A123 - Specification for Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
- D. ASTM A607 - Specification for Steel Sheet and Strip, Hot-Rolled and Cold-Rolled, High Strength, Low-Alloy Columbium and/or Vanadium.
- E. ASTM A653 SQ - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process, Structural (Physical) Quality
- F. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- G. National Electrical Code (NEC)
- H. National Electrical Manufacturers Association (NEMA) VE 1 – “Metal Cable Tray Systems”
- I. NEMA VE2, “Cable Tray Installation Guidelines”
- J. National Fire Protection Agency (NFPA) 70
- K. NFPA 70B, “Recommended Practice for Electrical Equipment Maintenance” cable tray systems
- L. Underwriters Laboratory (UL)
- M. UL 910 Test for Flame-Propagation and Smoke Density

- N. UL 2024 Standard for Cable Routing Assemblies and Communications Raceways
- O. Washington State Labor and Industry
- P. American National Standards Institute (ANSI)/National Fire Protection Agency (NFPA) 70 - National Electrical Code (NEC).

1.04 SUBMITTALS

- A. 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.
- B. 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).

1.05 QUALITY ASSURANCE

- A. 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.
- B. NEMA Compliance: Comply with NEMA standards publication number VE1, "Cable Tray Systems."
- C. NEC Compliance: Comply with NEC, as applicable to construction and installation of cable tray, conduit, and innerduct systems.
- D. Listing Compliance: Provide products that are UL labeled or Washington State Labor and Industry recognized.
- E. NFPA Compliance: Comply with NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" pertaining to installation of cable tray systems.

1.06 DRAWINGS

- A. 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.
- B. 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.

PART 2 PRODUCTS

2.01 COMMUNICATION CABLE TRAYS

- A. 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.
- B. Manufacturer: Cable tray systems shall be as manufactured by B-Line Systems, Chatsworth Products, Inc., Or Approved Equal.
- C. 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. 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.
 - 3. 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.
 - 4. NEC compliance: Cable trays shall be manufactured, to meet requirements of NEC Article 318 – Cable Trays. Bonding and grounding shall meet the requirements specified in Section 26 05 26 - Grounding.

2.02 CONDUIT REQUIREMENTS

- A. Size conduit for wires and cables as noted on Drawings. Typical Port minimum applications noted:
- B. Conduit penetrations into a new Equipment Room (ER) for Horizontal and Tenant Backbone infrastructure shall run to a minimum of one 36x36x16 Pull box (meet-me-box) with (4) 4" conduits into the ER.
- C. 4" conduit from Entrance Facility to Outside Plant (OSP) shall be (4) 4" conduits
- D. 4" conduit from (if no cable tray is present) Equipment Room (ER) to ER shall be (4) 4" conduits
- E. OSP ductbanks
 - 1. Comply with 26 05 43 Underground Ducts and Raceways for Electrical Systems.
 - 2. Minimum accepted; (2) 4" from each Maintenance Hole (MH)
 - 3. Backbone ductbank; (4) 4" from each Maintenance Hole (MH), concrete encased.

4. Tenant Demarcation conduit; One 2" conduit is placed from Destination Equipment location to the Port of Seattle ER or Micro Distribution Cabinet (MDC) that is within 90m.
5. Horizontal Data and Voice information outlet locations shall be 1" conduit to a 4x4 box, reducer to 1-gang.
- F. 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.
- G. The Contractor shall provide all metal conduits with threaded plastic bushings and pull cords.
- H. Routing of any metallic media cabling such as voice, data or coaxial in the same conduit as power conductors is not allowed.
- I. Continuous conduit runs shall not exceed 100 ft or have more than two 90 degree bends with out using appropriately sized pull boxes.
- J. Maximum conduit pathway capacity shall not exceed a 40% fill.

2.03 INNERDUCT

- A. Acceptable manufacturers:
 1. Pyramid
 2. Carlon
 3. Or Approved Equal.
- B. Specifications non-fabric duct
 1. Color: Orange
 2. Construction: Corrugated
 3. Pull Tape: Preinstalled, with footage markings
 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.
- C. Flexible fabric innerduct
 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.
 - D. Fittings: Non-metallic couplings suitable for the application as recommended by the innerduct manufacturer.
- 2.04 SUPPORTS, IN ADDITION TO STRUCTURAL SEISMIC SUPPORTS AND BRACING
- A. 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.
- 2.05 SLEEVES FOR PATHWAYS AND CABLES
- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends, with plastic bushings.
 - B. Sleeves for Rectangular Openings: Galvanized sheet steel.
 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).
- 2.06 PULL CORD
- A. 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.
 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 inches 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. Pull cord shall be installed by same contractor that installs the pathway.
- 2.07 GROUNDING SYSTEM AND CONDUCTORS
- A. Bonding and grounding shall meet the requirements specified in Section 26 05 26 - Grounding.
- 2.08 TRACER WIRE
- A. Single conductor copper wire, solid or stranded, #8 AWG
 - B. High Molecular Weight Polyethylene (SMWPE) insulation
- 2.09 GROUT

- A. 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.

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. All installation shall be in accordance with manufacturer's published recommendations.
- C. 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.
- D. Right of Way: Give to piping systems installed at a required slope.

3.02 SEPARATION FROM EMI SOURCES

- A. Comply with TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
- B. 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 inches.
 - 2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - 3. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
- C. 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 inches.
 - 2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - 3. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
- D. 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 inches.
 - 3. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
- E. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or higher: A minimum of 48 inches.

- F. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.03 SUPPORTS AND BRACING

- A. Install in accordance with applicable codes and regulations and as shown on the structural plans and details.
- B. 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.
- C. 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.
- D. 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.
- E. Do not fasten supports to piping, ductwork, mechanical equipment, or raceway.
- F. Do not use powder-actuated anchors.
- G. Do not drill or weld to existing structural steel members without specific permission of Construction Manager.
- H. 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.
- I. Do not use nylon or plastic tie wraps, wood or plastic expansion inserts or adhesives as principal or secondary support means.
- J. Install enclosures and panel-boards with minimum of four anchors.
- K. Do not support raceway from ceiling wire supports.
- L. 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.
- M. Cap top of open channel and pipe supports to prevent ingress of moisture and dirt.

3.04 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. 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.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. 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.

- E. 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.
- F. 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.
- G. Extend sleeves installed in floors 2 inches above finished floor level with respect to plastic “end-bushings”. The plastic “end-bushing” shall be plenum rated if applied in plenum space.
- H. Size pipe sleeves to provide ¼-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.
- I. 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.
- J. 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.
- K. 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.
- L. Roof-Penetration Sleeves: Weather seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing Work.

3.05 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. 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.
- C. 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.

- D. 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.
- E. Secure sleeves firmly in place using filling and patching materials (grout) that match with surrounding construction.
- F. 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.
- G. 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.
- H. 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.

3.06 UNDERGROUND DUCTS AND RACEWAYS

- A. Comply with 26 05 43 – Underground Ducts and Raceways for electrical systems.
- B. Tracer wire is required on all non-metallic underground conduits..
 - 1. Tape tracer wire to side of conduit every 8-10 feet.
 - 2. Terminate wire with purpose-built waterproof connectors.
 - 3. Perform a locate on the installation after conduit/ductbank has been buried, prior to project substantial completion..

3.07 PENETRATION OF BUILDING SURFACES

- A. 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.
- B. 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.
- C. 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.

3.08 TESTING

- A. 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.
- B. 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.

3.09 CUTTING AND PATCHING

- A. Provide openings, cutting, coring, and patching of openings in existing building construction as required.
- B. 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.
- C. 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.

PART 4 MEASUREMENT AND PAYMENT

4.01 GENERAL

- A. 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

01/23/2017 Incorporated ICT specifications

07/15/2021 Clarified requirements for pull cord.

01/01/2022 Removed reference to air blown fiber. Added requirements for exterior installations including ductbank.