SECTION 27 05 28

pathways for communication systems

Notes to the Specification Writer:

This Section has been written to cover most, but not all, project conditions that you will encounter. Depending on the project, you may need to add material, delete items, or modify what is currently written. Editing instructions are included throughout the document. (If this document is viewed or printed in color, these instructions appear in red specific bold italic text.)

Review this entire specification Section and edit it to meet the requirements of the specific project. Options or items where the specification writer’s input is needed are enclosed in [brackets].

Before publishing your final version of this specifications Section, remove all red bold italic instructions.

1. GENERAL

## SUMMARY

### This Section includes:

#### The supply, delivery, supervision, coordination, and installation of equipment items specified herein and shown on the Drawings

#### The documentation and instruction for completing the installation of Pathways for Communication Systems

### Examine the contract documents in their entirety (including drawings and specification sections in the other divisions) for requirements or work which may affect work under this section, regardless of whether such requirements or work are specifically indicated in this section.

### Contractor Shall Provide and Install

#### The materials and labor required for the installation of cable pathway systems include, but are not limited to:

##### Non-continuous cable supports

##### Non-metallic cable duct

##### Wire-mesh cable trays

#### Although such work is not specifically mentioned herein or on the Drawings, the Contractor shall furnish and install all miscellaneous items, accessories, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation, without claim for additional payment.

### Errors or Omissions in Drawings or Documentation

#### If any errors or omissions appear in Drawings, Specifications, or other documents, the bidding Contractor shall notify the Engineer no later than ten (10) days prior to submitting the bid.

#### Should conflict occur in or between Drawings and Specifications, the bidding Contractor is deemed to have estimated the more expensive way of doing the work, unless the bidding Contractor has asked for and obtained written decision (addendum) before submission of the bid as to which method or materials will be required.

### Related Sections:

#### Section 00 00 00 – Procurement and Contracting Requirements

#### Section 01 00 00 – General Requirements

#### Section 07 84 00 – Penetration Firestopping

#### Section 26 05 26 – Grounding and Bonding for Electrical System

#### Section 27 05 26 – Grounding and Bonding for Communication Systems

#### Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures

#### Section 27 11 26 – Communications Rack Mounted Power Protection and Power Strips

#### Section 27 13 23 – Communications Fiber Backbone Cabling

#### Section 27 15 13 – Communications Copper Horizontal Cabling

#### Section 27 16 13 – Communications Copper Custom Cable Assemblies

#### Section 27 16 13.01 – Communications Fiber Custom Cable Assemblies

#### Section 27 16 19 – Communications Patch Cords

## Definitions

### ANSI – American National Standards Institute

### AWG – American Wire Gauge

### BICSI – Building Industry Consulting Service International

### BCT – Bonding Conductor for Telecommunications

### EIA – Electronics Industries Alliance

### ETL – Intertek Certification Services

### IEC – International Electrotechnical Commission

### IEEE – Institute of Electrical and Electronic Engineers

### IDC – Insulation displacement contact

### ISO – International Standards Organization

### NECA – National Electrical Contractors Association

### NFPA – National Fire Protection Agency

### NRTL – Nationally Recognized Testing Laboratory

### TIA – Telecommunications Industry Association

### UL – Underwriters Laboratory

### Provide: Furnish, install, terminate, label, test and certify a complete operating cabling system.

### Contract Documents (CD): Design drawings, specifications, sketches, and schedules provided by the Engineer as they directly relate to this scope of work and this project.

### Structured Cabling Systems (SCS) wiring is defined as all required equipment and cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber cable installed and configured to provide computer data and voice connectivity.

### Point–of–Entry (POE): Unmarked Manholes/Vaults at property line

### NET–POP Rooms/MPOE (Main Point of Entry): The area where the outside plant media/carrier services appear in the facility. The NET–POP contains equipment used by owner or carrier to hand–off/transition cable from outside plant into inside plant type.

### Network Center/Main Distribution Frame (MDF) Areas: This technology space houses Layer 2/3 network switching gear and other main network distribution equipment and acts as the mid–connection point between the Core/Network and the TR/IDF/access zones for all connections.

### Telecommunications Room (TR)/Intermediate Distribution Frame (IDF): is the location for the termination of backbone cables and for termination of horizontal cables, and for the interconnection of each. The space also hosts access–layer switches and user network connections within each floor.

### Active Equipment: electronic equipment used to develop various WAN, LAN, and voice services, e.g., digital multiplexers, RS–232 controllers, Ethernet hubs, switches, routers, PBX, etc.

### Horizontal: cabling system consisting of media and termination hardware interconnecting the Telecommunication Outlets (TOs) and the TRs.

### Bonding: permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed on it.

### Basket Cable Tray: A cable support and management system fabricated of continuous, rigid, welded steel wire mesh and available in many sizes with attachment hardware suiting multiple installation methods

### Cable Tray: vertical or horizontal open supports, usually made of aluminum or steel, which are fastened to the building structure. Cables are laid in and fastened to the trays.

### Cabinet: free standing, floor–mounted or wall–mounted modular enclosure designed to house and protect rack–mounted electronic equipment and passive terminations.

### Channel: The end–to–end transmission path between two points at which application specific equipment is connected; encompasses all the elements of the horizontal cabling link, plus the equipment cords in the telecommunications spaces and work area.

### Cross–Connect: equipment used to terminate and tie together communications circuits.

### Cross–Connect Jumper: a cluster of twisted–pair conductors without connectors used to establish a circuit by linking two cross–connect termination points.

### Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.

### Jack: receptacle used in conjunction with a plug to make electrical contact between communications circuits, e.g., eight–position/eight–contact modular jacks.

### Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

### LAN: Local area network.

### Link: Horizontal cabling link encompassing all components of the horizontal cabling (TO, patch panels, blocks, jumpers and patch cords that join them in the horizontal cross–connect). It is distinguished from a channel because it does not include the equipment cables/cords at the telecom spaces or work area.

### Media: twisted–pair, and fiber optic cable or cables used to provide signal transmission paths.

### Mounting Frame: rectangular steel framework, which can be equipment rack or wall mounted to support wiring blocks, patch panels, and other communications equipment.

### Outside Plant (OSP): generally, any and all portions of the cable system that runs outside of an environmentally enclosed structure and/or building with each end terminated at different buildings. This specifically includes inter–building cables, conduits, manholes, hand–holes, and innerduct.

### UTP: Unshielded Twisted Pair.

### FO: Fiber Optic

### Passive Equipment: non–electronic hardware and apparatus, e.g., equipment racks, cable trays, electrical protection, patch panels, wiring blocks, fiber optic shelves, etc.

### Patch Cords: a length of wire or fiber cable with connectors on one or both ends used to join communications circuits at a cross–connect.

### Patch Panel: system of terminal blocks or connectors used with patch cords that facilitate administration of cross–connect fields.

### Pathway: facility for the placement of communications cable. A pathway facility can be composed of several components including conduit, wireway, cable tray, surface raceway, under floor systems, overhead systems, raised floor, ceiling support wires, etc.

### Protectors: electrical protection devices used to limit foreign voltages on metallic communications circuits.

### Raceway: an enclosed channel designed expressly for holding wires or cables; may be of metal or insulating material. The term includes conduit, tubing, wire ways, under floor raceways, overhead raceways and surface raceways; does not include cable tray.

### Racks: An open, freestanding, floor–mounted structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack.

### Riser Backbone: The Riser Backbone subsystem links the main cross connect (MDF) in the equipment room to the distribution rooms (TRs).

### Structured Cabling System (SCS): A SCS is defined as all required cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber optic cable installed and configured to provide computer data and voice connectivity from each data or voice device to the network file server or voice network/switch designated as the service point of the local area network.

### Telecommunication Outlet (TO): Connecting device mounted in a work area used to terminate horizontal cable and interconnect cabling with station equipment.

### Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

### Work Area Subsystem: The connection between the telecommunications outlet and the station equipment in the work area is provided by the Work Area Subsystem. It consists of cords, adapters, and other transmission electronics.

### Wireless Access Point (WAP): Telecom outlet designated for use with wireless network devices. Such an outlet shall be mounted above the ceiling.

### Contractor – The successful bidder engaged to provide the work of this specification

## REFERENCES

### Design, manufacture, test, and install telecommunications cabling networks per manufacturer’s requirements and in accordance with latest revision of the NFPA-70 (the National Electrical Code®), state codes, local codes, requirements of Authorities Having Jurisdiction (AHJs), and the following standards, including the most current revisions, addenda, and any Technical Service Bulletins (TSB’s) released at the time of bid, including the most recent editions and addenda of the following documents:

### ANSI/TIA 568 series, most recent revisions, addenda and systems bulletins. All applicable

### ANSI/TIA–569 Telecommunications Pathways and Spaces, most recent revision including all relevant addenda and systems bulletins

### ANSI/TIA–606 Administration Standard for Telecommunications Infrastructure, most recent revision including all addenda and systems bulletins

### ANSI/TIA–607 Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises, most recent revision including all addenda and systems bulletins

### ANSI/TIA–862 Structured Cabling Infrastructure Standard for Intelligent Building Systems, most recent revision including all addenda and systems bulletins

### ANSI/TIA–942 Telecommunications Infrastructure Standard for Data Centers, most recent revision including all addenda and systems bulletins

### ANSI/TIA–1179 Healthcare Facility Telecommunications Infrastructure Standard, most recent revision including all addenda and systems bulletins

### ANSI/TIA–4966 Telecommunications Infrastructure Standard for Educational Facilities, most recent revision including all addenda and systems bulletins

### ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel

### ASTM A 653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process

### ASTM A 510 – Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

### NEMA VE 1-2017/CSA C22.2 No. 126.1-17 – Metal Cable Tray Systems

### NEMA VE 2-2013 – Cable Tray Installation Guidelines

### ASTM A 641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

### IEC 61537 (2023) – Cable Tray Systems and Cable Ladder Systems for Cable Management

### ASTM D 3363 - 05 Standard Test Method for Film Hardness by Pencil Test

### NEC Article 392 – Cable Trays

### TIA–TSB–162 Telecommunications Cabling Guidelines for Wireless Access Points, most recent revision including all addenda and systems bulletins

### Telecommunications Distribution Methods Manual, most recent edition

### Information Transport Systems Installation Methods Manual (ITSIMM), most recent edition

### National Electric Codes (NEC) – all applicable

### OSHA Standards and Regulations – all applicable

### Local Codes and Standards – all applicable

### UL444 – Standard for Safety of Communications Cable

### UL 1666 – Standard for Safety of Flame Propagation Height

### Local Authority Having Jurisdiction (AHJ)

### Anywhere cabling standards conflict with one another or with electrical or safety codes, Contractor shall defer to the NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either

### Any violations of applicable standards or codes committed by the Contractor shall be remedied at the Contractor’s expense

## SYSTEM DESCRIPTION

### Pathways

#### Pathways are the support system for the infrastructure. All pathways shall conform to the TIA-569-B Commercial Building Standard for Pathways and Spaces. All horizontal and backbone cable shall be properly supported every 48” to 60” inches. Infrastructure Support Systems include, but may not be limited to, the following:

##### Conduits, both inside or outside, both above ground or underground, all of which shall be properly supported

##### Non-continuous cable supports, which shall be spaced no more than 60” inches apart

##### Non-metallic Pathway to separate copper and fiber cables

##### Filler

#### The optical fiber cable system shall be designed to segregate, route, and protect fiber optic and high-performance copper cabling between equipment racks and cabinets within a data center, telecommunications room, or service provider facility. The fiber routing systems are defined to include, but are not limited to straight sections of channel, covers, couplers, fittings and brackets.

#### Wire-mesh cable tray routes shown on the project drawings are indicative of the design intent and desired routing. The Contractor is responsible for detailed routing within the facility and shall coordinate the detailed routing with the Owner.

## SUBMITTALS

### Engineer’s Review

#### The Engineer’s review of shop drawings or samples shall not relieve the Contractor of responsibility for any deviation from the contract documents.

#### With the shop drawings, the Contractor shall include an index sheet detailing all deviations from the contract documents, and will be held responsible for all deviations, unless the Contractor has received written approval from the Engineer for the specific deviation, separate from general shop drawing approval.

#### The Engineer’s review shall not relieve the Contractor from responsibility for errors or omissions in the shop drawings or samples.

### General Component Data

#### For all products covered under this Section, the Contractor shall submit the following data for each component:

##### A Specification Section

##### The Manufacturer’s name.

##### The Manufacturer’s model and part number

### Identification

#### In addition to the general requirements above, the Contractor shall submit the following additional data:

##### Cable identification numbers scheme for all installed items

## QUALITY ASSURANCE

### Standards for Materials and Equipment

#### The Contractor shall provide all materials, equipment, and installation in compliance with the latest applicable standards from ANSI, FCC, ASTM, EIA/TIA, IEEE, NEC, NFPA, NEMA, OSHA, REA, and UL.

### Installer Qualifications

#### Refer to Section 27 05 00

## DELIVERY, STORAGE, AND HANDLING

### To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling

### The contractor shall coordinate the secure storage of equipment and materials on site, or, if no on-site storage is available, shall provide their own secure storage at the Contractor’s expense.

#### Do not store equipment where conditions fall outside the manufacturer's recommendations for environmental conditions.

#### Do not install damaged equipment. Remove environmental conditions from the site and replace damaged equipment with new equipment.

#### If off-site storage of materials is necessary, this shall be at the Contractor’s expense.

## COORDINATION

### The Contractor shall coordinate with all other trades. The Contractor will submit a schedule for the installation within 10 days of contract award.

#### The schedule shall include delivery, installation, and testing for conformance to specific job completion dates.

#### At minimum, the schedule shall provide dates for the start of demolition, the completion of demolition, the installation start date, the completion of copper cabling, the completion of backbone cabling, the completion of testing and labeling, cutover, the completion of the final punch list, final inspection, and acceptance.

### Meeting Attendance and Schedule Adherence

#### The Contractor must attend all project-related meetings and adhere to the schedule set by the Project Manager.

### Final Inspection

#### The Contractor is required to notify the Engineer of a proposed appointment for Final Inspection at least 72 hours before the appointment.

#### Within five working days after the final inspection, the Contractor shall send final project documentation and warranty information to the Owner and Engineer. The final project documentation shall include, but may not be limited to:

##### As-Built Drawings, in a CAD format, with legible outlet address and cable paths

##### Factory Test Results for each installed item with appropriate Identification

##### Outlet location spreadsheets with appropriate Identification

##### Warranty paperwork

##### A copy of the Final Inspection and Acceptance Signoff Sheet

##### Photos of each ER and TR

## PROJECT CONDITIONS

### Project Environmental Requirements

#### Hazardous Materials Prohibition

##### The Contractor shall ensure that all materials used in the project are asbestos-free, unless specifically authorized in writing by the Owner

#### Existing Conditions

##### Verify that all conditions on the project site are acceptable for the Work specified in this Section. Prior to bid opening, notify the Consulting Engineer, in writing, of any discrepancies, conflicts, or omissions. Otherwise, correct these issues at no additional cost to the Owner.

##### Continue to monitor the project site. If conditions develop that require a variance from the Specifications or Drawings, then immediately notify the Owner in writing. Otherwise, make recommendations, submit drawings showing how the Work may be installed, and, upon approval, proceed with the necessary changes without additional cost to the Owner.

### Record Drawings

#### Keep a complete set of all telecommunications drawings in the job site office for demonstration of the actual installation work specified in this Section.

#### Use this set of drawings for no other purpose.

#### Where any material, equipment, or system components are installed differently than what is shown on the drawings, indicate the differences clearly and neatly using ink or indelible pencil.

#### Upon completion of the project, submit the record set of drawings.

## USE OF THE SITE

### Where the Owner deems it necessary to place restrictions, use the site as directed by the Owner.

### When proceeding with the work, do not interfere with the ordinary use of streets, aisles, passages, exits, or operations of the Owner. During the day, set up cones and barriers in hallways and walkways. Do not string cable down the hallways during normal hours.

### Request a hazardous materials worksheet that identifies potentially-hazardous locations. Do not proceed with any work in locations where hazardous materials are known to be. Obtain instructions from the Contractor’s Project Manager on and when to work in these areas.

### Multiple times each day, each contractor shall remove all trash and debris from the site. Before leaving the room each day:

#### The Contractor shall replace all ceiling tiles that they have removed.

#### The Contractor shall place all furniture and equipment that they have moved back into its original location.

#### The Contractor shall return any equipment that they have disconnected to working order.

#### The Contractor’s Job Foreman shall inspect all work locations to ensure that the rooms are clean and that all of the tasks described above have been done.

#### It is recommended that the Contractor inspect the site and take pictures to document the condition of the ceilings and walls.

## CONTINUITY OF SERVICES

### Take no action that will interfere with or interrupt existing building services, unless previous arrangements have been made with the Owner's representative. Arrange all work to minimize shutdown time.

### The Owner's personnel shall perform shutdown of operating systems. When shutdown of systems is required, the Contractor shall give three (3) days advance notice.

### Should building services be inadvertently interrupted:

#### The Job Foreman shall immediately notify the Project Manager of the accidental disruption of services, the remedy, and how long it will take to restore services.

#### The Contractor shall immediately furnish the labor, including overtime, the material, and the equipment necessary to promptly restore the interrupted service at no cost to the Owner.

## WARRANTY

### Refer to Section 27 05 00

#  PRODUCTS

## GENERAL

### Refer to Section 27 05 00 for General Requirements

### All materials and products shall be:

#### Appropriate for the intended use

#### Recognized as such by a Nationally Recognized Testing Laboratory (NRTL) such as Underwriters Laboratories (UL), ETL SEMCO (ETL), the Canadian Standards Association (CSA) or the American National Standards Institute (ANSI)

#### Permitted by the Authority Having Jurisdiction (AHJ)

### All products shall be new, of the latest version at time of bid, and brought to the job site in original manufacturer's packaging. Used equipment and damaged material will be rejected.

### Any modifications to equipment to suit the intent of the specifications shall be performed in accordance with these requirements.

### Take care during installation to prevent scratches, dents, chips, etc. Equipment with significant or disfiguring cosmetic flaws will be rejected.

### All components will be approved by the Engineer and shall have the most aesthetic value possible while maintaining specified functionality. Hardware shall:

#### Be in compliance with the Construction Documents

#### Have fit and finish compatible with the existing surrounding structure

#### Be unobtrusive

#### Provide the required functionality

### Provide products that are suitable for the intended use, including, but not limited to environmental, regulatory, and electrical factors.

## SUBSTITUTION POLICY

### This is a performance-based specification developed from the experience of [Client Name] IT in providing exceptional solutions for all our facilities and departments. As such, substitution of specified products or systems is not allowed.

### Contractor shall assume all costs for removal and replacement of any product installed in substitution of those specified. Such costs shall include but not be limited to labor, materials as well as any penalties, fees or costs incurred for late completion.

### Refer to Section 27 05 00

## NON-CONTINUOUS CABLE SUPPORTS

### Non-continuous cable supports shall be J-MOD™/ J-PRO™ Cable Support System

### Non-continuous cable supports must:

#### Have a cable-bearing surface on the bottom that is at least equal to the full radius of the cable

#### Maintain complete horizontal and vertical bend radius control of 1 inch

#### Have 90° radius edges to prevent damage while installing cables

#### Be designed so that the mounting hardware is recessed to prevent cable damage

#### Have a removable and reusable hook and loop retainer to contain the cables within the hook

#### Be factory-assembled for direct attachment to walls, hanger rods, beam flanges, purlins, struts, floor posts, etc. as needed for various on-site conditions

#### Be manufactured from a non-conductive material suitable for use in air-handling spaces

### Provide separate cabling compartments or where additional capacity is needed, multi-tiered non-continuous cable supports shall be used.

### (CUSTOMER) approved Manufacturer:

#### Panduit

### (CUSTOMER) approved J-MOD part numbers. The part numbers and sizes listed are a small subset of the number available. For additional information, contact Panduit customer service or refer to the current parts catalog.

| **J-MOD*****Part Number*** | **Description** | **Max Cable Capacity****OD (0.300”)** | **OD (0.240”)** | **OD (0.225”)** |
| --- | --- | --- | --- | --- |
| JMJH2W-X20 | J Hook for wall mount applications \* | 30 | 46 | 55 |
| JMJH2-X20 | J Hook for use with brackets \* | 30 | 46 | 55 |
| JMCB-X | Chaining Bracket |  |  |  |
| JMTRB38-3-X\*\* | Threaded Rod Bracket – 3 level |  |  |  |

#### \*\* Not for use with chaining brackets

#### \* Suitable for use in air handling spaces per UL 2043.

#### Listed in accordance with CAN/ULC S102.2 when mounted as single units or in pairs.

#### Minimum spacing of 4 ft. (1220mm) required between mount points.

#### (Flame Spread Rating = 0, Smoke Developed Classification = 30)

### (CUSTOMER) approved J-PRO part numbers. The part numbers and sizes listed are a small subset of the number available. For additional information, contact Panduit customer service or refer to the current parts catalog.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Part Number** | **Part Description** | **Bundle Capacity****(In)** | **Material\*** | **Max. Cable Capacity** |
| **Cat 6 (0.240”)** | **Cat 5e (0.225”)** |
| **JP75DW-L20** | J Hook with clip for use with #12 wire, threaded rod up to 3/8" in diameter, or 1/8" – 3/8" thick flanges. | 0.75 | Nylon 6.6 J Hook with metal attachments | 8 | 10 |
| **JP75HBC50RB-L20** | J Hook with hammer-on beam clamp for use with flanges 5/16" – 1/2" thick. Rotates 360 degrees.  | 0.75 | Nylon 6.6 J Hook with metal attachments | 8 | 10 |
| **JP75SBC50-L20** | J Hook with screw-on beam clampfor use with flanges up to 1/2" thick. | 0.75 | Nylon 6.6 J Hook with metalattachments | 8 | 10 |
| **JP75SBC50RB-L20** | J Hook with screw-on beam clampfor use with flanges up to 1/2" thick. Rotates 360 degrees. | 0.75 | Nylon 6.6 J Hook with metalattachments | 8 | 10 |
| **JP75UF100-L20** | J Hook with under floor pedestal support clamp for use with pedestal support up to 7/8” sq. or 1 1/8”- 1 3/8” in diameter. | 0.75 | Nylon 6.6 J Hook withmetal attachments | 8 | 10 |
| **JP75W-L20** | J Hook for wall mount applications. One 1/4" (M6) mounting hole for user supplied screw. | 0.75 | Nylon 6.6 | 8 | 10 |
| **JP75WP2-L20** | J Hook for powder actuated installation on walls. One 5/32" (M4) mounting hole and one ¼” (M6) mounting hole for user supplied fasteners. | 0.75 | Nylon 6.6 J Hook with metal attachments | 8 | 10 |
| **JP75ZP-L20** | J Hook with z-purlin clip for use with angled flanges up to 1/4" thick. | 0.75 | Nylon 6.6 J Hook with metal attachments | 8 | 10 |
| **JP131CM-L20** | J Hook with ceiling mount bracket that has one 3/16" (M5), 1/4" (M6) and 3/8" (M10) mounting hole. | 1.31 | Nylon 6.6 J Hook with metal attachments | 25 | 29 |
| **JP131CP-L20** | J Hook with c-purlin clip for use with vertical flanges up to 1/4" thick. | 1.31 | Nylon 6.6 J Hook with metal attachments | 25 | 29 |
| **JP131DW-L20** | J Hook with clip for use with #12 wire, threaded rod up to 3/8" in diameter, or 1/8" – 3/8" thick flanges. | 1.31 | Nylon 6.6 J Hook with metal attachments | 25 | 29 |
| **JP131WP2B-L20** | J Hook for powder actuated installation on walls. One 5/32" (M4) mounting hole and one ¼” (M6) mounting hole for user supplied fasteners. | 1.31 |  Nylon 6.6 J Hook with metal attachments | 25 | 29 |
| **JP4HBC25RB-X20** | J Hook with hammer-on beam clamp for use with flanges 1/8" -1/4" thick. Rotates 360 degrees. | 4 | Nylon 6.6 J Hook with metal attachments | 180 | 200 |
| **JP4SBC50-X20** | J Hook with screw-on beam clamp for use with flanges up to 1/2" thick. | 4 | Nylon 6.6 J Hook with metal attachments | 180 | 200 |
| **JP4SBC50R-X20** | J Hook with screw-on beam clamp for use with flanges up to 1/2" thick. Rotates 360 degrees. | 4 | Nylon 6.6 J Hook with metal attachments | 180 | 200 |
| **JP4SBC87-X20** | J Hook with screw-on beam clamp with flanges up to 3/4" thick. | 4 | Nylon 6.6 J Hook with metal attachments | 180 | 200 |
| **JP4SBC87RB-X20** | J Hook with screw-on beam clamp with flanges up to 3/4" thick. Rotates 360 degrees. | 4 | Nylon 6.6 J Hook with metal attachments | 180 | 200 |
| **JP4UF100-X20** | J Hook with under floor pedestal support clamp for use with pedestal support up to 7/8” sq. or 1 1/8”- 1 3/8” in diameter. | 4 | Nylon 6.6 J Hook with metal attachments | 180 | 200 |
| **JP4W-X20** | J Hook for wall mount applications. One 1/4" (M6) mounting hole for user supplied screw. | 4 | Nylon 6.6 | 180 | 200 |
| **JP4WP2-X20** | J Hook for powder actuated installation on walls. One 5/32" (M4) mounting hole and one ¼” (M6) mounting hole for user supplied fasteners. | 4 | Nylon 6.6 J Hook with metal attachments | 180 | 200 |
| **JP4ZP-X20** | J Hook with z-purlin clip for use with angled flanges up to 1/4" thick. | 4 | Nylon 6.6 J Hook with metal attachments | 180 | 200 |

#### \* Suitable for use in air handling spaces in accordance with Sec. 300.22 (c) and (d) of the National Electrical Code when mounted as single units or in pairs.

#### JP4 family of parts suitable for use in single unit configurations only.

#### Listed in accordance with CAN/ULC S102.2 when mounted as single units or in pairs.

#### Maximum spacing of 4’ (1220mm) required between mount points.

####  (Flame Spread Rating = 0, Smoke Developed Classification = 20)

## NONMETALLIC CABLING DUCT - FiberRunner®

### Nonmetallic cabling duct shall be used to segregate and route cables between the equipment racks and cabinets in the data center. The nonmetallic cabling duct system shall include, but is not limited to, straight sections of channel, covers, couplers, fittings, and brackets.

### Nonmetallic Cabling Duct Materials shall meet the following requirements:

#### The channel and all nonmetallic system components shall be manufactured with UL-recognized materials that exhibit nonflammable self-extinguishing characteristics of UL94 (V 0).

#### The base and cover shall be manufactured of a rigid PVC material.

#### Molded fittings shall be manufactured of a rigid PC/ABS material.

#### Acceptable colors are yellow or black.

### The nonmetallic cabling duct system channel and cover shall meet the following requirements:

#### It shall have a two-piece design, with a base and cover.

#### To retain and inhibit cover movement, it shall have an integral high-friction design.

#### The 12” x 4” (305mm x 100mm), the 6” x 4” (150mm x 100mm), and the 4” x 4” (100mm x 100mm) covers shall snap on the base and shall hinge from one side.

#### The 2” x 2” (51 mm x 51 mm) covers shall snap on the base and hinge from both sides.

#### The 24” x 4” (610mm x 100mm) covers shall snap on the base and have retention geometry capable of holding other cover sections that are removed to access the base during cable installation.

### Couplers

#### Couplers shall be used at each connection.

#### Each fitting-to-fitting, channel-to-fitting, and channel-to-channel connection shall require a coupler.

#### Couplers shall be supplied pre-assembled. They shall be ready to use, they shall not require any bolts to fasten, nor shall any adjustments need to be made.

#### The coupler shall be removable when needed.

### Fittings

#### A full complement of fittings must be available including, but not limited to, 45° and 90° flat, vertical, inside and outside elbows, horizontal and vertical tees, cross fittings, spillouts, reducers, end caps, and all other components required to make the system workable.

#### Snap-on split covers shall be available for all directional fittings.

#### The fittings shall be capable of maintaining a minimum cable bend radius of 2 inches (51 mm).

#### All fitting bases and covers shall be supplied as separate components, except for the 2” by 2” (51 mm x 51 mm) size, where the fitting bases and covers are supplied together

### System Spillouts and Accessories

#### Multiple spillout options shall be provided to accommodate the safe transition from horizontal to vertical runs into various equipment and rack configurations.

#### The spillout options shall include, but are not limited to, channel, slotted channel, corrugated loom tubing, and three-sided bend radius trumpets.

### Adapters to Competitive Systems

#### To help facilitate the transition from other existing pathway systems to the selected system, adapters shall be offered in various sizes.

#### The other existing pathway systems that must be accommodated include, but are not limited to, CommScope, Amphenol Telect, Hellerman Tyton, Newton, and Warren & Brown.

### Mounting Brackets

#### A full complement of mounting brackets must be available, including, but not limited to, new and existing threaded rod bracket kits, wall bracket kits, cabinet bracket kits, equipment rack kits, and all other components necessary to make the system workable.

#### The mounting brackets shall be manufactured from commercial grade cold-rolled steel with zinc chromate, e-coating, or painted black powder coat finish.

#### The channel shall be attached to the brackets by securing the bracket slide clamps to the rail on the bottom of the channel base.

### (CUSTOMER) approved Manufacturer:

#### Panduit

### (CUSTOMER) approved FiberRunner® part numbers. The part numbers and sizes listed are a small subset of the number available. For additional information, contact Panduit customer service or refer to the current parts catalog.

| Part Number | Description |
| --- | --- |
| FR6X4YL6 | FiberRunner® Channel, 6” x 4” (150mm x 100mm), 6’ Long, YL |
| FRHC6YL6 | FiberRunner® Hinged Channel Cover, Snap-On, 6” x 4” (150mm x 100mm), 6’ Long, YL |
| FRSHC6YL6 | FiberRunner® Channel Split Hinged Cover, Snap-On, 6” x 4” (150mm x 100mm) 6’ Long, YL |
| FRBC6X4LYL | FiberRunner® Coupler, 6” x 4” (150mm x 100mm), YL |
| FREC6X4LYL | FiberRunner® End Cap Fitting,6” x 4” (150mm x 100mm), YL |
| FRFWC6X4LYL | FiberRunner® 4-Way Cross Fitting, 6” x 4” (150mm x 100mm), YL |
| FRFWCSC6LYL | FiberRunner® 4-Way Cross Split Cover, 6” x 4” (150mm x 100mm), YL |
| FRH45SC6LYL | FiberRunner® Split Cover for Horizontal 45° Fitting, 6” x 4” (150mm x 100mm), YL |
| FRIV456X4LYL | FiberRunner® Inside Vertical 45° Fitting and Cover, 6” x 4” (150mm x 100mm), YL |
| FRIVRA6X4LYL | FiberRunner® Inside Vertical 90° Fitting and Cover, 6” x 4” (150mm x 100mm), YL |
| FROV456X4LYL | FiberRunner® Outside Vertical 45° Fitting, 6” x 4” (150mm x 100mm), YL |
| FROV45SC6LYL | FiberRunner® Split Cover for Outside Vertical 45° Fitting, 6” x 4” (150mm x 100mm), YL |
| FROVRA6X4LYL | FiberRunner® Outside Vertical 90° Fitting, 6” x 4” (150mm x 100mm), YL |
| FROVRASC6LYL | FiberRunner® Split Cover for Outside Vertical 90° Fitting, 6” x 4” (150mm x 100mm), YL |
| FRRA6X4LYL | FiberRunner® Horizontal Right-Angle Fitting, 6” x 4” (150mm x 100mm), YL |
| FRRASC6LYL | FiberRunner® Split Cover for Horizontal Right-Angle Fitting, 6” x 4” (150mm x 100mm), YL |
| FRT6X4LYL | FiberRunner® Horizontal Tee Fitting, 6” x 4” (150mm x 100mm), YL |
| FRTSC6LYL | FiberRunner® Split Cover for Horizontal Tee Fitting, 6” x 4” (150mm x 100mm), YL |
| FRRF64LYL | FiberRunner® Reducer Fitting and Cover, From 6” x 4” FiberRunner to 4” x 4” Fiber-Duct, YL |
| FRADC6X4YL | FiberRunner® Adapter Fitting, From 6” x 4” FiberRunner to 4” x 6” CommScope FiberGuide, YL |
| FRSPJ2X2LYL | FiberRunner® Spill-Over Junction Fitting with 2x2 Exit, YL |
| FRSPJC26LYL | FiberRunner® Spill-Over Junction Cover for FRSPJ2X2LYL Spillover on 6”x4” Channel |
| FRVT6X4LYL | FiberRunner® Vertical Tee Fitting, 6” x 4” (150mm x 100mm), YL |
| FIDT4X4LBL | FiberRunner® 2-Port Spillout to 1.5” (38mm) Inside Diameter Corrugated Tube Fitting, BL |
| FTR4X4LYL | FiberRunner® 3-Sided Vertical Tee Spillout Trumpet Fitting, YL |
| F2PCLB58 | FiberRunner® 2-Piece Ladder Rack Bracket for 5/8-11- Threaded Rod  |
| FR6TRBN58 | FiberRunner® QuikLock New Threaded Rod Bracket for 5/8-11 Threaded Rod, Compatible with 4” x 4” & 6” x 4” FiberRunner |
| FR12TB12N | FiberRunner® QuikLock Trapeze Bracket for ½-13 Imperial or M12x1.75MetricThreaded Rod, Compatible with 6” x 4” and 4” x 4” |

## Panduit Wire BASKET – WIRE MESH CABLE TRAY

### Cable trays and accessories shall be as defined in NFPA 70 and shall be marked for intended location, application, and grounding.

### Obtain cable trays and components from Panduit in compliance with the requirements outlined in this specification.

### Provide cable trays and accessories of the types, materials, sizes, and configurations specified by the cable tray drawings

### The cable tray must be capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.

#### Concentrated Load: A load applied at midpoint of span and centerline of tray.

#### Load and Safety Factors: Applicable to both side rails and rung capacities.

### The cable tray shall be formed of a standard 3.7” (94 mm) by 5” (127 mm) wire mesh pattern with intersecting wires welded together to maximize cable exit capacity and minimize the number of pathway wires that need to be cut during when making length reductions or field fabricating bends and intersections.

### The mesh sections must have at least one bottom longitudinal wire along the entire length of the section.

### The cable tray materials shall have high-strength steel longitudinal wires with no bends.

### To protect the cables from damage and installers from injury, the wire ends along the wire-mesh pathway shall be rounded during manufacturing.

### Straight sections of the cable tray shall have the following requirements:

#### Furnished in standard 118” (3000 mm) lengths

#### Furnished in ~~s~~ix standard widths: 4” (100 mm), 6” (150 mm), 8” (200 mm), 12” (300 mm), 18” (450 mm, and 24” (600 mm)

#### Furnished in three standard depths: 2” (50 mm), 4” (100 mm), and 6” (150 mm)

### 4. Top longitudinal wire on each sidewall to have T-Weld to protect cable insulation and minimize risk of installer injury

### Cable Tray Material: Carbon Steel Wire, ASTM A510, Grade 1008

#### Electrodeposited Zinc Plating: ASTM B633, Type III, SC-1

#### Powder Coated: Black and White

### The available loading width in the cable tray shall match the width listed above for the cable tray deployed and the available loading depth in the cable tray shall match the height listed above.

### Splice connectors shall:

#### Allow for two sections of the cable tray to be quickly joined

#### Ensure electrical continuity throughout the cable tray system when bolt-on splice components are installed on bare metal or Electro Zinc surface finishes.

#### Neither splices in the support span nor intersections shall diminish the rated loading capacity of the cable tray.

### Cable Tray Accessories

#### The cable tray supports, and connectors shall be as recommended by the cable tray manufacturer.

### (CUSTOMER) approved Manufacturer:

#### Panduit

### (CUSTOMER) approved Wire-Mesh Cable Tray part numbers. The part numbers and sizes listed are a small subset of the number available. For additional information, contact Panduit customer service or refer to the current parts catalog.

| Part Number | Description |
| --- | --- |
| PWB4X12EZ | Wire Basket Pathway, 4” (100mm) H x 12” (300 mm) W x 118” (3000 mm) L, Electro Zinc (EZ) Finish |
| PWBIB4EZ | Wire Basket Intersection 90 Bracket, 4” (100mm) H, 3” (76.2mm) Radius, Electro Zinc (EZ) Finish |
| PWBHKBL | Wire Basket Hardware Kit, 50 Per Bag, Black Anodized Zinc Finish |
| PWBSCEZ | Wire Basket Strut Mount Clip, 50 Per Bag, Electro Zinc Finish |
| PWBCB18BL | Wire Basket Cantilever Bracket, 18” (450 mm) L, Black Powder Coat Finish |
| PWBWFWEZ | Wire Basket Bottom Waterfall Wide, Electro Zinc Finish |
| PWBSPJ4BL | Wire Basket Sidewall Spillover Exit, 4” (100 mm) x 4” (100mm) Cable Exit, Black |
| PWBTB24EZ | Wire Basket Trapeze Bracket, 24” (600 mm) Pathway, Electro Zinc Finish |
| PWBTSBEZ | Wire Basket Trapeze Support Hanger Bracket, Electro Zinc Finish |
| PWBWMWBL | Wire Basket Wall Termination Bracket, Wide, Black Powder Coat Finish |

## WYRGRID® – OVERHEAD CABLE TRAY

### Cable trays and accessories shall be as defined in NFPA 70 and shall be marked for intended location, application, and grounding.

### Obtain cable trays and components from Panduit in compliance with the requirements outlined in this specification.

### Provide cable trays and accessories of the types, materials, sizes, and configurations specified by the cable tray drawing

### The cable tray must be capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.

####  Concentrated Load: A load applied at midpoint of span and centerline of tray.

#### Load and Safety Factors: Applicable to both side rails and rung capacities.

### The cable tray shall be formed of a standard 3.7” (94 mm) by 5” (127 mm) wire mesh pattern with intersecting wires welded together. The mesh sections must have at least one bottom longitudinal wire along entire length of the section.

### To minimize cutting on straight sections and eliminate cutting at intersections, straight sections of the cable tray shall be furnished without integral sidewalls.

### To retain cables within the cable tray system, optional snap-on sidewalls shall be installed where needed.

### To accommodate future cabling requirements without having to replace the cable tray, the optional snap-on sidewalls must be removable, so that they can be replaced with larger sidewalls.

### The cable tray materials shall have high-strength steel longitudinal wires with no bends.

### To protect the cables from damage and installers from injury, the wire ends along the wire-mesh pathway shall be rounded during manufacturing.

### Straight sections of the cable tray shall have the following requirements:

#### Furnished in standard 118” (3000 mm) lengths

#### Furnished in four standard widths: 12” (305 mm), 18” (457 mm), 24” (610 mm) and 30” (762 mm)

#### Optional snap-on sidewalls shall be offered in three height configurations: 2” (51 mm), 4” (102 mm) and 6” (152 mm)

### The available loading width in the cable tray shall match the width listed above for the cable tray deployed and the available loading depth in the cable tray shall match the height listed above for the snap-on sidewalls deployed.

### Splice connectors shall:

#### Allow for two sections of the cable tray to be quickly joined

#### To ensure electrical continuity throughout the cable tray system, the cable tray shall have an integrated screw feature that mechanically bonds continuous pathway sections.

#### Neither splices in the support span nor intersections shall diminish the rated loading capacity of the cable tray.

### Cable Tray Accessories

#### The cable tray system shall have snap-on waterfalls, snap-on radius bend kits and other fittings, as indicated, constructed of the same materials and with the same finishes as the cable tray.

#### The cable tray supports, and connectors shall be as recommended by the cable tray manufacturer.

### (CUSTOMER) approved Manufacturer:

#### Panduit

### (CUSTOMER) approved Wire-Mesh Cable Tray part numbers. The part numbers and sizes listed are a small subset of the number available. For additional information, contact Panduit customer service or refer to the current parts catalog.

|  |  |
| --- | --- |
| Part Number | Description |
| WG12BL10 | Wyr-Grid® Pathway, 12” W x 118” L, Black Powder Coated |
| WGINTBRC4BL | Wyr-Grid® Snap-on Intersection Bend Radius Control, 4” High, Black Powder Coated |
| WGSW4BL | Wyr-Grid® Snap-on Sidewall, 4” High, Black Powder Coat |
| WGINTSPLBL | Wyr-Grid® Intersection Bonding Splice, Black Powder Coated |
| WGSPL1218BL | Wyr-Grid® Straight Bonding Splice Connector for 12” to 18” Pathway, Black Powder Coated |
| WGBTMWFBL | Wyr-Grid® Snap-on Bottom Waterfall, Black Powder Coated |
| WGSWF4BL | Wyr-Grid® Snap-on Side Waterfall for Wyr-Grid Pathway |
| WGTBS12BL | Wyr-Grid® Trapeze Bracket, 12” Pathway, Black Coated |
| WGWMTB12BL | Wyr-Grid® Wall Mount Termination Bracket, 12” Pathway, Black Powder Coated |

# EXECUTION

## GENERAL

### Upon completion of work, a Registered Communications Distribution Designer (RCDD) shall submit as-built drawings to the Owner and Engineer

### Provide any necessary screws, anchors, clamps, tie wraps, support hardware, etc. necessary to facilitate the installation of the identification communication system.

### Furnish any special installation equipment or tools necessary to properly complete the installation.

### Failure to follow the appropriate guidelines may require the installer to provide additional material and labor required to bring the installation back into alignment with the guidelines and to correct, any and all, damage to the cables by the installer during the implementation.

### All techniques and fixtures used in the installation must allow for easy maintenance of, and ready access to, all components for test measurements.

### No self-tapping screws shall be used.

### All parts shall be made of corrosion resistant material, such as plastic, anodized aluminum or brass.

### All materials used in installation shall be resistant to fungus growth and moisture deterioration.

### All of the pathways shown on the drawings are suggested routes for the Contractor to use as guidelines. Prior to construction, the Contractor shall coordinate in the field with other trades to determine the exact feeder, tie, and riser backbone cabling pathways. In any case where the communication pathway must be removed and re-routed, due to conflicts with other trades with which the Contractor did not previously coordinate, the Contractor is responsible for all costs associated with the removal and relocation

## NON-CONTINUOUS CABLE SUPPORTS

### The use of non-continuous cable supports as a primary pathway is not permitted.

### Non-continuous cable supports shall be used to support horizontal cables from the point of their exit from the main pathway (wire basket or cable tray) to the point of termination.

### Follow the manufacturer’s recommendations for allowable fill capacity for each size of non-continuous cable support.

### Installation and configuration of non-continuous cable supports shall conform to the requirements of the ANSI/EIA/TIA Standards 568-C and 569-B, NFPA 70 (National Electrical Code), and applicable local codes.

### Non-continuous cable supports shall be placed straight, following building lines on 48” to 60” (1200 mm to 1500 mm) centers.

### Non-continuous cable supports shall be installed every 48” to 60”, with a maximum sag of 6”.

### At no point shall cables rest on acoustic ceiling grids or panels.

### Non-continuous cable supports shall be attached to walls, purlins, beams, threaded-rod, or other components in strict compliance with all manufacturer Instructions and as directed by the Authority Having Jurisdiction (AHJ).

## NONMETALLIC CABLING DUCT - FiberRunner®

### Coordinate the installation of the fiber optic cable pathway with all other work as required to properly interface installation of this pathway with cabinets, racks, etc.

### In spaces through which fiber optic cable pathway is run, provide sufficient space to install and maintain cables.

### FiberRunner® channels and accessories shall be delivered carefully to avoid breakage, bending and scratching to the material finish and stored in original packaging in a clean dry environment.

### Ensure that vendor approved pathway supports are positioned at a maximum span of 5-feet along continuous straight lengths and within 6” to 12” of couplers used to attach molded directional fittings. Supports are to be Panduit QuikLock Brackets or approved Panduit strut retention clips on c-channel strut profiles not supplied by Panduit.

### Cut all fiber optic cable pathway using a miter box and saw. For clean, burr-free cuts, cut larger quantities with a plastic cutting saw blade. Recommended carbide 80T or 100T blade, .090 thickness, with a 0.125” kerf.

### Install the fiber optic cable pathway in accordance with recognized industry practices per UL 2024A, to ensure that the system complies with the requirements of the UL / ULC standards that pertain to Optical Fiber Cable Routing Assemblies for Riser. Do not install damaged equipment.

### Contractor shall ensure that pathway sections and fittings are clean and free of construction debris prior to cable installation.

##  Panduit Wire Basket – Wire Mesh CABLE TRAY

### Install cable tray as indicated, in accordance with recognized industry practices (NEMA VE-2 2000), to ensure that the cable tray equipment complies with requirements of NEC, and applicable portions of NFPA 70B and NECA “Standards of Installation” pertaining to general electrical installation practices.

### Coordinate the installation of cable tray with other electrical work as required to properly interface cable tray installation with other work.

### Install cable trays as a complete system, including fasteners, hold-down clips, support systems, splice connectors, cable waterfalls, adapters, and bonding.

### Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

### Remove burrs and sharp edges from cable trays.

### Fasten cable tray supports to building structure.

### Place supports so that the spans do not exceed the maximum indicated on the schedules, and provide the clearances shown on the Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity.

### Construct supports from manufacturers suggested parts list, for the support required, channel members, threaded rods, and other appurtenances furnished by the cable tray manufacturer. Arrange supports in trapeze or wall-bracket form, as required by the application.

### Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.

### Support wire-mesh cable trays with trapeze hangers and wall brackets.

### Support trapeze hangers for wire-mesh trays with a 1/2” (12 mm) diameter rods.

### Make changes in direction and elevation using the manufacturer’s recommended fittings.

### Make cable tray connections using the manufacturer’s recommended fittings.

### Seal penetrations through fire and smoke barriers, in compliance with the requirements set forth by the Authority Having Jurisdiction (AHJ).

### Install cable trays with enough workspace to permit access for installing cables.

### After installing the cable tray, install warning signs in visible locations on or near cable trays.

### Test wire basket support systems to ensure the electrical continuity of bonding and grounding connections and to demonstrate compliance with the specified maximum grounding resistance. For testing and test methods, see NFPA 70B, Chapter 18.

## WYRGRID® – OVERHEAD CABLE TRAY

### Install cable tray as indicated, in accordance with recognized industry practices (NEMA VE-2 2000), to ensure that the cable tray equipment complies with requirements of NEC, and applicable portions of NFPA 70B and NECA “Standards of Installation” pertaining to general electrical installation practices.

### Coordinate the installation of cable tray with other electrical work as required to properly interface cable tray installation with other work.

### Install cable trays as a complete system, including fasteners, hold-down clips, support systems, splice connectors, cable waterfalls, adapters, and bonding.

### Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

### Remove burrs and sharp edges from cable trays.

### Fasten cable tray supports to building structure.

### Place supports so that the spans do not exceed the maximum indicated on the schedules, and provide the clearances shown on the Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity.

### Construct supports from manufacturers suggested parts list, for the support required, channel members, threaded rods, and other appurtenances furnished by the cable tray manufacturer. Arrange supports in trapeze or wall-bracket form, as required by the application.

### Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.

### Support wire-mesh cable trays with trapeze hangers and wall brackets.

### Support trapeze hangers for wire-mesh trays with a 1/2” (12 mm) diameter rods.

### Make changes in direction and elevation using the manufacturer’s recommended fittings.

### Make cable tray connections using the manufacturer’s recommended fittings.

### Seal penetrations through fire and smoke barriers, in compliance with the requirements set forth by the Authority Having Jurisdiction (AHJ).

### Install cable trays with enough workspace to permit access for installing cables.

### After installing the cable tray, install warning signs in visible locations on or near cable trays.

### Test wire basket support systems to ensure the electrical continuity of bonding and grounding connections and to demonstrate compliance with the specified maximum grounding resistance. For testing and test methods, see NFPA 70B, Chapter 18.

## Cable INSTALLATION

### Install cables only after each cable tray run has been completed and inspected.

### Fasten cables on horizontal runs with hook and loop tape in accordance with NEMA VE 2. Tighten the tape only enough to secure the cable, without indenting the cable jacket.

### Fasten cables on vertical runs to pathways every 18 inches (450 mm).

### Fasten and support cables that pass from one pathway to another or drop from cable trays to equipment enclosures. Fasten cables to the pathway at the point of exit, and support cables independent from the enclosure. The length of the cable between pathways or between cable tray and enclosure shall be no more than 72 inches (1800 mm).

### Remove all inactive and abandoned cables, as required by NFPA 70.

## CABLE TRAY GROUNDING

### Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" and Section 27 25 26 “Communications Grounding, Earthing and Bonding.”

### Cable trays with communications cable shall be bonded together with Wyr-Grid® Splice connectors.

### Cable trays with control conductors shall be bonded together with Wyr-Grid® Splice connectors.

### When using Wyr-Grid® Splice Connectors, use a standard 9/16” socket driver and tighten the integrated thread cutting screw until it pierces the paint of adjacent cable tray sections to create a completely bonded connection, ensuring electrical continuity between cable tray sections.

### Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

## Cable tray FIELD QUALITY CONTROL

### Perform the following tests and inspections

#### After installing pathways and after electrical circuitry has been energized, survey for compliance with requirements.

#### Visually inspect cable insulation for damage. Correct sharp corners, protuberances in pathways, vibrations, and thermal expansion and contraction conditions that may cause or may have already caused damage.

#### Verify that the number, size, and voltage of cables in the pathways do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate pathways.

#### Verify that no items such as pipes, hangers, or other equipment intrude into the pathway.

#### Remove all dust deposits, industrial process materials, trash, and anything else that might block tray ventilation.

#### Visually inspect each pathway joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and re torque areas any areas that appear to have issues.

#### Ensure that all bonding screws have been secured on all splice connectors.

#### Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. If any are found, replace them with the specified hardware.

#### Perform visual and mechanical checks of pathway grounding. Verify that all takeoff raceways are bonded to cable trays. Test the entire pathway system for continuity. The maximum allowable resistance is 1 ohm.

#### SECTION 27 05 28