SECTION 27 11 23

Communications CABLE MANAGEMENT

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 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 <<karats>>.

Before publishing your final version of this specifications, remove all placeholders / instructions in red text.

1. GENERAL

## SUMMARY

### This Section includes:

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

#### Products supplied but not installed under this section, including loose equipment specified herein, which is to be turned over to the Owner at the completion of this project

### 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 Contractor shall furnish and install telecommunications passive equipment, including:

##### Horizontal Cable Management

##### Vertical Cable Management

#### 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.

#### The Contractor shall provide system demonstration, system documentation, and instruction of Owner personnel, 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 00 – Common Work Results for Communications

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

#### Section 27 05 53 – Identification for Communication Systems

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

#### Section 27 11 19 – Communications Termination Blocks and Patch Panels

## Definitions

### ANSI – American Northern Standards Institute

### AWG – American Wire Gauge

### BICSI – Building Industry Consulting Service International

### BCT – Bonding Conductor for Telecommunications

### BD – Building Distributor – A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made

### CP – Consolidation Point – A connection facility within Cabling Subsystem 1 for interconnection of cables extending from building pathways to the equipment outlet

### EDA – Equipment Distribution Area – A space allocated for end equipment, including computer systems and telecommunications equipment

### EF – Entrance Facility – An entrance to a building for both public and private network service cables, including wireless, that includes the entrance point of the building and continues to the entrance room or space

### EIA – Electronics Industry Alliance

### ER – Equipment Room – An environmentally-controlled, centralized space for telecommunications equipment that serves the occupants of the building, considered distinct from a Telecommunications Room (TR) because of the nature or complexity of the equipment.

### ESD – Electro Static Discharge – The sudden flow of electricity between two electrically-charged objects caused by contact, an electrical short, or dielectric breakdown

### ETL – Intertek Certification Services

### IEC – International Electrotechnical Commission

### IEEE – Institute of Electrical and Electronic Engineers

### IDC – Insulation displacement contact

### ISO – International Standards Organization

### HC – Horizontal Cross-connect – A group of connectors, such as patch panels or punch-down blocks, that allow horizontal, backbone, and equipment cabling to be cross-connected with patch cords or jumpers

### HDA – Horizontal Distribution Area – A space in a computer room where a Horizontal Cross-connect (HC) is located, and which may include LAN switches, Storage Area Network (SAN) switches, and Keyboard/Video/Mouse (KVM) switches for the end equipment located in the Equipment Distribution Areas (EDAs)

### IC – Intermediate Cross-connect – A facility enabling the termination of different levels of backbone cabling and interconnection between them or equipment

### MC – Main Cross-connect – A facility enabling the termination of backbone cables and their connection to incoming services, other backbone cabling or equipment

### MDA – Main Distribution Area – The central point of distribution for the structured cabling system, which includes the Main Cross-connect (MC) and, when equipment areas are served directly from the MDA, may also include Horizontal Cross-connect (HC)

### MM – Multimode Fiber

### NECA – National Electrical Contractors Association

### NFPA – National Fire Protection Agency

### NRTL – Nationally Recognized Testing Laboratory

### TIA – Telecommunications Industry Association

### SM – Single Mode Fiber

### 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.

### Campus Backbone: cabling system consisting of media and termination hardware interconnecting POE, Net–Pop’s and Future onsite buildings.

### Building Backbone: cabling system consisting of media and termination hardware interconnecting MDFs to IDFs.

### 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 outlet shall be mounted above ceiling.

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

## REFERENCES

### 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

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

### TIA-526 Series – Standard Test Procedures for Fiber Optic Systems

### TIA-942 – Telecommunications Infrastructure Standard for Data Centers

### Telecommunications Distribution Methods Manual, most recent edition

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

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

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

### NECA/FOA 301– Installing and Testing Fiber Optic Cables

### 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

### Manufacturers’ Recommendations - Install all cabling and termination devices per the manufacturers’ recommended installation practices for the applications warranties.

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

## SYSTEM DESCRIPTION

### This document describes the products and execution requirements relating to furnishing and installing Communications Cable Management.

## 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

## 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 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 an AutoCAD format, with legible outlet address and cable paths

##### Outlet location spreadsheets

##### Warranty paperwork

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

##### Photos of each ER and TR

## PROJECT CONDITIONS

### Project Environmental Requirements

#### 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

#### 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

### Fabricate custom-made equipment with careful consideration given to aesthetic, technical, and functional aspects of the equipment and its installation.

### 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 <<ClientName>> 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.

## VERTICAL CABLE MANAGEMENT

### The system shall be a complete cable management system that has vertical cable managers, horizontal cable managers, and cable management accessories throughout the cabling system.

### Vertical cable managers shall be PatchRunner™ 2 (PR2V) or PatchRunner™ 2 Enhanced (PE2V) Series Vertical Cable Management System

### The initial quantity of cables in the cable manager will not exceed 30% of the interior area of the cable manager

### Vertical cable managers will create a space for storing and organizing cables along the side of the rack or frame and will maintain separation between cordage and premise cables

### The vertical cable manager will be affixed to the side of racks or frames with manufacturer-supplied hardware.

### Vertical cable managers will be either:

#### A single-sided C-shaped trough with a cover that will provide a single pathway.

#### A double-sided H-shaped trough with covers that will provide independent front and rear cable pathways and will have multiple, evenly-spaced, edge-protected, front-to-rear cable pass-through holes in the center divider.

### The vertical cable manager will match the height of the racks or frames to which it is attached and will be of an appropriate size to accommodate the cabling.

### A single vertical cable manager, either single or double-sided, shall be used between bayed racks or frames and will be of an appropriate size to accommodate the total cable requirements for both racks or frames. The manufacturer’s product documentation will state estimated cable fills for the cable manager

### PatchRunner™ 2 (PR2V) Vertical Cable Managers shall have the following attributes:

#### Consist of a metal backbone with cable management fingers that align with EIA rack spacing

#### Have integrated molded plastic door hinge pin receivers, which rest directly on the floor for added support.

#### Doors to have “push-to-close” functionality

#### Available in sizes 6” wide, 8” wide, 10” wide and 12” wide

#### Available in black and white colors

#### Accept a metal, hinged, push-to-close door that can open to the right or left

#### Door support brackets shall be integrated into the manager with no assembly required

#### Doors ship with managers, simplifying ordering process with less packaging waste

### PatchRunner™ 2 Enhanced (PE2V) Vertical Cable Managers shall have the following attributes:

#### Consist of a metal backbone with cable management fingers that align with EIA rack spacing

#### Metal backbone contains vertical RU spaces for added versatility and additional RU capacity

#### Have integrated molded plastic door hinge pin receivers, which rest directly on the floor for added support.

#### Doors to have “push-to-close” functionality

#### Available in sizes 6” wide, 8” wide, 10” wide and 12” wide

#### Available in black and white colors

#### Accept a metal, hinged, push-to-close door that can open to the right or left

#### Doors ship with managers, simplifying ordering process

### <<ClientName>> approved Manufacturer:

#### Panduit

### <<ClientName>> approved Vertical Cable Manager 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 |
| --- | --- |
| PR2VD06 | PatchRunner™ 2 Vertical Cable Manager, 6”, Dual-sided, Steel, 45RU, Includes two full-length metal, dual-hinging, push-to-close doors, pre-assembled, Black |
| PR2VFD06 | PatchRunner™ 2 Vertical Cable Manager, 6”, Single-sided, Steel, 45RU, Includes one full-length metal, dual-hinging, push-to-close doors, pre-assembled, Black |
| PR2VD08 | PatchRunner™ 2 Vertical Cable Manager, 8”, Dual-sided, Steel, 45RU, Includes two full-length metal, dual-hinging, push-to-close doors, pre-assembled, Black |
| PR2VD12WH | PatchRunner™ 2 Vertical Cable Manager, 12”, Dual-sided, Steel, 45RU, Includes two full-length metal, dual-hinging, push-to-close doors, pre-assembled, White |
| PE2VD06 | PatchRunner™ 2 Enhanced Vertical Cable Manager, 6”, Dual-sided, Steel, 45RU, Includes two full-length metal, dual-hinging, push-to-close doors, Black |
| PE2VD08 | PatchRunner™ 2 Enhanced Vertical Cable Manager, 8”, Dual-sided, Steel, 45RU, Includes two full-length metal, dual-hinging, push-to-close doors, Black |
| PE2VD12 | PatchRunner™ 2 Enhanced Vertical Cable Manager, 12”, Dual-sided, Steel, 45RU, Includes two full-length metal, dual-hinging, push-to-close doors, Black |
| PE2VFD06 | PatchRunner™ 2 Enhanced Vertical Cable Manager, 6”, Single-sided, Steel, 45RU, Includes one full-length metal, dual-hinging, push-to-close door, Black |
| PE2VD12WH | PatchRunner™ 2 Enhanced Vertical Cable Manager, 12”, Dual-sided, Steel, 45RU, Includes two full-length metal, dual-hinging, push-to-close doors, White |

## horizontal CABLE MANAGEMENT

### Horizontal cable management devices will provide containment and concealment of interconnect or equipment cordage in an enclosure or rack, guide patch and equipment cords between the vertical cable manager and individual connections and allow access for cables without blocking the jacks

### The horizontal cable manager will be of an appropriate size to accommodate cabling requirements. A single horizontal cable manager may be used to support multiple patch panels, if it can accommodate cable fill requirements.

### The horizontal cable manager shall:

#### Be manufactured of composite materials

#### Have a color that matches the rack or enclosure

#### Provide 1 RU of horizontal cable management for every RU of connectivity

#### Match the rack-mount width of the racks, frames, or cabinets that it serves

#### Attach to the front or rear of the equipment mounting rail with screws and will be of a size that fits within standard EIA 310 spacing

#### Be a <<PICK ONE: single-sided C-shaped or double-sided H-shaped>> trough

#### Fitted with a removable cover, hinged to open up or down, that will snap on to secure the cover in the closed position

#### Have bend-limiting slots or holes at the rear to facilitate front-to-rear cabling through the horizontal manager

#### Have bend-radius-controlling T-shaped or L-shaped cable guides, along the top and bottom surfaces

#### Have evenly-spaced cable openings, with rounded edges to protect cables, between the cable guides to allow cables to enter and exit the cable manager in a neat and orderly fashion

| Part Number | Description |
| --- | --- |
| WMPSE | PatchLink Horizontal Cable Manager Front and Rear 1 RU |
| WMPFSE | PatchLink Horizontal Cable Manager Front Only 1 RU |
| WMP1E | PatchLink Horizontal Cable Manager Front and Rear 2 RU |
| WMPF1E | PatchLink Horizontal Cable Manager Front Only 2 RU |
| NM2 | NetManager Horizontal Cable Manager High Capacity Front and Rear 2 RU |
| NM4 | NetManager Horizontal Cable Manager High Capacity Front and Rear 4 RU |
| NMF2 | NetManager Horizontal Cable Manager High Capacity Front Only 2 RU |
| NMF4 | NetManager Horizontal Cable Manager High Capacity Front Only 4 RU |
| PR2HF2 | PatchRunner™ 2 Horizontal Cable Manager, Front Only, 2RU, Black |
| PR2HF2WH | PatchRunner™ 2 Horizontal Cable Manager, Front Only, 2RU, White |
| PR2HF4 | PatchRunner™ 2 Horizontal Cable Manager, Front Only, 4RU, Black |
| PR2HF4WH | PatchRunner™ 2 Horizontal Cable Manager, Front Only, 4RU, White |

# EXECUTION

## GENERAL

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

### Provide any required screws, anchors, clamps, hook and loop, miscellaneous grounding and support hardware, etc. needed to facilitate the installation.

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

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

### 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 locations of the racks, cabinets, enclosures and cable mangers. 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.

## HORIZONTAL AND VERTICAL CABLE MANAGEMENT

### Place and install all horizontal and vertical wire and cable management devices and assemblies so as not to impede the efficient use of or connection to adjacent panels, enclosures, or equipment.

### Upon completion of the task, replace all covers, doors, and panels that were removed during the installation.

### Vertical Cable Management

#### Attach vertical cable managers to the side of the rack or frame according to the manufacturer’s installation instructions and using the hardware provided.

#### When a single vertical cable manager is used between two racks or frames, attach the vertical cable manager to both racks or frames.

#### When more than one cable manager is used on a rack or frame or on a group of racks or frames, use the same make, style, and size of vertical cable manager.

#### The color of the cable managers must match the color of the racks or frames.

#### After cabling is complete, attach the doors to the cable managers in the closed position

### Horizontal Cable Managers

#### When more than one horizontal cable manager is used on a rack, frame, or cabinet, or on a group of racks, frames, or cabinets, use the same make and style cable manager.

#### The color of the cable managers must match the color of the racks or frames.

#### Attach horizontal cable managers to the rack, frame, or cabinet with four screws according to the manufacturer’s installation instructions. Each cable manager should be centered in the allocated rack-mount space.

#### Place horizontal managers so that the number of ports (cables) they support will not exceed the cable fill capacity of the cable managers.

#### After cabling is complete, attach the covers to the cable managers in the closed position.

#### Install equipment rack horizontal cable and wire management panels directly adjacent to (above and below) all distribution enclosures, patch panels, and termination hardware in the rack as depicted in the appropriate project Drawings.

END OF SECTION 27 11 23