

SECTION 27 11 23
COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

PART 1 - GENERAL

1.1 STIPULATIONS

- A. The specifications sections "General Conditions to the Construction Contract", "Special Conditions" and "Division 01 – General Requirements" form a part of the Section by this reference thereto, and shall have the same force and effect as if printed herewith in full.

1.2 SUMMARY

- A. This section includes the minimal requirements for cable management and ladder rack (cable runway) installed in the telecommunications rooms.
1. Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
 2. Horizontal Cable Management
 3. Vertical Cable Management
 4. Ladder Rack (Universal Cable Runway)

1.3 REFERENCES

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.
- B. Related Documents and Sections:
1. Division 01 – General Requirements
 2. Section 27 00 00 – Communications General
 3. Section 27 05 26 – Grounding and Bonding for Communications Systems
 4. Section 27 05 28 – Pathways for Communications Systems
 5. Section 27 11 16 – Communications Cabinets, Racks, Frames and Enclosures
 6. Section 27 11 23 – Communications Cable Management and Ladder Rack
 7. Section 27 13 13 – Communications Copper Backbone Cabling
 8. Section 27 13 23 – Communications Optical Fiber Backbone Cabling
- C. The following codes, associations, acts and agencies, as required by law;
1. NFPA-70, 2011 (National Electric Code)
 2. National Electrical Safety Code (NESC)
 3. Occupational Safety and Health Administration (OSHA)
- D. The current edition of the following standards:
1. Refer to Section 27 00 00 – Communications General

E. The current edition of the following guidelines:

1. Refer to Section 27 00 00 – Communications General

F. When a discrepancy arises between the above-mentioned codes, standards or guidelines and the standards contained in this document, it shall be brought to the attention of the Owner immediately for resolution. The more stringent of the two guidelines shall be implemented.

1.4 SYSTEM DESCRIPTION

A. Horizontal Cable Managers shall be bolted in the top and middle of the rack. Location of Horizontal Managers shall be as indicated on Project Drawings

B. Vertical Cable Management sections, 84 inches in height, shall be bolted-in between all Open Frame Racks. Width of Vertical Cable Management sections shall be as indicated on Project Drawings.

C. The work covered under this section consists of furnishing all necessary coordination, labor, supervision, materials, equipment, tests and services required to install complete Ladder Rack (Cable Runway) systems within all MDF, and TR spaces, as indicated within Project Drawings.

1.5 SUBMITTALS

A. Refer to Section 27 00 00 – Communications General

B. Provide table of contents with all product names, manufacturer, and specific product number identified to accompany manufacturer's product information cut sheets or specifications sheets.

1.6 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed.

B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing data cabling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable Manufacturers:

1. CommScope
2. Chatsworth Products Incorporated (CPI)
3. Middle Atlantic Products
4. Legrand
5. Hubbell
6. Panduit Corporation

7. Approved Equal

2.2 HORIZONTAL CABLE MANAGEMENT

- A. Furnish and install Horizontal Cable Managers in the top and middle of the rack, 19 inches W x 3 inches H (2RU) where specifically indicated on Project Drawings.
- B. All 19 inch horizontal managers must have sufficient depth and surfaces to allow for Category 6 copper cables bend radii.
- C. Horizontal cable managers shall be single sided and shall provide sufficient depth to allow for Category 6 copper and optical fiber bend radii internally and when entering and/or leaving the wire management frame.
- D. All components of the cable management system shall be full metal or high-strength rigid plastic construction and black in color.
- E. The horizontal cable manger will be UL Listed.
- F. Manager shall be black in color.

2.3 VERTICAL CABLE MANAGEMENT

- A. Vertical cable management shall be manufactured from aluminum and/or steel extrusion.
- B. Each vertical cable manager shall be punched to all attachment along the sides of the rack.
- C. Every Rack/Frame shall have a minimum of one Vertical Cable Manager furnished and installed between racks and at the end of multiple rack line-ups. The Vertical Cable Manager shall create a space for storing and organizing cables along the side of each Rack/Frame.
- D. Vertical Cable Manager shall match the height of the Rack/Frame to which it shall be attached.
- E. Vertical Cable Manager shall bolt to the side of Racks/Frames using factory-provided hardware and mounting provisions. The manufacturer of the Vertical Cable Manager shall be by the same manufacturer as the Racks/Frames. Refer to Section 27 11 16 – Communications Cabinets, Racks, Frames, & Enclosures.
- F. The Vertical Cable Manager shall be a single-sided U-shaped trough. The front metal edges in between the latches shall be covered by plastic edge protectors to protect cables. The single-sided trough shall provide independent front cable pathways and shall have multiple evenly-spaced edge-protected front-to-rear cable pass-through holes for cables in the center divider.
- G. Used for organizing patch cords on front and incoming cables at rear of freestanding equipment racks.
- H. All vertical cable management on 2-post equipment racks shall be 8 inches in width between racks unless otherwise noted on the drawings
- I. All vertical cable management on 2-post equipment racks shall be 6 inches in width at both end of row unless otherwise noted on the drawings.
- J. All vertical cable management on 2-post equipment racks shall be 7 feet in height unless otherwise noted on the drawings.

1. All vertical cable management on 2-post equipment racks shall be 9.7 inches in depth unless otherwise noted on the drawings.
- K. Dual hinged, removable, full-length doors shall be provided on the front of the management.
- L. The vertical cable manager will be UL Listed.
- M. Finish shall be black

2.4 LADDER RACK, SUPPORTS, AND ACCESSORIES

A. Ladder Rack (Universal Cable Runway)

1. Ladder rack shall be manufactured from 3/8 inches wide by 1-1/2 inches high tubular steel with .065 inches wall thickness.
2. Ladder rack (side stringers) will be 9 feet-11-1/2 inches long. Cross members will be welded in between stringers on 12 inch intervals/centers beginning 5-3/4 inches from one end so that there are 10 cross members per ladder rack. There will be 10-1/2 inches of open space in between each cross member.
3. Ladder rack will be delivered individually boxed, and available in the width(s) specified below.
4. Ladder rack will be UL Classified for suitability as an equipment grounding conductor only (the installer must remove paint or use ground straps at splices and intersections)
5. Finish shall be epoxy-polyester hybrid powder coat black.

B. Horizontal 90-Degree Turns (Cable Runway E-Bend)

1. Horizontal 90-degree turns shall be manufactured from 3/8 inches wide by 1-1/2 inches high tubular steel with .065 inches wall thickness.
2. Stringers (sides) will be formed in a 90-degree arc. Cross members will be welded in between stringers on approximate 23-degree increments so that there are 5 cross members per turn. The welded assembly will have a 15 inch inside radius and will create a smooth horizontal 90-degree turn.
3. Horizontal 90-degree turns will be available in the width(s) specified below.
4. Finish shall be epoxy-polyester hybrid powder coat black.

C. Vertical-To-Horizontal 90-Degree Turns (Cable Runway Outside Radius Bend)

1. Vertical-to-horizontal 90-degree turns shall be manufactured from 3/8 inches wide by 1-1/2 inches high tubular steel with .065 inches wall thickness.
2. Stringers (sides) will be formed in a 90-degree arc with a 12-1/2 inches outside radius. Cross members will be welded in between stringers on approximate 23-degree increments so that there are 3 cross members per turn. The welded assembly will create a smooth 90-degree vertical-to-horizontal turn.
3. Vertical-to-horizontal 90-degree turns will be available in width(s) specified below.
4. Finish shall be epoxy-polyester hybrid powder coat black.

D. Horizontal-To-Vertical 90-Degree Turns (Cable Runway Inside Radius Band)

1. Horizontal-to-vertical 90-degree turns shall be manufactured from 3/8 inches wide by 1-1/2 inches high tubular steel with .065 inches wall thickness.
2. Stringers (sides) will be formed in a 90-degree arc with a 12-1/2 inches outside radius. Cross members will be welded in between stringers on approximate 23-degree increments

so that there are 3 cross members per turn. The welded assembly will create a smooth 90-degree horizontal-to-vertical turn.

3. Horizontal-to-vertical 90-degree turns will be available in the width(s) specified below.
4. Finish shall be epoxy-polyester hybrid powder coat black.

E. Corner Brackets (Cable Runway Corner Bracket)

1. Corner brackets shall be manufactured from 3/8 inches wide by 1-1/2 inches high tubular steel with .065 inches wall thickness.
2. The inside stringers of the corner bracket will be formed at 90-degree with a small chamfer at the vertex. The outside stringer of the corner bracket will be formed in a 90-degree arc that is either 15 inches or 24 inches in radius. A single cross member will connect the chamfered portion of the inside stringer to the outside stringer. The welded assembly will create a smooth 90-degree turn within the L-shaped corner created by two intersecting ladder racks.
3. Corner brackets will be available in the size(s) specified below. Installation hardware will be included with the corner bracket. Corner bracket installation hardware does not include the junction splice kit required to form the L-shaped intersection between two ladder racks.
4. Finish shall be epoxy-polyester hybrid powder coat black.

F. Ladder Rack Splices

1. Splice kits will provide a method of mechanically connecting ladder rack sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.
2. Grounding kits will provide a method of bonding ladder rack sections and turns together that is independent of the pathway splices. The grounding kit should be constructed of UL Listed components. The preferred solution is a #6 AWG green insulated stranded copper conductor connected on both ends to ladder rack using two-hole compression lugs and stainless-steel hardware.
3. An insulator bar kit will provide a means of electrically isolating individual ladder rack sections through an end-to-end splice separated with a non-conductive material. The preferred solution is a 3/8 inches wide by 1-1/2 inches high by 5-1/2 inches long insulator bar made of Delrin® (by DuPont, Delrin is a registered trademark of E.I. du Pont de Nemours and Company).
4. Splices (splice plates) will be manufactured from steel. Splice, grounding and insulator bar kits will include installation hardware.
5. Finish (of splice plates and hardware) shall be zinc plate in the color black.

G. Ladder Rack Support

1. Supports will be sized to match the width of the ladder rack that is supported. Some supports will work with multiple or all widths of ladder rack.
2. Each support will include a means of mechanically securing ladder rack to the support.
3. Supports will be manufactured from steel or aluminum.
4. Finish shall be epoxy-polyester hybrid powder coat black.

H. Ladder Rack Accessories

1. Cable straps used for attaching cable bundles to the ladder rack cross members must be reusable with a hook and loop-style closure, at least 3/4 inch wide, and sized for cable bundles that are 2 inches, 3 inches or 4 inches in diameter.
2. Cable retaining posts used to keep cable from falling off of the side of the ladder rack shall be manufactured from 1 inch by 1/2 inch tubular steel with .065 inches wall thickness. Cable retaining posts will be 8 inches high and will attach to the side stringer of the ladder

rack with included hardware. The top of the cable retaining posts will be fitted with a rubberized end cap to protect cables.

3. End caps used to cover the ends of ladder rack will be manufactured from a black fire-retardant rubberized material. End caps will be sized for 3/8 inches wide by 1-1/2 inches high side stingers and will be sold in pairs.
4. End closing kits used to cover the end of ladder rack will be manufactured from 3/8 inches wide by 1-1/2 inches high tubular steel with .065 inches wall thickness. Kits will consist of a bar cut to match the width of the ladder rack and the hardware required to attach the bar to the end of a length of ladder rack.
5. Radius drops used to create a radius to form cables over as the cables exit or enter the ladder rack will be manufactured from aluminum extrusion. The extrusion will be formed in a 90-degree arc with a minimum bend radius of 3 inches. Radius drops will attach to either the side stringer or the cross member of the ladder rack using a clevis pin. Radius drops will include 1-1/2 inches high cable spools that attach to the top of the radius drop to guide cables.
6. Movable cross members used to support cross member radius drops in between welded cross members on ladder rack will be manufactured from 3/8 inches by 1-1/2 inches aluminum bar. Movable cross members will attach to ladder rack at the side stringers with included hardware so that the location of the movable cross member can be adjusted. Moveable cross member will support a cross member radius drop.
7. Cable spools used to separate ladder rack into multiple cable pathways will be made from a black flame-retardant ABS. Cable spools will attach to the cross members with a clip that allows the width of the ladder rack to be divided into any proportion. The spools will be 3.94 inches tall, with a 1.94 inches diameter top cap, and a body that tapers from .88 inches diameter at the top to .62 inches diameter at the bottom.
8. Auxiliary support brackets used to support cables that should be physically separated from the cables in the ladder rack will be made from 1/8 inches by 1 inch steel bar. The bracket will be L-shaped and will attach to the side stringer of the ladder rack. The bracket will hang below the ladder rack a minimum of 4 inches. The bracket support surface will be 4 inches long. The bracket will be zinc plated with a gold chem. finish.
9. Touch-up paint used on ladder rack and ladder rack system components will be color-matched to the finish on the ladder rack or component. A spray on and brush on option will be available.
10. Unless otherwise noted, finish on all metal components shall be epoxy-polyester hybrid powder coat black.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Check actual site conditions prior to start of any work. Ensure all preceding trade work associated with the telecommunications system is accurate and complete before proceeding with installation or use of products specified in this section. Examples of work which must be checked include, but are not limited to:
 1. Electrical requirements (conduit installation and capacity)
 2. The TRs are the size shown on the project drawings.
 3. Adequate clearances of doors, riser spaces, and ceilings for all component of the telecommunications system.
 4. Examine and compare the telecommunications drawings and specifications with the drawings and specifications of other trades. Report any discrepancies between them to the A/E and obtain written instructions for changes or revisions.

3.2 INSTALLATION

A. Horizontal Cable Management

1. Install all horizontal cable management per the manufacturer's recommended installation instructions, as indicated in the drawings.
2. All cable bundles inside the telecommunications rooms shall be secured with Velcro™ cable wraps; plastic wire ties are not acceptable.
3. Velcro™ wraps shall not be pulled tight enough to kink the cable jacket.

B. Vertical Cable Management

1. Install all vertical cable management troughs per the manufacturer's recommended installation instructions, as indicated in the project drawings.

C. Ladder Rack (Universal Cable Runway)

1. Ladder Rack (Cable Runway) may be attached to the top of the rack to deliver cables to the rack. The rack should not be drilled to attach cable tray. Use appropriate hardware from the cable tray manufacturer.
2. Cable Runway shall be installed with side stringers facing down so that the ladder forms an inverted U-shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.
3. Cable Runway splices shall be made in mid-span, not over a support, using the manufacturer's recommended splice hardware.
4. Cable Runway shall be supported every 5 feet or less in accordance with TIA-569-D. Cable Runway shall be supported within 2 feet of every splice and within 2 feet on both/all sides of every intersection. Support Cable Runway within 2 feet on both sides of every change in elevation. Support Cable Runway every 2 feet when attached vertically to a wall.
5. When the pathway is overhead, Cable Runway shall be installed with a minimum clearance of 12 inches above the Cable Runway. Leave a minimum of 12 inches in between Cable Runway and ceiling/building truss structure. Leave a minimum of 2 inches in between Cable Runway and the tops of equipment racks and/or cabinets. Multiple tiers of Cable Runway shall be installed with a minimum clearance of 12 inches in between each tier of Cable Runway. When located above an acoustical drop ceiling, leave a minimum of 3 inch clearance between the top of the drop ceiling tiles and the bottom of the Cable Runway.

6. Within each TR, Cable Runway should be bonded together, electrically continuous, and bonded to the TMGB and TGB, unless otherwise specifically noted in the Project Drawings. Cable Runway and turns shall be bonded across each splice with a bonding kit. Cable Runway shall be bonded to the TMGB and TGB using an approved ground lug on the Cable Runway and a minimum #6 grounding wire or as recommended by the AHJ. Remove paint from the Cable Runway where bonding/ground lugs contact the Cable Runway so that the lug shall contact bare metal. Use antioxidant joint compound in between the bare metal on the Cable Runway and ground lug. Use antioxidant joint compound in between the bus bar and the ground lug. Verify continuity through the bonds at splices and intersections between individual Cable Runway sections and turns and through the bond to the TMGB and TGB.
7. The combined weight of cables within the Cable Runway shall not exceed the stated load capacity of the Cable Runway as stated in the manufacturer's product specifications or load/design tables.
8. Use a radius drop to guide cables wherever cable exits overhead Cable Runway to access a rack, cabinet or wall-mounted rack, cabinet or termination field. Furnish and install a moveable cross member also to attach and align the radius drop in between the welded cross members of a Cable Runway.
9. Cover the exposed ends of cable runway that do not terminate against a wall, the floor or the ceiling with end caps or an end closing kit.
10. The installer shall furnish and apply touch-up paint color-matched to the finish on the Cable Runway and shall correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the owner. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component shall be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the Cable Runway system.
11. Install Cable Runway level and straight unless specifically notes on Project Drawings.
12. Alternate spacing ladder arrangements shall be made for all Cable Runway runs above and parallel to TR rack rows so that space above entry point into vertical wire managers remains clear and precise alignment of cable runway radius drops can be assured.
13. Ladder type runway shall be capable of carrying a uniformly distributed load of 135 lbs./ft. on a 5 foot support span with a safety factor of 1.5 when supported as a simple span. Load and safety factors specified are applicable to both side rails and rung capacities.

END OF SECTION