

SECTION 27-11-23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The work covered by this section of the Specifications includes all labor necessary to perform and complete such construction, all materials and equipment incorporated or to be incorporated in such construction and all services, facilities, tools and equipment necessary or used to perform and complete such construction. The work of this section shall include, but is not limited to, the following:
 - 1. ER/TR/EF ladder racks complete with all necessary installation hardware.

1.02 QUALITY ASSURANCE

- A. Refer to Section 27-00-00 for general details.

1.03 CODES AND STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations in Section 27-00-00.
- B. Cal Poly ITS Telecomm group, Telecommunications Standards Document and the Labeling, Design & Syntax Standards in Appendix B.
- C. ***All installations and hardware must meet seismic zone 4 requirements.***

1.04 SUBMITTALS

- A. Refer to Section 27-00-00 for general details.
- B. Shop Drawings:
 - 1. Shop drawings shall show the position of ladder racks in the EF/TR/ER. Ladder racks shall be dimensioned and the position of the ladder rack shall be dimensioned from (2) walls in each EF/TR/ER.
 - 2. Shop drawings for ladder racks shall also show the method of attachment to the ceilings.
- C. Submit Manufacturer's Cut Sheets for the following:
 - 1. Any products not specifically listed in the PRODUCTS section shall require a submittal of the manufacturer's cut sheets and approval by the Cal Poly ITS Telecomm group.

1.05 IDENTIFICATION

- A. None Required.

1.06 DEFINITIONS

- A. N/A

1.07 WARRANTY

- A. Refer to Section 27-00-00 for general details.

PART 2 – PRODUCTS

2.01 PRODUCT CONSISTENCY

- A. Product Consistency: Any given item of equipment or material shall be the product of one manufacturer throughout the facility. Multiple manufacturers of any one item will not be permitted.

2.02 LADDER RACK - GENERAL

- A. Unless otherwise noted, finish on all metal components shall be epoxy-polyester hybrid powder coat and grey in color, Hardware will be zinc plated with a gold chemical finish.
- B. Elements shall be provided from the manufacturer as a complete kit, including all fasteners and required hardware.

2.03 LADDER RACK

- A. Ladder rack shall be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness.
- B. Ladder rack (side stringers) will be 9'-11½" long. Cross members will be welded in between stringers on 12" centers beginning 5-3/4" from one end so that there are 10 cross members per ladder rack. There will be 10-1/2" of open space in between each cross member.
- C. Ladder rack will be delivered individually boxed, and available in 18" widths.
- D. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal

2.04 VERTICAL-TO-HORIZONTAL 90° TURNS (CABLE RUNWAY OUTSIDE RADIUS BEND)

- A. Vertical-to-horizontal 90° turns shall be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness, and shall be available in 18" widths.
- B. Stringers (sides) will be formed in a 90° arc with a 12-1/2" outside radius. Cross members will be welded in between stringers on approximate 23° increments so that there are 3 cross members per turn. The welded assembly will create a smooth 90° vertical-to-horizontal turn.
- C. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal

2.05 HORIZONTAL-TO-VERTICAL 90° TURNS (CABLE RUNWAY INSIDE RADIUS BEND)

- A. Horizontal-to-vertical 90° turns shall be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness, and shall be available in 18" widths.
- B. Stringers (sides) will be formed in a 90° arc with a 12-1/2" outside radius. Cross members will be welded in between stringers on approximate 23° increments so that there are 3 cross members per turn. The welded assembly will create a smooth 90° horizontal-to-vertical turn.
- C. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal

2.06 CORNER BRACKETS (CABLE RUNWAY CORNER BRACKET)

- A. Corner brackets shall be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness.

- B. The inside stringers of the corner bracket shall be formed at 90° with a small chamfer at the vertex. The outside stringer of the corner bracket shall be formed in a 90° arc with a 15" radius. A single cross member shall connect the chamfered portion of the inside stringer to the outside stringer. The welded assembly shall create a smooth 90° turn within the L-shaped corner created by two intersecting ladder racks.
- C. Corner brackets shall be available in the size(s) specified below. Installation hardware shall be included with the corner bracket. Corner bracket installation hardware shall not include the junction splice kit required to form the L-shaped intersection between two ladder racks.
- D. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal

2.07 LADDER RACK SPLICES

- A. Splice kits shall provide a method of mechanically connecting ladder rack sections and turns together end-to- end to form a continuous pathway for cables.
- B. Splices (splice plates) shall be manufactured from steel with zinc plating.
- C. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal

2.08 JUNCTION SP SPLICE KITS

- A. Splice kits shall provide a method of mechanically connecting ladder rack sections and turns together side-to- end to form a continuous pathway for cables.
- B. Splices (splice plates) shall be manufactured from steel with zinc plating.
- C. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal

2.09 LADDER RACK SUPPORTS

- A. Ladder Rack Supports for Suspension from an Open Ceiling
 - 1. Supports shall be sized to match the width of the ladder rack that is supported.
 - 2. Each support shall include a means of securing ladder rack to the support.
 - 3. Supports shall be manufactured from steel.
 - 4. Support kit shall utilize no less than a 3/8" threaded rod.
 - 5. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal
- B. Horizontal Ladder Rack Supports for Wall Mounting (Horizontal Wall Angle Support)
 - 1. Supports shall be sized to match the width of the ladder rack that is supported.
 - 2. Each support shall include a means of securing ladder rack to the support.
 - 3. Supports shall be manufactured from steel.
 - 4. Support shall be 2" x 2" x .105" steel angle designed specifically this application.
 - 5. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal
- C. Vertical Ladder Rack Supports for Wall Mounting
 - 1. Supports shall be sized to match the size of the ladder rack stringers that are supported.
 - 2. Supports shall be manufactured from steel.

3. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal
- D. Ladder Rack Supports for Top of Rack
 1. Supports shall be sized to match the width of the ladder rack that is supported.
 2. Each support shall include a means of securing ladder rack to the support, and the support to the rack.
 3. Supports shall be manufactured from steel.
 4. The 3" wide mounting plate shall include a hat shaped mounting bracket to secure the plate to the rack top angles without intruding into the rack mounting spaces.
 5. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal

2.10 LADDER RACK ACCESSORIES

- A. Ladder Rack Radius Drops
 1. Supports shall be sized to match the width of the ladder rack that is supported.
 2. Each radius drop mounts to the cross member or stringer and shall be secured with a clevis pin.
 3. Radius drop shall provide minimum 3" bend radius, and shall be equipped with three 1½" cable spools.
 4. Supports shall be manufactured from steel or aluminum.
 5. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal
 6. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal
- B. Ladder Rack Grounding
 1. Use 8" insulated green #6 AWG stranded copper conductor as bonding. **(See Fig.#141 in Appendix B)**
 2. **Utilizes two-hole, double crimp, compression lugs with 1/4" bolt holes spaced on 5/8" centers.**
 3. Shall use all UL Listed components.
 4. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal
- C. End Caps
 1. End caps used to cover the ends of ladder rack shall be manufactured from a black fire-retardant rubberized material.
 2. End caps shall be sized to fit stringers 3/8" wide by 1-1/2" high.
 3. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal
- D. Touch-Up Paint
 1. Use air dry waterborne paint available in a bottle with applicator.

2. Approved Manufacturer: Chatsworth Products, Inc. or Cal Poly ITS Telecomm group approved equal

2.11 CABLE MANAGEMENT ACCESSORIES (STRAPS AND TIES)

A. Cable Straps

1. Construction shall be laminated, as opposed to heat bonded or glued.
2. Hook side shall be constructed from 100% Polyethylene
3. Loop Hook side shall be constructed from 100% Nylon
4. Available in multiple widths and colors, but ¾" black shall be used.
5. Approved Manufacturer: Rip-Tie or Cal Poly ITS Telecomm group approved equal

B. Cable Ties (Indoor)

1. Cable ties shall be used indoors with OSP, riser copper cables only.
2. Low profile head with parallel-entry (180° entry)
3. Width shall be at minimum 0.3"
4. Minimum Loop Tensile Strength of 120lbs.
5. Material shall be nylon and Black in color.

C. Cable Ties (Outdoor)

1. Cable ties shall be used outdoors with OSP cables.
2. Low profile head with parallel-entry (180° entry)
3. Width shall be at minimum 0.3"
4. Minimum Loop Tensile Strength of 120lbs.
5. Material shall be weather resistant nylon and Black in color.
6. Approved Manufacturer: Panduit or Cal Poly ITS Telecomm group approved equal

D. Cable Tie Mount

1. Shall employ a cradle design with a recessed #10 screw mounting hole
2. Material shall be weather resistant nylon and Black in color.
3. Approved Manufacturer: Panduit or Cal Poly ITS Telecomm group approved equal

PART 3 – EXECUTION

3.01 GENERAL

- A. Location and placement of ladder rack shall be as shown on the Drawings or defined in these Specifications and Schedules.
- B. Where cable leaves a pathway to transition to a ladder rack, and that transition spans more than 18", continuous support shall be required.
- C. Ladder rack and all related accessories shall be assembled and installed as per the manufacturers' printed instructions.

- D. Ladder rack and all cable management accessories shall be installed level, plumb, square and placed in a professional workmanship like manner.
- E. The installer shall provide touch-up paint color-matched to the finish on the ladder rack and shall correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the University. 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.
- F. If a component is physically damaged or exhibiting rust due to mishandling, improper storage or modification during the installation process, it shall not be used.
- G. Any excess length of bolts or threaded rods shall be trimmed to no more than ½" past the nut and deburred.
- H. All exposed sharp edges shall be filed smooth.
- I. Do not install cabling using the ladder rack until after the ladder rack installation has been approved by the Cal Poly ITS Telecomm group representative.

3.02 QUANTITIES

- A. Quantities and sizes of ladder rack and components shown on the Drawings are illustrative only and shall be meant to indicate the general configuration of the work. The Contractor shall be responsible for providing the correct quantities of all materials necessary to accommodate the equipment and to terminate, cross connect and patch the volume of cable described in these specifications and schedules and shown on the Drawings
- B. Ladder Rack Radius Drops
 - 1. Cable Runway Radius Drops shall be required in any instance where a cable or transitions on or off ladder racking, except where the cable enters from above. Contractor shall supply a minimum of three spare Cable Runway Radius Drops for Stringers per telecom room.

3.03 INSTALLATION

- A. Ladder Rack
 - 1. Ladder rack 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.
 - 2. Ladder rack shall be secured to the structural ceiling, building truss system, wall, floor or the tops of equipment racks using the manufacturer's recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction.
 - 3. Ladder rack splices shall be made in mid-span, not over a support, with the manufacturer's recommended splice hardware.
 - 4. At each splice point or termination cut the ladder rack ¼" short to allow for thermal expansion.
 - 5. Maintain correct cross member spacing when splicing ladder rack sections.
 - 6. Ladder rack shall be supported every 5' or less in accordance with TIA-569-B. Where additional support is required for runs over 5', ladder rack shall be supported from the hard ceiling.
 - 7. Ladder rack shall be supported within 2' of every splice and within 2' on both/all sides of every intersection. Support ladder rack within 2' on both sides of every change in elevation. Support ladder rack every 2' when attached vertically to a wall.

8. Ladder rack installed parallel to the wall shall be placed with a 4" offset (gap) from the wall.
 9. Leave a minimum of 12" in between ladder rack and mechanical systems, lighting fixtures, ceiling or any other obstructions. If multiple tiers of ladder rack are required they shall be installed with a minimum clearance of 12" in between each tier of ladder rack.
 10. The quantity of cables within the ladder rack shall not exceed the manufacturer's product specifications for each product. Actual cable fill for ladder rack shall not exceed 6" in height.
 11. The combined weight of cables within the ladder rack shall not exceed the stated load capacity of the ladder rack as stated in the manufacturer's product specifications or load/design tables.
 12. When a single ladder rack supports different types of cable media, the cable media shall be separated within the pathway. Treat each type of cable media and divided area of the ladder rack separately when determining cable fill limits.
 13. Use a radius drop to guide cables wherever cable exits overhead ladder.
 14. Cover the exposed ends of cable runway that do not terminate against a wall, the floor or the ceiling with end caps.
- B. Cable Ties & Straps
1. Riser, Tie and OSP Cables shall be secured at every cross member of ladder rack with cable ties.
 1. Station Cables (cable bundles) shall be secured to every cross member of ladder rack with reusable Hook and Loop straps.
 2. Cable Tie Mounts spaced 12" on center shall be used to support cable runs on backboard.
 3. Riser, Tie and OSP Copper Cables shall use cable ties in all locations, station cables shall use reusable Hook and Loop straps in all locations.

3.04 GROUNDING & BONDING

- A. Within each EF/TR/ER, ladder rack shall be bonded together, electrically continuous, and bonded to the TGB/TMGB.
- B. Ladder rack and transition elements shall be bonded across each splice with a bonding kit. Ladder rack shall be bonded to the TGB/TMGB using an approved, two hole non reversible ground lug on the ladder rack and a minimum #6 grounding wire.
- C. Remove paint from the ladder rack where bonding/ground lugs contact the ladder rack so that the lug shall contact bare metal, or use star washers between the nut and the stringer.
- D. Use antioxidant joint compound in all locations where bonding/grounding elements are mechanically attached.
- E. Verify continuity through the bonds at splices and intersections between individual ladder rack sections and turns and through the bond to the TGB/TMGB.
- F. Install all grounding and bonding components per the manufacturer's written specifications. A. Refer to Section 27-05-26 for additional details.

3.05 TESTING

- A. None Required

3.06 ACCEPTANCE

- A. Any deviation from the approved Drawings shall require submission and approval of the revised shop drawings by the Cal Poly ITS Telecomm group before the installation begins.
- B. Once the installation and testing has been completed and the Cal Poly ITS Telecomm group representative is satisfied that all work is in accordance with the Contract Documents, the Cal Poly ITS Telecomm group representative shall notify the Contractor and/or Cal Poly Project Manager in writing or via email.

3.07 RECORD (AS-BUILT) DRAWINGS

- C. The Project Record Drawings shall show the types and locations of installed ladder rack.

END OF SECTION

DOCUMENT VERSION CONTROL

REVISION	DATE	AUTHOR	REASON
1	02/20/2014	R. VOLK	INITIAL DOCUMENT DEVELOPMENT
	02/20/2014	DW & MH	PRIMARY REVIEW COMPLETE