NORTH ORANGE COUNTY COMMUNITY COLLEGE DISTRICT
SECTION 27 11 00 – COMMUNICATIONS EQUIPMENT ROOM FITTINGS
SAMPLE SPECIFICATION

RELATED SECTIONS:

Section 27 00 00 General Requirements
Section 27 02 00 General Communication Requirements
Section 27 05 26 Grounding and Bonding for Communications
Section 27 05 28 Pathways for Communication Systems
Section 27 05 37 Fire-stopping For Communication Systems
Section 27 10 00 Structure Cabling Testing
Section 27 12 00 Communication Requirements for (RF) CATV System
Section 27 13 00 Communications Backbone Cabling
Section 27 13 23 ABF Fiber Optic Cabling
Section 27 15 00 Communications Horizontal Cabling
Section 27 16 00 Communications Connection Cords

Communications Racks

PART 1 – GENERAL

1.1 WORK INCLUDED
A. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

1.2 SCOPE OF WORK
A. This section includes the minimum requirements for the equipment and cable installations in communications equipment rooms (Telecommunications Closets).
B. Included in this section are the minimum composition requirements and installation methods for the following:
Communication Racks and Rack Cable Management

1.3 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. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
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 communications/data cabling.
C. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:
ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,

ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
EIA-310-E, Cabinets, Racks, Panels, and Associated Equipment (most recent version)
NFPA 70 – National Electric Code
BICSI – Telecommunications Distribution Methods Manual

1.4 SUBMITTALS

A. Provide product data for the following:

Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

PART 2 – PRODUCTS

2.1 GENERAL

A. RACKS

1. Racks shall be manufactured from aluminum and/or steel extrusion.
2. Each rack will have two L-shaped top angles, two L-shaped base angles and two equipment-mounting channels. The rack will assemble with nut and bolt hardware. The base angles will be pre-punched for attachment to the floor.
3. Equipment mounting channels will be punched on the front and rear flange with the EIA-310 Universal Mounting hole pattern.
   a. Aluminum Racks will be threaded with 12-24 roll-formed threads and will include 40 each combination pan head, pilot point mounting screws.
   b. Steel Racks will have 3/8" square holes and will include 40 each #12-24 x ½" mounting screws and 40 each #12-24 cage nuts.
4. The rack will include assembly and equipment-mounting hardware.
5. The rack will be rated:
   a. Two Post Racks: 1,000 lb. (453.6 kg) of equipment
   b. Four Post Racks: 2,000 lb. (907.2 kg) of equipment
6. The rack will be UL Listed
7. When assembled with top and bottom angles, equipment-mounting channels will be spaced to allow attachment of 19" EIA rack-mount equipment.
8. Communication Racks and Rack Cable Management shall be black in color.

B. RACK CABLE MANAGEMENT

1. Vertical cable management shall have doors that are lightweight, sturdy, and be available in different sizes to allow flexibility in design.
2. The cable management system shall have a C-Channel bracket that allows for easy access to the cable trough.
3. The vertical cable management system shall allow tool-less installation of Cable Spool.
4. Doors shall come standard with on all cable management and be available in both single and double sided configurations.

5. The door shall have dual hinge design that can be opened to the right or left.
6. The door latching mechanism shall have an easy closing feature.
7. The door shall have one point removal and installation process for door.
8. Horizontal wire managers: The door shall have horizontal cover hinges up or down and be lockable into position with cylindrical finger ends for easy snap on installation.
9. The door shall have a recessed handle to eliminate snag potential for clothes and arms.
10. The Horizontal cable management system shall have an open back on 1U, 2U and 3U horizontal troughs for easy pass-through of cables.

2.2 FREE STANDING TWO POST ALUMINUM RACKS

A. 45U - 7ft (2134 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack
   1. Rack is to provide 45 rack-mount spaces in a “7 foot rack” for equipment. Each mounting space will be marked and numbered on the mounting channel.
   2. For the "7 foot rack" the assembled rack will measure 84" (2133.6 mm) high, 20.4" (518 mm) wide and 15" (381 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
   3. Finish shall epoxy-polyester hybrid powder coat in the color as specified.
   4. Approved Manufacturer: CPI or approved equal
      a. (Part Number here or Provide Appendix for Approved Materials List)

B. 52U - 8ft (2438 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack
   1. Rack is to provide 52 rack-mount spaces in an “8 foot rack” for equipment. Each mounting space will be marked and numbered on the mounting channel.
   2. For the "8 foot rack" the assembled rack will measure 96" (2438 mm) high, 20.4" (518 mm) wide and 15" (381 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
   3. Finish shall be epoxy-polyester hybrid powder coat in the color as specified.
   4. Approved Manufacturer: CPI or approved equal.
      a) (Part Number here or Provide Appendix for Approved Materials List)

2.3 FREE STANDING TWO POST STEEL RACKS

A. 45U - 7ft (2134 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack
   1. Rack is to provide 45 rack-mount spaces in a “7 foot rack” for equipment. Each mounting space will be marked and numbered on the mounting channel.
   2. For the "7 foot rack" the assembled rack will measure 84" (2133.6 mm) high, 20.4" (518 mm) wide and 15" (381 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
   3. Finish shall be epoxy-polyester hybrid powder coated and textured in Black.
   4. Approved Manufacturer: CPI or approved equal.
      a) (Part Number here or Provide Appendix for Approved Materials List)

B. 52U - 8ft (2438 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack

1. Rack is to provide 52 rack-mount spaces in an “8 foot rack” for equipment. Each mounting space will be marked and numbered on the mounting channel.
2. For the "8 foot rack" the assembled rack will measure 96" (2438 mm) high, 20.4" (518 mm) wide and 15" (381 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
3. Finish shall be epoxy-polyester hybrid powder coated and textured in Black.
4. Approved Manufacturer: CPI or approved equal
   a) (Part Number here or Provide Appendix for Approved Materials List)

2.4 FREE STANDING FOUR POST ALUMINUM RACKS

A. 45U - 7ft (2134 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack
   1. Rack is to provide 45 rack-mount spaces in a “7 foot rack” for equipment. Each mounting space will be marked and numbered on the mounting channel.
   2. For the "7 foot rack" the assembled rack will measure 84" (2133.6 mm) high, 20.4" (518 mm) wide and 29" (736.6 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
   3. Finish shall be epoxy-polyester hybrid powder coat in the color as specified.
   4. Approved Manufacturer: CPI or approved equal
      a) (Part Number here or Provide Appendix for Approved Materials List)
B. 52U - 8ft (2438 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack
   1. Rack is to provide 52 rack-mount spaces in an “8 foot rack” for equipment. Each mounting space will be marked and numbered on the mounting channel.
   2. For the "8 foot rack" the assembled rack will measure 96" (2438 mm) high, 20.4" (518 mm) wide and 29" (736.6 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
   3. Finish shall be epoxy-polyester hybrid powder coat in the color as specified.
   4. Approved Manufacturer: CPI or approved equal
      a) (Part Number here or Provide Appendix for Approved Materials List)

2.5 FREE STANDING FOUR POST STEEL RACKS

A. 45U - 7ft (2134 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack
   1. Rack is to provide 45 rack-mount spaces in a “7 foot rack” for equipment. Each mounting space will be marked and numbered on the mounting channel.
   2. For the "7 foot rack" the assembled rack will measure 84" (2133.6 mm) high, 20.4" (518 mm) wide and 29" (736.6 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
   3. Finish shall be epoxy-polyester hybrid powder coated and textured in Black.
   4. Approved Manufacturer: CPI or approved equal
      a. (Part Number here or Provide Appendix for Approved Materials List)
B. 52U - 8ft (2438 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack
   1. Rack is to provide 52 rack-mount spaces in an “8 foot rack” for equipment. Each mounting space will be marked and numbered on the mounting channel.

2. For the "8 foot rack" the assembled rack will measure 96" (2438 mm) high, 20.4" (518 mm) wide and 29" (736.6 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
3. Finish shall be epoxy-polyester hybrid powder coated and textured in Black.
4. Approved Manufacturer CPI or approved equal.
   a. (Part Number here or Provide Appendix for Approved Materials List)

2.6 VERTICAL CABLE MANAGEMENT FOR RACKS

A. The vertical cable management kits are installed on the side of a 19-inch or 23-inch (483 or 584 mm) wide industry standard rack.
B. The door(s) shall be designed to provide a concealed vertical space for organizing patch cables.
C. Cable spools shall be used to organize longer patch cable lengths.
D. Cable managers are to be matched to the cable rack. Cable managers are available in 6 inch (152 mm), 8 inch (203 mm), 10 inch (254 mm), and 12 inch (305 mm) widths and in 7 foot (2.1 m), 8 foot (2.4 m), and 9 foot (2.7 m) heights.
E. Approved Manufacturer: CPI or approved equal
   1. Vertical Cable Management
      a. (Part Number here or Provide Appendix for Approved Materials List)

2.7 HORIZONTAL CABLE MANAGEMENT FOR RACKS

A. The horizontal cable management kits are installed on a 19-inch (483 mm) wide industry standard rack above or below panels to organize patch cables.
B. The kits shall be available in a single-sided and double-sided configuration, and in a 1U-, 2U-, and 3U-height.
C. The units shall include covers that can be opened from the top, the bottom, or removed altogether.
D. The cover hinges shall be designed to hold the cover open from the top or bottom to facilitate faster cabling.
E. The 2U and 3U cable managers shall have a pass-through feature allowing access to and from the rear for additional cable routing.
F. The depth of the units shall be
   1. Single-sided: 5-1/2 inches (140 mm) deep from front to back with the cover closed
   2. Double-sided: 11 inches (280 mm) deep from front to back with the covers closed.
G. Approved Manufacturer: CPI or Approved Equal
   1. Horizontal Cable Management
      a. (Part Number here or Provide Appendix for Approved Materials List)

PART 3 – EXECUTION

3.1 INSTALLATION

A. Racks and Cable Management
   1. Assemble racks and cable management according to manufacturer's instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.

2. All racks must be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below.
3. Racks shall be grounded to the TGB using appropriate hardware provided by the contractor. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).
4. In seismic areas, the rack should have additional bracing as required by building codes and the recommendations of a licensed structural engineer.
5. Ladder rack may be attached to the top of the rack to deliver cables to the rack. The rack should not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.
6. The equipment load should be evenly distributed and uniform on the rack. Place large and heavy equipment towards the bottom of the rack. Secure all equipment to the rack with equipment mounting screws.

Communications Termination Blocks and Patch Panels

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

1.2 SCOPE OF WORK

A. This section includes the minimum requirements for Horizontal and Backbone cable terminations installed in communications equipment rooms (Telecommunications Rooms, Equipment Rooms, or "Telecommunications Closets").
B. Included in this section are the minimum composition requirements and installation methods for the following:
   Patch Panels

1.3 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. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
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 communications/data cabling.
C. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:
   ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,

TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – National Electric Code
ISO/IEC 11801 - Generic cabling for customer premises
CENELEC EN-50173 - Generic cabling systems
BICSI – Telecommunications Distribution Methods Manual

1.4 SUBMITTALS

A. Provide product data for the following:
Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

PART 2 – PRODUCTS

2.1 Patch Panels

A. Category 5e/Class D Patch Panels
1. General specifications: Patch panel shall be constructed of high strength steel with black powder finish and designed for wall or 19-inch rack mounting.
2. Panels shall be available in 24-port and 48-port configurations, with height of 1 Rack Unit (RU) of 44.5 millimeters (1.75 inches) for each group of 24 ports.
3. Removable rear mounted cable management bar and front and rear identification labels.
4. Panel shall support 1 Gb network line speeds.
5. Panel shall be Category 5 and 3 backward compatible.
6. Panel shall comply with the standards for Category 5e/Class D patch panels listed in the TIA/EIA-568 Series Standards and ISO/IEC 11801.
7. Panel shall support IEEE 802.3 1000BASE-T plus other legacy LANs and applications.
8. Basis for Design Specifications: CommScope UNP510 Patch Panel series.
9. Approved Manufacturer: CommScope Systimax
   a. Straight Patch Panels
   b. Angled Patch Panels
   (Provide Appendix A for Approved Materials and Parts List)

B. Category 6A/Class Ea Patch Panels
1. General specifications: Patch panel shall be constructed of high strength steel with satin chrome finish and designed for wall or 19-inch rack mounting.
2. Panels shall be available in 24-port and 48-port configurations, with height of 1 Rack Unit (RU) of 44.5 millimeters (1.75 inches) for each group of 24 ports.
3. Removable rear mounted cable management bar and front and rear identification labels.

4. Patch panels must be capable of connection to the CommScope Intelligent Patching solution or upgradable to connection to the CommScope Intelligent Patching Solution.
5. Patch panels shall support 5 meter cables in 3 and 4 connector channels, 3 meter cables in 2 connector channels and cross connect cords down to 1 meter.
6. Comply with the standards for Category 6A/Class E_A patch panels listed in the TIA/EIA-568 Series Standards and ISO/IEC 11801.
7. Basis for Design Specifications: CommScope ULTRA 10© Patch Panel series.
8. Approved Manufacturer: CommScope Systimax
   a. Straight Patch Panels
   b. Angled Patch Panels
   (Provide Appendix A for Approved Materials and Parts List)

C. High Density Modular Patch Panels
1. General specifications: Patch panel shall be constructed of high strength steel with black powder finish and designed for wall or 19-inch rack mounting.
2. Panels shall be available in a 48-port configuration, with height of 1 Rack Unit (RU) of 44.5 millimeters (1.75 inches).
3. Removable rear mounted cable management bar and front and rear identification labels.
4. Basis for Design Specifications: CommScope Systimax Category 5e, and 6A Information Outlets.
5. Approved Manufacturer: CommScope Systimax
   a. Straight Patch Panel
   b. Angled Patch Panel
   (Provide Appendix A for Approved Materials and Parts List)

D. Fiber Optic Shelf Panels
1. General specifications: Shelves shall be constructed of high strength steel with black powder finish and designed for wall or 19-inch rack mounting.
2. Shelves shall be available in multi U configurations, with height of 1 Rack Unit (RU) 44.5 mm (1.75 in), to 4 RU 177.8 mm (7 in).
3. Removable rear mounted cable management bar, door or cover and front and rear identification labels.
4. Comply with the standards for patch panels listed in the TIA/EIA-568 Series Standards and ISO/IEC 11801.
5. Fiber Shelf Panels shall accept ST, SC or LC modular adapter panels.
6. Basis for Design Specifications: CommScope Ready© Shelf series.
7. Approved Manufacturer: CommScope Systimax:
   a. 1U Internal Sliding Modular Fiber Shelf
   b. 2U Internal Sliding Modular Fiber Shelf
   c. 4U Internal Sliding Modular Fiber Shelf
   (Provide Appendix A for Approved Materials and Parts List)

E. Multimedia Patching Systems
1. General specifications: Patch panel shall be constructed of high strength steel with black powder finish and design for wall or 19-inch rack mounting.

2. Panels shall be available in 24, 36 and 48-port straight or angled configurations with Rack mounted base unit, 1 RU (44.5 millimeters [1.72 inches]) or 2 RU (90mm [2.54 inches]), with slide-in modules with interchangeable front bezels, cable management brackets, and a flip-down removable front cover for closeout.
3. Removable rear mounted cable management bar and front and rear identification labels.
4. Jacks, Outlets and Adapters
   a. Unit shall support modular video jacks, 8P8C jacks, and fiber optic type jacks
   b. Comply with requirements specified for jacks corresponding to the cable and terminations specified or indicated for the patch panel.
   c. Colors shall be specified or selected by the Owner's Representative from the manufacturer's standard colors.
   d. Basis for Design Specifications: CommScope Multimedia series
   e. Approved Manufacturer: CommScope Systimax
   (Provide Appendix A for Approved Materials and Parts List)

PART 3 - EXECUTION

1.1 Installation

A. All Patch Panels shall be installed in the racks installed in the telecommunications space.
B. Each patch panel shall be attached to the rack using the four (4) rack screws supplied with the panel
C. All Patch Panels shall be installed level and plum within the racks.
D. Patch Panels shall be installed per the elevation drawings for the Telecommunications space.

Communications Cable Management and Ladder Rack

PART 1 – GENERAL

1.1 WORK INCLUDED

Provide all labor, materials, and equipment for the complete installation of work called for in the contract documents.

1.2 SCOPE OF WORK

A. This section includes the minimum requirements for the equipment and cable installations in telecommunications rooms.
B. Included in this section are the minimum composition requirements and installation methods for the following:
   Ladder Rack.

1.3 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.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the owner or the owner representative.

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

D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – National Electric Code
BICSI – Telecommunications Distribution Methods Manual

1.4 SUBMITTALS

Provide product data for the following:
Manufacturer's data/cut sheets, product drawing/specifications and installation instructions for all products (submit with bid).

PART 2 – PRODUCTS

2.1 LADDER RACK SUPPORTS, AND ACCESSORIES

A. Ladder Rack

1. Ladder rack shall be manufactured from tubular steel. Stringers (sides) will be made from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness. Cross members (rungs) will be made from 1" wide by ½" high tubular steel with .065" wall thickness.
2. Ladder rack/tray cross members will be welded in between stringers on 9" centers. There will be 8" of open space in between each cross member.
3. Approved Manufacturer: CPI, B-Line or approved equal.
   Example part numbers
   (Provide Appendix A for Approved Materials and Parts List)

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

1. Horizontal 90° turns shall be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness.
2. Stringers (sides) will be formed in a 90° arc. Cross members will be welded in between stringers on approximate 23° increments so that there are 5 cross

members per turn. The welded assembly will have an inside radius that will create a smooth horizontal 90° turn.

3. Approved Manufacturer: CPI, B-Line or approved equal
   Example part numbers
   a. (Provide Appendix A for Approved Materials and Parts List)

C. Ladder Rack Splices
   1. Splice kits will provide a method of mechanically connecting ladder rack/tray sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.
   2. Approved Manufacturer: CPI, B-Line or approved equal
   3. Example part numbers
      a. (Provide Appendix A for Approved Materials and Parts List)

D. Ladder Rack Accessories
   1. Cable straps used for attaching cable bundles to the ladder rack/tray cross members must be reusable with a hook and loop-style closure, at least ¾" wide, and sized for cable bundles that are 2", 3" or 4" in diameter.
   2. Cable retaining posts used to keep cable from falling off of the side of the ladder rack/tray shall be manufactured from 1" by ½" tubular steel with .065" wall thickness. Cable retaining posts will be 8" high and will attach to the side stringer of the ladder rack/tray 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/tray will be manufactured from a black fire-retardant rubberized material. End caps will be sized for 3/8" wide by 1-1/2" high side stingers and will be sold in pairs.
   4. Radius drops or "waterfalls" used to maintain the bend Radius of the cables as they exit or enter the ladder rack/tray will be manufactured from aluminum extrusion. The extrusion will be formed in a 90° arc with a minimum bend radius of 3". Radius drops will attach to either the side stringer or the cross member of the ladder rack/tray using a clevis pin. Radius drops will include 1-1/2" high cable spools that attach to the top of the radius drop to guide cables.
   5. Auxiliary support brackets used to support cables that should be physically separated from the cables in the ladder rack/tray will be made from 1/8" x 1" steel bar. The bracket will be L-shaped and will attach to the side stringer of the ladder rack/tray. The bracket will hang below the ladder rack/tray a minimum of 4". The bracket support surface will be 4" long. The bracket will be zinc plated.
   6. Unless otherwise noted, finish on all metal components shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below.
   7. Approved Manufacturer: CPI, B-Line or approved equal
      Example part numbers
      a. (Provide Appendix A for Approved Materials and Parts List)

PART 3 – EXECUTION

3.1 INSTALLATION

A. Provide all components of the ladder rack/tray system (ladder rack/tray, turns, splices, supports, and accessories) from a single manufacturer.

B. Ladder rack/tray 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.

C. Ladder rack/tray shall be secured to the structural ceiling, building truss system, wall, floor or the tops of equipment racks and/or cabinets using the manufacturer's recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).

D. Ladder rack/tray splices will be made in mid-span, not over a support, with the manufacturer's recommended splice hardware.

E. Ladder rack/tray shall be supported every 5' or less in accordance with TIA-569. Ladder rack/tray shall be supported within 2' of every splice and within 2' on both/all sides of every intersection. Support ladder rack/tray within 2' on both sides of every change in elevation. Support ladder rack/tray every 2' when attached vertically to a wall.

F. When the pathway is overhead, ladder rack/tray shall be installed with a minimum clearance of 12" above the ladder rack/tray. Leave a minimum of 12" in between ladder rack/tray and ceiling/building truss structure. Leave a minimum of 3" in between ladder rack/tray and the tops of equipment racks and/or cabinets. Multiple tiers of ladder rack/tray shall be installed with a minimum clearance of 12" in between each tier of ladder rack/tray. When located above an acoustical drop ceiling, leave a minimum of 3" clearance between the top of the drop ceiling tiles and the bottom of the ladder rack/tray.

G. All threaded rod used in support of overhead cable trays shall have cable guard protectors installed over the exposed threaded rod in the area of the tray. The exposed end of the threaded rod hangers shall be cut flush with the mounting brackets, filed, and painted to match site conditions. Install rubber finishing caps on any exposed metal end rail or potential sharp point.

H. When installed under a raised floor, ladder rack/tray shall be installed with a minimum 3" clearance between the top of the ladder rack/tray and the bottom of the floor tiles or floor system stringers, whichever is lower in elevation. Maintain a 3" clearance between ladder racks/trays wherever ladder racks/trays cross.

I. Within each telecommunications room, ladder rack/tray should be bonded together, electrically continuous, and bonded to the TGB, unless otherwise noted in the specifications and contract documents. Ladder rack/tray and turns shall be bonded across each splice with a bonding kit. Ladder rack/tray shall be bonded to the Telecommunications Grounding Busbar (TGB) using an approved ground lug on the ladder rack/tray and a minimum #6 grounding wire or as recommended by the AHJ. Remove paint from the ladder rack/tray where bonding/ground lugs contact the ladder rack/tray so that the lug will contact bare metal. Use antioxidant joint compound in between the bare metal on the ladder rack/tray 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 ladder rack/tray sections and turns and through the bond to the TGB.

J. The quantity of cables within the ladder rack/tray will not exceed a whole number value equal to 50% of the interior area of the ladder rack/tray divided by the cross-sectional area of the cable. The interior area of ladder rack/tray will be considered to

be the width of the ladder rack/tray multiplied by a height of 2", unless cable retaining posts are added to the ladder rack/tray. The interior area of ladder rack/tray equipped with cable retaining posts will be considered to be the width of the ladder rack/tray multiplied by a height of 6". Actual cable fill for ladder rack/tray that is not equipped with cable retaining posts will not exceed 2" in height. Actual cable fill for ladder rack/tray equipped with cable retaining posts will not exceed 6" in height.

K. The combined weight of cables within the ladder rack/tray will not exceed the stated load capacity of the ladder rack/tray as stated in the manufacturer's product specifications or load/design tables.

L. Cables (cable bundles) will be secured to the cross members of ladder rack/tray with ¾" wide reusable straps. Straps are not required when ladder rack/tray is equipped with cable retaining posts.

M. Use a radius drop to guide cables wherever cable exits overhead ladder rack/tray to access a rack, cabinet or wall-mounted rack, and cabinet or termination field. Provide a support other conductors that should be physically separated from cables within the ladder rack/tray as defined by local code or the authority having jurisdiction (AHJ).

N. Whenever possible, maintain a 2' separation between ladder rack/tray used for communications cables and pathways for other utilities or building services.

O. The installer will provide touch-up paint color-matched to the finish on the ladder rack/tray and will 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 will 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 ladder rack/tray system.

END of SECTION