Section 27 1116
Communications Cabinets, Racks, Frames and Enclosures
Part 1 - General
1.1 - Work Included

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

1.2 - Scope of Work

A. This document describes the products and execution requirements relating to furnishing and installing Telecommunications Cabling. Communication Equipment Room Fittings of cabinets, racks, frames and enclosures are covered under this document.
B. The Communication Equipment Room shall support no less than (2) 4-pair Unshielded Twisted Pair (UTP) Copper Cables to each work area outlet unless otherwise noted for specific locations. The cables shall be installed from the Work Area Outlet to the Telecommunications Room (TR) located on the same floor and routed to the appropriate rack serving that area and terminated as specified in this document.
C. This section includes minimum requirements for the following:
    1. Cabinets
    2. Racks and Rack Cable Management
    3. Frames
    4. Enclosures
D. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the telecommunications contractor as detailed in this document.
E. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types will be provided as an attachment to this document. If the bid documents are in conflict, this specification shall take precedence. Caltech will assist in the design, layout and specification detail needed to clarify any ambiguity between this document and other construction documentation. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

1.3 - Regulatory References

A. All products, services, materials and documentation provided by the Installer shall meet the requirements of the following where applicable:
    1. National Electrical Manufacturer's Association (NEMA)
    2. American National Standards Institute (ANSI)
    3. National Fire Prevention Act (NFPA)
        a. National Electric Code 2020 (NEC)
    4. Relevant State Electric and Fire Codes

5. Institute of Electrical and Electronic Engineers (IEEE)
6. Underwriters Laboratories, Inc. (UL)
7. Telecommunications Industry Association / Electronic Industries Alliance (TIA/EIA)
    a. TIA-526-7A Fiber-Optical Power Loss Measurements SM
    b. TIA-526-14C Fiber Optical Power Loss Measurements MM
    c. TIA-568_0-D Generic Telco Cabling Customer Premises
    d. TIA-568_0-D1 Generic Telecom Cabling for Customer Premise Addendum
    e. TIA-568_1-D Commercial Building Telcom Infrastructure Std
    f. TIA-568_1-D1 Commercial Building Infrastructure Standard Addendum
    g. TIA-568_2D Balanced Twisted Pair Cabling and Components
    h. TIA-568_3-D Optical Fiber Cabling Components Standards
    i. TIA-569-E Telecom Pathways and Spaces
    j. TIA-598-D Optical Fiber
    k. TIA-598-D Optical Fiber Addendum
    l. TIA-598-D1 Optical Fiber Color Coding Addendum
    m. TIA-606-C Admin for Telecom Infrastructure
    n. TIA-607-D Grounding and Bonding
    o. TIA-758-B Customer Owned OSP
    p. TIA-942-B Data-Centers
8. Building Industry Consulting Service International (BICSI) publications:
    a. Telecommunications Distribution Methods Manual (TDMM), 14th ed.
    b. Outside Plant Design Reference Manual (OSPDRM), 6th ed.
    c. Information Technology Systems Installation Methods Manual (ITSIMM), 7th ed.
    d. Telecommunications Project Management Manual (TPMM), 1st edition
    e. ANSI/BICSI 006, Distributed Antenna System (DAS) Design and Implementation Best Practices
    f. ANSI/BICSI 008, Wireless Local Area Network (WLAN) Systems Design and Implementation Best Practices
    g. ANSI/BICSI 005, Electronic Safety and Security (ESS) System Design and Implementation Best Practices
    h. ANSI/BICSI 007, Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises
    i. ANSI/BICSI 001, Information and Communication Technology Systems Design and Implementation Best Practices for Educational Institutions and Facilities
9. Manufacturer's recommendations and installation guidelines
10. All cabling shall comply with all appropriate requirements of NEC Articles 770 and 800 and shall comply with the State Fire Codes as interpreted by the State Fire Marshall's Dept.

B. All publications referred to in this document shall be the latest edition thereof together with any amendments and/or addenda.

1.4 - Quality Assurance

A. Panduit Certification Plus System Warranty shall provide a complete system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of at least 25 years.
B. A factory registered Panduit PCI contractor shall complete network installation.
C. Contractor shall have completed standards-based product and installation training.
D. A copy of the PCI Contractor Registration shall be submitted in the proposal.
E. Product Guarantee:
F. All Panduit PAN-NET non-consumable products have a 25-year guarantee. When installed per TIA or ISO/IEC standards, the Panduit PAN-NET Network Cabling System will operate the application(s) for which the system was designed to support. Installation shall support 10/100/1000/10,000 Mbps Ethernet (IEEE 802.3).
G. In order to qualify for the guarantee, the structured cabling system must be installed per the following:
    1. Meet all TIA/EIA commercial building wiring standards.
    2. Manufacturer categorized products must be used in conjunction with an equivalent or higher Category UL or ETL verified cable.
    3. Manufacturer's products must be installed per Manufacturer's instruction sheets.
H. Note: All Networks shall be installed per applicable standards and manufacturer's guidelines.
I. If any Panduit PAN-NET product fails to perform as stated above, PANDUIT will provide new components at no charge.
J. This guarantee is made in lieu of and excludes all other warranties, expressed or implied. The implied warranties of merchantability and fitness for a particular use are specifically excluded. Neither seller nor manufacturer shall be liable for any other injury, loss or damage, whether direct or consequential arising out of the use of, or the inability to use, the product. Before using, user shall determine the suitability of the product for its intended use, and user assumes all risk and liability whatsoever in connection therewith. The foregoing may not be altered except by an agreement signed by officers of seller and manufacturer.

Part 2 - Products

2.1 - Approved Products

A. Approved rack manufacturer: Chatsworth, Panduit
B. Approved rack cable management system manufacturer: Chatsworth, Panduit
C. Approved vertical cable manager manufacturer: Panduit
D. Approved horizontal cable manager manufacturer: Panduit
E. Approved wall mounted fiber optic enclosure manufacturer: Corning, Panduit
F. Approved rack mounted fiber optic enclosure manufacturer: Corning
G. Approved stackable cable rack spacer manufacturer: Panduit

H. Approved threaded rod cover manufacturer: Panduit
I. Approved cable support system manufacturer: CEAS, ERICO, Panduit
J. Approved zone cabling box manufacturer: Panduit

2.2 - Equivalent Products

A. Refer to section 270000 Part 6 regarding substitution of materials.

2.3 - General

A. Provide materials to support copper cable plant, optical fiber plant and network electronics installation.
B. Provide overhead ladder rack fixed to the top of each rack and running from the top of the rack to the telephone backboard where the feeder and distribution cables run, as shown on the drawings.
C. Provide cable bend management fixtures to maintain the proper bend radius as the cables drop into the rack. Do not allow cables to be unsupported as they run from conduit or cable tray to equipment cabinets.
D. Racks to be seismically braced in accordance with local seismic bracing requirements. Racks are to be braced against sway on all three axes. Horizontal cable tray or other cable support that is also rated as a seismic brace may be used to meet some of the seismic bracing requirements.
E. Fiber optic cables are properly supported providing correct bend radii.

2.4 - Racks

A. The rack shall be manufactured from extruded aluminum and marked with Rack Unit spacing.
B. Provide rack as shown on the Drawings and as specified in this section.
C. The Rack system shall meet all EIA requirements as defined in EIA-310-D.
D. Provide all mounting components and accessories to securely fix racks to floor and supporting walls.
E. Each rack shall be UL listed for a load-carrying capacity of 1000 lbs. (454 kg.).
F. Pass through holes shall be located on the front, back and side of the rack for maximum flexibility.
G. Rack must be capable of accepting plastic D-rings that are movable.
H. Two post racks are to be threaded for #12-24 threads.
I. Four post racks are not to be threaded, but instead utilize cage nuts that are threaded for #12-24 threads.

2.5 - Cable Management

A. General

1. Cable Management System shall be used to provide a neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures.
2. The system shall be a complete cable management system comprised of vertical cable managers, horizontal cable manager (if applicable), and cable management accessories used throughout the cabling system.
3. Cable management system shall protect network investment by maintaining system performance, controlling cable bend radius and providing cable strain relief.
4. Provide patch management ring runs in each rack as specified by drawings.
5. Provide strain relief and cable management at the rear of each rack to ensure uniform routing of all feeder and distribution cables.
6. Each rack to have a minimum of eight power sockets mounted on a horizontal strip mounted rack. The power outlets on the connector strip shall be NEMA 5-20R compatible. The plug shall be NEMA 5-20P compatible.
7. Provide all racks with grounding kits and wires.
8. Provide Raised Floor Rack Supports from rack manufacturer for all equipment racks mounted on raised "access" floor. Racks installed on raised floors are to be bolted through the raised floor directly into the concrete flooring below.
9. The rack system solution shall provide integral cable management including vertical channels, pass through holes and slots for additional cable management accessories.

B. Horizontal Cable Management

1. Provide (1) 2U high horizontal patch management in the above and below each non-angled patch panel (when non-angled patch panels are utilized).
2. Part number WMPH2 Horizontal patch management at top of rack as shown by drawings.
3. Horizontal cable managers shall include components that aid in routing, managing and organizing cable to and from patch panels and/or equipment.
4. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief.
5. Panels shall be a universal design mounting to EIA 19" racks and constructed with cable management fingers.
6. The fingers shall include retaining tabs to keep cables in place during cover removal.
7. The covers shall be easily removed or hinged to allow for quick moves, adds, and changes.
8. Cable managers shall be provided with wire retainers to retain the cables during cover removal and #12-24 English and M6 metric mounting screws.
9. Part number WMPH2E Front & Rear Duct is typical, refer to Drawings for detailed information.

C. Vertical Cable Management

1. Provide side-mounted vertical cable management with covers on both sides of each rack.

2. Vertical cable management between racks shall be 12" in width.
3. Vertical cable management on the end where another rack will not be installed shall be no less than 8" in width.
4. Cable management shall be with cover plates and bracket kits as needed to attach to adjacent racks.
5. Vertical cable management shall have swinging doors and utilize a latching mechanism (snap on covers are not acceptable) located on the front and back of the vertical cable managers.
6. Vertical cable managers shall include components that aid in routing, managing and organizing cable to and from patch panels and/or equipment.
7. Managers shall protect network equipment by controlling cable bend radius and providing cable strain relief.
8. Managers shall be a universal design mounting to EIA 19" or 23" racks and constructed of a base with cable management fingers.
9. Cable management fingers shall include retaining tabs to keep cables in place during cover removal.
10. Cable management covers shall be hinged to open in either direction allowing for quick moves, adds, and changes.
11. Part Number Type Rack PRV12 with PRD12 for 12" vertical cable managers and PRV8 with PRD8 for 8" vertical cable managers and associated mounting hardware.
12. Note there is a shallow and deep side to the vertical cable managers, deep side is to face the front side of rack to allow for patch cable management.

2.6 - Enclosures

A. Wall mounted fiber optic enclosures - Used for special application only and approved on a case-by-case basis.
B. Rack mounted fiber optic enclosures - See section 27 1323 for fiber optics specifications.
C. Wall mounted cabinets for communications cable and network electronics enclosures - Used for special application only and approved on a case-by-case basis.

2.7 - Zone Cabling - Not used at Caltech

Part 3 - Execution

3.1 - Horizontal Distribution Cable Installation

A. Shall be installed in accordance with manufacturer’s recommendations and best industry practices.
B. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
C. Cable raceways shall not be filled greater than the TIA/EIA-569-A maximum fill for the particular raceway type or 40%.
D. Cables shall be installed in continuous lengths from origin to destination (no splices).
E. Where transition points, or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

F. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
G. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48-to-60-inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
H. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
I. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
J. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.
K. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
L. Cables shall be identified by a self-adhesive, self-laminating or heat shrink label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606.
M. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
N. Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
O. Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.

3.2 - Horizontal Cross Connect Installation

A. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B standard, manufacturer's recommendations and best industry practices.
B. Pair untwist at the termination shall not exceed 3.18 mm (0.125 inch). C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
C. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
D. The cable jacket shall be maintained as close as possible to the termination point.
E. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.3 - Racks

A. Racks shall be securely attached to the concrete floor using minimum 3/8” hardware or as required by local codes
B. Racks shall be placed with a 36-inch (minimum) clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.
C. All racks shall be grounded to the telecommunications ground bus bar in accordance with Section Ground and Bonding for Communications Systems of this document.
D. Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
E. Racks are to be installed with mechanical bracing in all the axis and installed to meet Seismic requirements for local zone.
F. Vertical cable managers to be securely fastened to, and if needed, between racks.

End Section