



CSI DIVISION 27

MASTER BOILERPLATE

SPECIFICATION

8/1/12

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a standard specification applicable to commercial building structured cabling applications.

The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines.

The information contained in this document is based on our experience to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be used with their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements consult the factory. This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supercedes and voids all previous literature, etc.

It is highly recommended and the issuers responsibility to have any RFQ documents, including those based on this general format, reviewed by the issuing company's professional advisors before it is released to the public. In no way may this document be used in a manner that is detrimental to the interests of Panduit and/or its subsidiaries.

**CSI Division 27
Panduit Master Boilerplate Specification
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CSI SECTION 270500 COMMON WORK RESULTS FOR COMMUNICATIONS

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SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 & 1 Specification Sections, apply to this Section.
1. TIA/EIA-526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7 (August 1998)
 2. TIA/EIA-526-14-A - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – OFSTP-14 (August 1998)
 3. TIA/EIA-568-B 1.1 - Commercial Building Telecommunications Cabling Standard Part 1: General Requirements (August 2001)
 4. ANSI/TIA/EIA-568-B.2 - Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components
 5. TIA/EIA-568-B.2-4 - Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components (June 2002)
 6. ANSI/TIA/EIA-568-B.3 - Optical Fiber Cabling Components Standard
 7. TIA/EIA-568-B.3-1 - Optical Fiber Cabling Components Standard (April 2002)
 8. ANSI/TIA/EIA-569-A - Commercial Building Standard for Telecommunications Pathways and Spaces
 9. TIA/EIA-569-A-7 - Commercial Building Standard for Telecommunications Pathways and Spaces (December 2001)
 10. TIA/EIA-598-B - Optical Fiber Cable Color Coding (December 2001)
 11. TIA/EIA-606-A - Administration Standard for Commercial Telecommunications Infrastructure (May 2002)
 12. J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications (October 2002)
 13. TIA/EIA-758-1 - Customer-Owned Outside Plant Telecommunications Cabling Standard (April 1999)
 14. TIA 942 Telecommunications Infrastructure Standard for Data Centers
 15. ANSI/TIA/EIA-568-B.2-10; Transmission Performance Specifications for 4-Pair 100 Ω Augmented Category 6 Cabling
 16. ANSI/TIA 455-78-B-2002; Optical Fibers – Part 1-40: Measurement Methods and Test Procedures – Attenuation
 17. ANSI/TIA 598-C-2005; Optical Fiber Cable Color Coding
 18. ANSI/TIA 569-B-2004; Commercial Building Standard for Telecommunications Pathways and Spaces
 19. TIA/TSB 140-2004; Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems
 20. ISO/IEC 11801 A1: 2002 – Information Technology – Generic Cabling For Customer Premises
 21. National Electrical Code
 22. ANSI/NECA/BICSI-568 - Standard for Installing Commercial Building

Telecommunications Cabling

23. BICSI - Telecommunications Distribution Methods Manual, 11th Edition.
 24. BICSI - Information Transport Systems Installation Manual, 5th Edition.
 25. BICSI - Network Design Reference Manual, 6th Edition.
 26. BICSI – Outside Plant Design Manual, 4th Edition.
 27. Federal, state, and local codes, rules, regulations, and ordinances
 28. The Contractor shall perform all work according to Federal, State, and local codes, rules, regulations, and ordinances governing the work, and as fully part of the specifications as if herein repeated or hereto attached. If the Contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the owner's representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.
 29. Consider adding a reference to UL 2024A Optical Fiber Cable Routing Assemblies for non-metallic cable pathways and NEMA VE1/CSA22.2 Metal Cable Tray systems for ladder rack and cable tray systems.
- B. All standards related to or referenced by the standards listed herein.

1.3 DEFINITIONS

- A. Provide: Furnish, install, terminate, label, test and certify a complete operating cabling system.
- B. 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.
- C. 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.
- D. Point-of-Entry (POE): Unmarked Manholes/Vaults at property line
- E. NET-POP Rooms: The area where the outside plant media/carrier services appears 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.
- F. 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 IDF/access zones for all connections.
- G. 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.
- H. 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.
- I. Campus Backbone: cabling system consisting of media and termination hardware interconnecting POE, Net-Pop's and Future onsite buildings.
- J. Building Backbone: cabling system consisting of media and termination hardware interconnecting MDFs to IDFs.
- K. Horizontal: cabling system consisting of media and termination hardware interconnecting the Telecommunication Outlets (TOs) and the IDFs.
- L. 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.
- M. 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.
- N. Cabinet: free standing, floor-mounted or wall-mounted modular enclosure designed to house and protect rack-mounted electronic equipment and passive terminations.

- O. 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.
- P. Cross-Connect: equipment used to terminate and tie together communications circuits.
- Q. Cross-Connect Jumper: a cluster of twisted-pair conductors without connectors used to establish a circuit by linking two cross-connect termination points.
- R. Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.
- S. Jack: receptacle used in conjunction with a plug to make electrical contact between communications circuits, e.g., eight-position/eight-contact modular jacks.
- T. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- U. LAN: Local area network.
- V. 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.
- W. Media: twisted-pair, and fiber optic cable or cables used to provide signal transmission paths.
- X. Mounting Frame: rectangular steel framework, which can be equipment rack or wall mounted to support wiring blocks, patch panels, and other communications equipment.
- Y. 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.
- Z. UTP: Unshielded Twisted Pair.
- AA. FO: Fiber Optic
- BB. Passive Equipment: non-electronic hardware and apparatus, e.g., equipment racks, cable trays, electrical protection, patch panels, wiring blocks, fiber optic shelves, etc.
- CC. 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.
- DD. Patch Panel: system of terminal blocks or connectors used with patch cords that facilitate administration of cross-connect fields.
- EE. 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.
- FF. Protectors: electrical protection devices used to limit foreign voltages on metallic

communications circuits.

- GG. 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.
- HH. Racks: An open, freestanding, floor-mounted structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack.
- II. Riser Backbone: The Riser Backbone subsystem links the main cross connect (DC/NC) in the equipment room to the distribution rooms (IDFs).
- JJ. 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.
- KK. Telecommunication Outlet (TO): Connecting device mounted in a work area used to terminate horizontal cable and interconnect cabling with station equipment.
- LL. 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.
- MM. 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.
- NN. Wireless Access Point (WAP): Telecom outlet designated for use with wireless network devices. Such outlet shall be mounted above ceiling.
- OO. Contractor – The successful bidder engaged to provide the work of this specification

1.4 SUBMITTALS

- A. General:
 - 1. Refer to Divisions 0 & 1.
- B. Provide all applicable portions of the following information for sections listed in paragraph 1.2 above, in addition to the standard requirements, within 7 days after receiving each reel and/or box of cable:
 - 1. Manufacturer's product test data for fiber optic cable components.
 - 2. Visually inspect Category-6A UTP. Materials cannot be used before results have been submitted to CM and approved by the Owner or its representative.
 - 3. On-reel OTDR testing of all fiber.

C. Provide all applicable portions of the following completed test documentation for sections listed in paragraph 1.2 above, in addition to the standard requirements, within 10 days after completion of the tests for each cable channel or link:

1. Test reports shall be submitted in the following manner:
 - a. To the Owner: One copy on eight and one-half inch by eleven papers providing for quality reproducible printing, and electronic copy in MS Excel format.
 - b. Submit test report documentation through CM for review by the Engineer for specification conformance and one copy in electronic format.
2. Twisted-pair field test documentation.

1.5 QUALITY ASSURANCE

A. Manufacturers Warranty and Application Assurance

1. The Structured Connectivity Solutions Extended Manufacturers Warranty and Application Assurance
 - a. The extended manufacturer's warranty, for a minimum of 20 years from the date of occupancy, shall include providing replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s) for the period indicated above.
 - b. Minimum twenty (20) year application assurance: The application assurance shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future for a minimum twenty (20) year period.
 - c. System certification: Upon successful completion of the installation and subsequent inspection, the Owner shall be provided with a numbered certificate, from the manufacturer(s), registering the installation.
2. Extended Product Warranty
 - a. The Extended Product Warranty covers all passive Registered Manufacturer SCS components (i.e., cable and connectivity components that make up the passive data and telecommunications signal transmission infrastructure). "Passive Components" are defined as Manufacturer SCS components that exhibit no gain or contribute no energy. Manufacturer Solutions warrants, from the occupancy date, provided a registration certificate is issued by the Manufacturer Solutions to the customer, the following:
 - 1) that the Passive Components of Registered Manufacturer SCS will be free from manufacturing defects in material and workmanship under normal and proper use;
 - 2) that all Manufacturer Solutions Passive Components in the Registered Manufacturer SCS meet or exceed the relevant component specification of the TIA 568-C series and ISO/IEC 11801: 2002 standards;
 - 3) that the Registered Manufacturer SCS compliant links/channels will meet or exceed the applicable requirements of the TIA 568-B series, and ISO/IEC 11801: 2002 standards for cabling links/channel configurations specified in these standards;
 - 4) that the Registered Manufacturer SCS compliant channels will additionally meet or exceed the Guaranteed Published Channel

Performance in the Manufacturer SCS Performance Specifications Addendum in effect at the time of installation.

- b. Under the Extended Product Warranty, Manufacturer Solutions will (or will authorize a Manufacturer Business Partner to) either repair or replace the defective Registered Manufacturer SCS product at Manufacturer Solution's cost. Manufacturer Solutions will pay a Manufacturer Business Partner for the cost of labor to repair or replace any such defective product on behalf of Manufacturer Solutions, provided, that such repair or replacement and associated labor costs receive the prior written approval of Manufacturer Solutions. If Manufacturer Solutions chooses to repair products, Manufacturer Solutions will use new replacement parts. If Manufacturer Solutions chooses to replace products, Manufacturer Solutions may replace such products with new products of the same or similar design. Any such repair or replacement will be warranted for either
 - 1) 90 days or
 - 2) The remainder of the original warranty period, whichever is longer.
3. Application Assurance
 - a. The Application Assurance covers the Registered Manufacturer SCS compliant to support operations of the application(s) that the system was designed to support, as well as additional application(s) defined below. Manufacturer Solutions warrants that the Registered Manufacturer SCS will be free from defects that prevent operation of the specific application(s) for which the Registered Manufacturer SCS was initially designed as long as the design is in compliance with the Manufacturer SCS Performance Specifications for said applications and is in compliance with all other terms and conditions of this warranty.
 - b. The Application Assurance also covers the following additional applications:
 - 1) those as specified in the current (at the time of installation) Manufacturer SCS Performance Specifications and Addendums; and
 - 2) in accordance with application standards specifications, any application introduced in the future by recognized standards or user forums that use the relevant TIA 568-C series or ISO/IEC 11801 components and link/channel specifications for cabling, to the extent that such applications are defined to operate over the guaranteed channel performance and/or the installed channel topologies.
 4. Term of Warranty
 - a. The warranty period will be for a minimum of Twenty (20) years from the date of occupancy.
 - b. Moves, additions, or changes are covered by the original registration certificate if performed by a Manufacturer Business Partner in compliance with the Manufacturer SCS design, installation and registration requirements.
 - c. Administration of Manufacturer SCS cords by the end user is covered by the original registration certificate.
 5. Person / Entity Covered
 - a. This warranty is for the sole benefit of the person or entity to whom the Manufacturer Solution's registration certificate is issued and any successor

in interest to the site in which such Registered Manufacturer SCS was originally installed.

B. Testing and Inspection of Communications Equipment

1. Provide tests specified below, when applicable, and as indicated under individual items of material, equipment, and work specified in this Specification.
 - a. Furnish all test equipment and instruments required for the tests.
 - b. Responsible, qualified employees of the contractor in the presence of the Owner or an authorized representative shall perform the cable testing.
 - c. All individuals involved in the testing phase of the project shall not have been involved in the installation phase nor shall have immediate knowledge of the installation task.
2. End to end performance of all parts and channels will be tested.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.7 REGULATORY REQUIREMENTS

- A. Conformance to the latest national, state, and local codes and other legal requirements are the responsibility of the contractor.

1.8 RESPONSIBILITIES AND COORDINATION.

- A. The contractor shall provide all materials, qualified labor and services required to ensure a complete and operational system, installed in accordance with the intent of the Contract Documents.
- B. The contractor shall furnish and install all incidental items not actually shown or specified, but which are required by best practices to provide complete functional systems.
- C. The contractor shall coordinate the details of facility equipment and construction for all specification divisions, which affect the work covered under this Division.
- D. The contractor shall coordinate all activities with the overall construction schedule.
- E. The contractor shall develop a bill of materials, perform material management and efficient use of the materials whether they are issued by Owner or purchased by the Contractor.
- F. The contractor shall ensure materials in excess of those required to complete the project are kept in their original condition and packaging for restocking.

1.9 DESIGN CRITERIA

- A. Compliance by the contractor with the provisions of this Specification does not relieve him or she from the responsibilities of providing materials and equipment of proper design, mechanically and electrically suited to meet operating requirements at the specified service conditions.
- B. The soliciting Owner seeks a state-of-the-art infrastructure for this new building. The design intends to achieve a technology infrastructure geared towards a complex environment. The design will also employ features applied at similar facilities and draw concepts from the new TIA-942 – Telecommunications Infrastructure Standard for Data Centers. Furthermore, the design will be of high reliability and offer manageable fault-tolerant topology.
- C. The following are incorporated into the design:
 - 1. The intent of the drawings is to restrict the maximum horizontal subsystem cabling length to 295 feet for all horizontal cabling.

1.10 LABELING

- A. Comply with TIA/EIA-606-A, TIA/EIA-606-A, Addendum 1 and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Refer to Section 270553 – “Identification for Communications Systems”

PART 2 - PRODUCTS

- A. This Section includes General Requirements for each section in Division 27 and shall be used in conjunction with specifications, other related Divisions and related Contract Documents to establish the total requirements for the project:
 - 1. Refer to specific sections for Products.
- B. All products must be from same manufacturer

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. Manufactured products, materials, equipment, and components shall be provided, conditioned, applied, installed, connected, and tested in accordance with the manufacturer’s specifications and printed instructions.
- B. The installation of all system components shall be carried out under the direction of qualified personnel. Appearance shall be considered as important as mechanical and electrical efficiency. Workmanship shall meet or exceed industry standards.

3.2 INTENT OF DRAWINGS:

- A. The technology drawings show only general locations of equipment, devices, raceways, cable trays, boxes, etc., unless specifically dimensioned.
- B. The contractor shall be responsible for the proper placement and routing of equipment, cable, raceways, cable runway, and related components, according to the Contract Documents and subject to prior review by the Owner and structured cabling engineer.
- C. The contractor shall refer any conflicts within the Contract Documents to the Construction Manager and/or Owner for resolution.

3.3 GROUNDING

- A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A and the National Electrical Code.

3.4 FIRESTOPPING

- A. Comply with requirements in the National Building Code and the National Electrical Code,
- B. Comply with Section 078413 "Penetration Firestopping".

3.5 SERVICE CONTINUITY

- 1. Maintain continuity of communications services to all functioning portions of the process or buildings during hours of normal use.
- 2. Arrange temporary outages for cutover work with CM. Keep outages to a minimum number and a minimum length of time in order to provide minimum impact.

3.6 LAYOUT AND TOLERANCES

- A. Follow as closely as practicable the schematic design shown on the drawings. Make all necessary measurements in the field to verify exact locations and ensure precise location and fit of specified items in accordance with the drawings. Make no substantial alterations without prior approval of the Owner and the Engineer.

3.7 CABLE TERMINATION AND TEST PLANS

- A. General:
 - 1. Provide proof of testing technician(s) certification for operation of the specific units of test equipment, which are proposed for use.
 - 2. The contractor shall obtain CM approval for each termination and test plan prior to execution of the work.

3. This Section covers work necessary to furnish communications system testing, including the following:
 - a. Outside Plant (OSP) Cabling Infrastructure (Campus LAN/WAN extension)
 - b. Back-Bone Cabling Infrastructure
 - c. Horizontal Cabling Systems
4. Inspection Requirements:
 - a. As part of any performance test, inspect cable, material, and equipment for physical damage, continuity, and proper connection.
 - b. Verify identification and labeling at required locations for visibility, condition, legibility, and accuracy.
5. Test Report Requirements - Each test report shall include the following sections:
 - a. Scope of testing
 - b. List of equipment used in the test with a photocopy of the factory calibration certificate.
 - c. List of technician performing the tests identified in the scope of testing
 - d. Summary of test results: Hardcopy and electronic copies of the summary forms are to be delivered at conclusion of the project before final payment will be made.
 - e. Individual test data sheets: The individual test data sheets shall be developed and completed by the contractor. Formatted output from cable scanners is typically acceptable provided they contain all of the test parameters including graphs of the information required by this Section.

B. Cable Termination Plans:

- 1) Submit detailed termination plans for both fiber optic and twisted pair cables, which describe how each system component will be installed and terminated.

C. Cable Test Plans:

CABLE TERMINATION AND TEST PLANS

A. General:

3. Provide proof of testing technician(s) certification for operation of the specific units of test equipment, which are proposed for use.
4. The contractor shall obtain CM approval for each termination and test plan prior to execution of the work.
3. This Section covers work necessary to furnish communications system testing, including the following:
 - c. Outside Plant (OSP) Cabling Infrastructure (Campus LAN/WAN extension)
 - d. Back-Bone Cabling Infrastructure
 - c. Horizontal Cabling Systems
4. Inspection Requirements:
 - c. As part of any performance test, inspect cable, material, and equipment for physical damage, continuity, and proper connection.
 - d. Verify identification and labeling at required locations for visibility, condition, legibility, and accuracy.
5. Test Report Requirements - Each test report shall include the following sections:

- e. Scope of testing
- f. List of equipment used in the test with a photocopy of the factory calibration certificate.
- g. List of technician performing the tests identified in the scope of testing
- h. Summary of test results: Hardcopy and electronic copies of the summary forms are to be delivered at conclusion of the project before final payment will be made.
- e. Individual test data sheets: The individual test data sheets shall be developed and completed by the contractor. Formatted output from cable scanners is typically acceptable provided they contain all of the test parameters including graphs of the information required by this Section.

D. Cable Termination Plans:

- 1) Submit detailed termination plans for both fiber optic and twisted pair cables which describe how each system component will be installed and terminated.

E. Cable Test Plans:

- 1. Submit detailed test plans for both fiber optic and twisted-pair cable channels which include at least the following information:
 - a. Describe the tests to be performed.
 - b. Explain when and how each system component will be tested.
 - c. List the test equipment to be used.
 - d. Itemize how theoretical loss budgets and test parameters will be calculated and listed.
 - e. Provide an example of the test reporting documentation for each type of test, which provides a written verification of the results as required in paragraph 2 below.
- 2. Provide testing documentation which includes:
 - a. Dates and times of test;
 - b. Personnel performing tests;
 - c. Initial test results;
 - d. Description of discrepancies found or failure, if any;
 - e. Corrective action, if any;
 - f. Date and person performing corrections;
 - g. Retest results, if required;
 - h. Include space for Owner's sign-off;
 - i. Copy of test equipment calibration certificates
 - j. Intrabuilding (Vertical and Horizontal Subsystem) fiber optic segment post-installation test plan;
- 3. Twisted-Pair Cable Tests: Testing shall be performed using a Level III, Category-6 tester approved by the engineer.
- 4. Twisted-Pair Test Plans: Provide separate post-installation test schemes for the following activities:
 - a. Backbone Subsystem twisted-pair segment test plan. (Copper and Fiber)
 - b. Horizontal Subsystem twisted-pair segment test plan. (Copper and Fiber)
- 5. Fiber-Optic Cable Tests: Testing shall be performed using a Level III tester with approved test-heads approved by the engineer.

6. Fiber-Optic Test Plans: Provide separate post-installation test schemes for the following activities:
 - a. Backbone subsystem fiber-optic segment test plan.
 - b. Horizontal subsystem fiber-optic segment test plan.

3.8 TESTING AND INSPECTION OF COMMUNICATIONS EQUIPMENT

- A. Provide tests specified below, when applicable, and as indicated under individual items of material, equipment, and work specified in this Specification.
 1. Furnish all test equipment and instruments required for the tests.
 2. Responsible, qualified employees of the contractor in the presence of the Owner or an authorized representative shall perform the cable testing.
 3. All individuals involved in the testing phase of the project shall not have been involved in the installation phase nor shall have immediate knowledge of the installation task.

3.9 FINAL TEST AND ADJUST

- A. The contractor shall be responsible for post-installation performance testing of all cabling systems specified elsewhere in this Section of the Contract Documents:
 1. Testing procedures shall permit recording the length of each link, theoretical loss budget, and tested parameters for each pair and fiber, including space for sign-off by CM and Owner.
 2. Any cable links or fiber strands, which fail to meet performance test criteria, shall be reterminated, reconnectorized, or replaced by the contractor free of charge.
 3. Submit final field test documentation in list form, including the CM signature for Owner's approval.
- B. Unshielded Twisted-Pair Cable System Testing:
 1. Permanent Link Test Configuration: Perform metered tests on each multi-pair twisted-pair and/or four-pair UTP cable through the wiring block, patch panel, at each end of the cable section and/or telecommunication outlet (T.O.). The permanent link test shall be undertaken as described in ANSI/TIA/EIA-568-B.2.1.
 2. Performance Testing:
 - a. Horizontal Cable System:

- 1) Use Level III field test instruments capable of the following swept/stepped frequency voltage measurements in accordance with the performance parameters required by EIA/TIA 568-B.2. 1.
 - (a) Category-6a:
 - 2) Test each horizontal link to verify/determine, wire map, length, attenuation, skew, and near-end-cross-talk (NEXT) as described in EIA/TIA 568-B.2.1.
3. Test Reports: Include field test results for each cable including cable link length in accordance with EIA/TIA 568-B.2. 1. The test summary shall include:
 - a. Cable Identification as it appears on cable schedule.
 - b. Cable identification as it appears on the individual test reports.
 - c. Cable identification as it is labeled in accordance to the Specifications.
 - d. Pass/Fail Status.
 - e. All test parameters shall appear on each test document including graphics and indicating each test parameter result.
 - f. The individual test data sheet shall include the automated print out produced by the cable scanning equipment.

3.10 CONSTRUCTION REVIEW

- A. The Engineer and Owner will review and observe installation work to ensure compliance by the contractor with requirements of the Contract Documents.
- B. The contractor shall inspect and test completed communications installations to demonstrate specified performance levels including the following:
 1. Furnish all instruments and personnel required for the inspections and tests.
 2. Perform tests in the presence of the Engineer and Owner.
 3. Demonstrate that the system components operate in accordance with the Contract Documents.
- C. Review, observation, assistance, and actions by the Engineer and Owner shall not be construed as undertaking supervisory control of the work or of methods and means employed by the contractor. The Engineer and Owner review and observation activities shall not relieve the contractor from the responsibilities of these Contract Documents.
- D. The fact that the Engineer and Owner does not make early discovery of faulty or omitted work shall not bar the Owner from subsequently rejecting this work and withholding payment until the contractor makes the necessary corrections.
- E. Regardless of when discovery and rejection are made, and regardless of when the contractor is ordered to correct such work, the contractor shall have no claim against the Engineer or Owner for an increase in the Subcontract price, or for any payment on account of increased cost, damage, or loss.

3.11 PROJECT RECORD DOCUMENTS

- A. Provide detailed project record documentation for sections listed in paragraph 1.2 above, in addition to the standard requirements, within 30 days after completion of the work.

- B. Maintain separate sets of redlined record drawings for the communications work, which show the exact placement, and identification of as-built system components. These are subject to weekly review by the CM, Owner, or its representative.
- C. Provide communication room record drawings which indicate exact placement for all components; e.g., conduit, wireway, cable tray, backboards, equipment cabinets, equipment racks, and cross-connect equipment, etc.
- D. Provide communication wiring and cabling record drawings and schedules which indicate exact placement, routing, and connection details for all components, e.g., twisted-pair cables, splices, cable cross-connect termination locations, enclosures, telecommunications outlets, and cross-connect jumpers, patch cords, etc.
- E. Provide network schematics when appropriate.
- F. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- G. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for IDFs, backbone pathways and cables, entrance pathways and cables.

3.12 DEFINITION OF ACCEPTANCE

- A. System acceptance shall be defined as that point in time when the following requirements have been fulfilled:
 - 1. All submittals and documentation have been submitted, reviewed, and approved.
 - 2. The complete system has successfully completed all testing requirements.
- B. All punch list items have been corrected and accepted.

END OF SECTION 270500



CSI SECTION 270526

COMMUNICATIONS GROUNDING, EARTHING, AND BONDING

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a standard specification applicable to commercial building structured cabling applications.

The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines.

The information contained in this document is based on our experience to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be used with their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements consult the factory. This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supercedes and voids all previous literature, etc.

It is highly recommended and the issuers responsibility to have any RFQ documents, including those based on this general format, reviewed by the issuing company's professional advisors before it is released to the public. In no way may this document be used in a manner that is detrimental to the interests of Panduit and/or its subsidiaries

The information contained in this document is based on our experience at Panduit to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be used with their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements always consult the manufacturer of the device in question. This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supersedes and voids all previous literature, etc.

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SECTION 27 05 26

TELECOMMUNICATION GROUNDING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Commercial building grounding and bonding requirements for telecommunication infrastructure.
 - 2. Requirements for bonding and communications cabling, equipment, pathways, spaces, and mounting equipment.
- B. Related Sections:
 - 1. Section 01 33 00 – Submittal Procedures.
 - 2. Section 26 05 26 – Grounding and Bonding for Electrical System.
 - 3. Section 27 00 00 - Telecommunications.
 - 4. Section 27 05 28 - Pathways for Communication Systems.

1.2 REFERENCES

- A. ANSI/NFPA-70, 2011 National Electrical Code (NEC)
- B. ANSI/IEEE Std. 1100-2005, Recommended Practice for Powering and Grounding Electronic Equipment
- C. ANSI/IEEE Std. C2, 2007 National Electrical Safety Code (NESC)
- D. TIA-607-B (September 2011) Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises
- E. ANSI/TIA-606-B (March 2012) Administration Standard for Telecommunications Infrastructure
- F. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
- G. OSHA Standards and Regulations – all applicable
- H. Local Codes and Standards - all applicable

Anywhere low-voltage cabling Standards conflict with electrical or safety Codes, Contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either. Knowledge and execution of applicable codes is the sole responsibility of the Contractor. Any code violations committed at the time of installation shall be remedied at the Contractor's expense. Contractor is responsible to bring any perceived conflicts between project documents and referenced Standards or Codes to the attention of (CUSTOMER) for resolution.

1.3 SYSTEM DESCRIPTION

- A. Provide a communications bonding and grounding system as described in this document, documents and drawings specific to that project, and in compliance with the above cited Codes, Standards and Agencies.
- B. Comply with the requirement of Code of Practice for Info-Communications Facilities in Buildings.
- C. Comply with the requirement for Section 26 05 26 – Grounding and Bonding for Electrical System.
- D. Bond the following items within the telecommunications grounding system.
 - 1. All communications system active equipment.
 - 2. All POU and surge protection equipment.
 - 3. Raised floor systems.
 - 4. Underfloor grounding grids (a.k.a. “supplemental bonding grids” or SBGs) for computer or telecommunications rooms.
 - 5. Metallic raceway systems, including metallic cable trays.
 - 6. Communications equipment enclosures (cabinets) or cross-connect frames.
 - 7. Broadband passive devices.
 - 8. Metallic splice cases.
 - 9. Metallic cable screens, armor or shields.
 - 10. All metal cable conduit.
 - 11. Electrical service panels in entrance facilities, telecommunications and equipment rooms.
 - 12. Wall and rack mounted grounding busbars.
 - 13. Exposed building steel that is within 6 feet of equipment racking systems.
 - 14. Building steel extending to earth in outside-plant.
 - 15. All related bonding accessories.

1.4 DESIGN REQUIREMENTS

- A. Quality Assurance:
 - 1. Grounding to conform to applicable building codes.
 - 2. Cable and equipment to be installed in a neat and workmanlike manner.
 - 3. Methods of construction that are not specifically described or indicated in the contract documents to be subject to the control and approval of the (CUSTOMER) or their official representatives.
 - 4. Equipment and materials specified shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed.
 - 5. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to written approval by from (CUSTOMER) per the Substitutions Policy listed below.
 - 6. Materials and Methods shall comply in every way with above cited Standards and Codes.
- B. Materials Substitution Policy:

- a. Substitution of products for those specified within this document is not allowed without express written permission from (CUSTOMER).
- b. Should Contractor feel product substitution unavoidable for reasons of logistics or availability, Contractor shall submit to the (CUSTOMER) project representative a request for product substitution in writing no less than 5 business days in advance of bid explaining need for deviation from this specification.
- c. Written requests for substitution shall be accompanied by all drawings, specification sheets and engineering documents, as well as third party laboratory performance test results proving equivalent or superior performance in mechanical or electrical function of the product to be substituted.
- d. Equal substituted product acceptance must be received in writing from (CUSTOMER).
- e. Contractor shall be responsible for, and assume all costs for removal and replacement of any substituted materials or products not approved in writing from (CUSTOMER). Such costs shall include, but not be limited to labor, materials as well as any penalties or fees for late completion.

1.5 SUBMITTALS

- A. Make submittals in accordance with Section 01 33 00, Submittal Procedures.
- B. Action Submittals:
 1. Shop drawings showing construction details and locations of components, and description and routing of interconnecting cabling.
 2. Manufacturers cut sheets, specifications and installation instructions for additional products (submit with bid).

PART 2 PRODUCTS

2.1 MATERIALS

- A. Pipe Clamps:
 1. Used to ground copper code conductor to water pipe or copper tubing.
 2. Cast from high strength, electrolytic bronze to provide reliable grounding connections.
 3. Plated steel screws provide high strength and inhibit corrosion.
 4. Accommodates a wide range of pipe, tube, rod and conductor sizes – minimizes inventory.
 5. cULus 467 Listed for grounding and bonding with AWG conductor.
 6. (CUSTOMER) approved manufacturers:
 - a. Panduit
 - b. (CUSTOMER) approved equivalent
 7. (CUSTOMER) approved bronze grounding pipe clamps are as follows:

Part Number	Description
GPC2-1-Q	For pipe range 1/2 – 1" and conductor size range #10 SOL - #2 STR
GPC2-2-L	For pipe range 1 1/4 – 2 and conductor size range #10 SOL - #2 STR
GPC2-4-X	For pipe range 2 1/2 – 4 and conductor size range #10 SOL - #2 STR
GPC2-6-X	For pipe range 4 1/2 – 6 and conductor size range #10 SOL - #2 STR

B. Bronze Grounding Clamps for Conduit:

1. Used to ground copper conductor parallel to, or at a right angle to a rod, tube, or pipe.
2. Made from high strength, electrolytic cast bronze.
3. High strength silicon bronze hardware provides long term reliable assembly.
4. Accommodates a wide range of pipe, tube, rod and conductor sizes – minimizes inventory.
5. cULus 467 Listed for grounding and bonding with AWG conductor and suitable for direct burial in earth or concrete.
6. (CUSTOMER) approved manufacturers:
 - a. Panduit
 - b. (CUSTOMER) approved equivalent
7. (CUSTOMER) approved bronze grounding conduit clamps are as follows:

Part Number	Description
GPL-8-Q	For pipe size inches 1/2 or 3/4 and conductor size range AWG #8 SOL - #4 STRL
GPL-14-X	For pipe size inches 1 and conductor size range AWG #8 SOL - #4 STR
GPL-22-X	For pipe size inches 1 1/4 and conductor size range AWG 2/0 SOL – 250 kcmil
GPL-28-X	For pipe size inches 1 1/2 and conductor size range AWG 2/0 SOL – 250 kcmil
GPL-34-3	For pipe size inches 2 and conductor size range AWG 2/0 SOL – 250 kcmil

C. Bronze Ground Clamp with Lay-in Feature:

1. Bonds water pipe to continuous copper grounding conductors.
2. High strength, electrolytic cast bronze.
3. Phos bronze hardware provides long term reliable assembly.
4. cULus 467 Listed for grounding and bonding and suitable for direct burial in earth or concrete

Part Number	Description
GPLAC2-1-C	For conductor run parallel to pipe. Pipe size inches 1/2 or 3/4 and conductor size range AWG #10 SOL - #2 STR
GPLBC2-1-C	For conductor run perpendicular to pipe. Pipe size inches 1/2 or 3/4 and conductor size range AWG #10 SOL - #2 STR

D. Zinc Ground Clamp:

1. Bonds steel and aluminum pipe to aluminum conductors
2. Made from die cast zinc
3. Zinc plated steel hardware
4. cULus 467 Listed for grounding and bonding

Part Number	Description
GPCZ2-1-C	Pipe size inches 1/2 or 3/4 and conductor size range AWG #10 SOL - #2 STR

- E. Compression-type Aluminum-to-Copper Reducing Splice:
1. Dual rated for use with aluminum or copper conductors.
 2. Factory pre-filled with joint compound and sealed with easy pull-out end plug to inhibit corrosion.
 3. Color-coded end plug and Panduit and specified competitor die index numbers marked on barrel for proper crimp die selection
 4. Tin-plated to inhibit corrosion
 5. For use up to 35 KV and temperature rated 90°C when crimped with Panduit and specified competitor crimping tools and dies

Part Number	Description
SAR2-4-X	Bonds aluminum conductor size #2 AWG to Aluminum or copper conductor size #4 AWG

- F. Copper and Aluminum One-Hole Grounding Lay-in Lug for bonding ladder rack:
1. Used for quick installation of a continuous grounding conductor
 2. cULus 467 Listed for grounding and bonding, copper lugs. UL Listed for direct burial in earth or concrete
 3. cULus Listed for use up to 600 V and temperature rated 90°C

Part Number	Description
LICC4-22-C	Copper body, 0.22 inch stud hole, conductor size range AWG #14 SOL - #4 STR
LICC4-22TP-C	Tin plated copper body, 0.22 inch stud hole, conductor size range AWG #14 SOL - #4 STR
LIAC4-22-C	Tin plated aluminum body, 0.22 inch stud hole, conductor size range AWG #14 SOL - #4 STR
LIAS1/0-14-L	Tin plated aluminum body, 0.27 inch stud hole, conductor size range AWG #14 SOL - #1/0 STR
LIAS250-56-Q	Tin plated aluminum body, 0.33 inch stud hole, conductor size range AWG #6 SOL - 250 kcmil STR

- G. Communication Grounding Rods:
1. Material: Copper-clad steel.
 2. Size: 3/4-inch by 8 feet long.
 3. Standards: Meet requirements of ANSI@/UL 467-1984, CSA, and ANSI/NEMA GR-1.
 4. (CUSTOMER) approved manufacturers:
 - a. Erico
 - b. (CUSTOMER) approved equivalent

- H. Electrolytic Ground Rods:
1. Where standard ground rods do not have acceptable levels of conductivity (typically greater than 5 ohms resistance) to earth due to local soil conditions, electrolytic systems may be considered.
 2. Such systems shall meet the following:
 - a. Be comprised of a hollow stainless steel or copper tube 10 feet or longer and filled with a mixture of hygroscopic electrolytic salts.
 - b. Function as an active grounding system by absorbing moisture out of the air and constantly leaching and electrolytic solution into the surrounding soil to maintain high conductivity.
 - c. Rod shall be encased in a conductive, non-corrosive carbon based back fill material.
 - d. Provide low resistance to ground.
 - e. Provide season to season stability.
 - f. Be maintenance-free for 30 years.
 - g. Contain no hazardous materials or chemicals.
- I. Telecommunications Bonding Backbone (TBB) Grounding Conductors:
1. To be bare or insulated copper, of minimum conductor size #6 AWG and sized at 2 kcmil per linear foot up to a maximum size of 750 kcmil. (For details on TBB sizing see "Execution" section at end of this document).
 2. Where un-insulated, to be identified with green tape at termination location.
 3. Labeled in accordance with recommendations set forth in ANSI/TIA-606-B (March 2012) Administration Standard for Telecommunications Infrastructure.
 4. (CUSTOMER) approved manufacturers:
 - a. General Cable
 - b. Southwire
 - c. (CUSTOMER) approved equivalent
- J. Two-hole, Long-barrel Copper Compression Lugs for Grounding Conductors:
1. Meets TIA-607-B requirements for network systems grounding applications.
 2. Tested by Telcordia – meets NEBS Level 3 with AWG conductor.
 3. UL Listed and CSA Certified with AWG conductor for use up to 35 KV** and temperature rated 90°C when crimped with Panduit and specified manufacturers' crimping tools and dies.
 4. Color-coded barrels marked with Panduit and specified manufacturers' die index numbers for proper crimp die selection.
 5. Have long barrel to maximize number of crimps and provides premium wire pull-out strength and electrical performance.
 6. Have "inspection window" over tongue to visually assure full conductor insertion.
 7. Be tin-plated to inhibit corrosion.
 8. Available with NEMA and BICSI hole-sizes and spacing.
 9. (CUSTOMER) approved Manufacturers for lugs:
 - a. Panduit
 - b. (CUSTOMER) approved Equivalent

10. (CUSTOMER) approved parts for two-hole compression lugs are as follows:

Part Number	Description
LCC-W series	Panduit two-hole compressing lugs for code conductors in BICSI hole spacing

- K. Code/Flex Conductor H-TAPs:
1. Used as a splice, or to tap smaller (pigtail) conductors into larger continuous conductors.
 2. Each HTAP terminates a wide range of conductor sizes and combinations of code and flex conductors Class G, H, I and Locomotive to suit a variety of applications.
 3. Slotted design allows quick and easy assembly of conductor to HTAP using
 4. Three Panduit 94V-0 cable ties (supplied).
 5. Tap grooves are separated from one another, allowing them to function independently so HTAP can be used with single or multiple conductors, providing maximum design and installation flexibility.
 6. Color coded and marked with Panduit die index numbers for proper crimp die selection.
 7. UL Listed and CSA Certified, with wide size range of conductor sizes and rated for applications up to 600 V when crimped with Panduit tools and dies, or with other specified manufacturers' crimping tool and dies.
 8. Tin plated to inhibit corrosion.
 9. Available with an assortment of clear covers with integrated label fields.
 10. (CUSTOMER) approved Manufacturers for HTAPs and clear covers:
 - a. Panduit
 - b. (CUSTOMER) approved Equivalent
 11. (CUSTOMER) approved parts for HTAPs are as follows:

Part Number	Description
HTCT series	Panduit HTAPs. Must be selected according AWG size of run and tap conductors.
CLRCVR series	Panduit clear covers for HTAPs. Must be selected according to HTAP being covered.

- L. Code Conductor, Thin Wall, Tin-plated C-TAP (splice):
1. For copper-to-copper splicing or pigtail tap splicing.
 2. Wide wire range-taking capability minimizes inventory requirements.
 3. Color-coded for proper crimp die selection.
 4. Ribbed design provides high strength.
 5. Made from high conductivity wrought copper.
 6. Tin-plated to inhibit corrosion and oxidation.
 7. UL Listed and CSA Certified with AWG conductor to 600 V and temperature rated to 90°C when crimped with Panduit and specified manufacturers' crimping tools and dies.
 8. (CUSTOMER) approved Manufacturers for C-TAPs:
 - a. Panduit
 - b. (CUSTOMER) approved Equivalent
 - 9.

10. (CUSTOMER) approved parts for C-TAPs are as follows:

Part Number	Description
CTAPF series	Panduit C-TAPs. Must be selected according AWG size of conductors being spliced.

- M. Access Floor Grounding Clamps:
1. Bonds crossed grid conductors to each other, and bonds the access floor pedestals to the conductors.
 2. Specifically designed to bond perpendicular Mesh-BN (a.k.a. MCBN or Mesh Common Bonding Network) conductors per TIA-942-A and TIA-607-B.
 3. Bonds to the pedestal with a single bolt to simplify installation.
 4. Accommodates conductor sizes from #6 – 1/0 AWG, minimizing inventory requirements.
 5. Bonds both round and square access floor pedestals for greater flexibility.
 6. Crossing grounding conductors affixed and bonded using a split bolt quad clamp which requires only one nut to install.
 7. Split bolt design allows easy insertion of perpendicular conductors speeding installation and is UL 467 Listed and CSA
 8. Split bolt is UL Listed and CSA Certified for use up to 600 V and temperature rated 90°C.
 9. Each clamp accepts up to two conductors for a high performance bond with faster installation.
 10. Wide wire range-taking capability minimizes inventory requirements.
 11. Split-bolt made from high strength, electrolytic bronze to provide reliable grounding connections.
 12. (CUSTOMER) approved Manufacturers for Access Floor Grounding Clamps:
 - a. Panduit
 - b. (CUSTOMER) approved Equivalent
 13. (CUSTOMER) approved parts for access floor grounding clamps are as follows:

Part Number	Description
GPQC7-1/0	Panduit underfloor grounding clamp for MCBN conductor range #6 SOL to 1/0 STR for pedestal diameter 3/4" to 7/8" round
GPQC10-1/0	Panduit underfloor grounding clamp for MCBN conductor range #6 SOL to 1/0 STR for pedestal diameter 1" to 1 1/8" round and 7/8" square
GPQC12-1/0	Panduit underfloor grounding clamp for MCBN conductor range #6 SOL to 1/0 STR for pedestal diameter 1 1/4" round
GPQC15-1/0	Panduit underfloor grounding clamp for MCBN conductor range #6 SOL to 1/0 STR for pedestal diameter 1 1/2" round
GPQC17-1/0	Panduit underfloor grounding clamp for MCBN conductor range #6 SOL to 1/0 STR for pedestal diameter 1 3/4" round
GPQC20-1/0	Panduit underfloor grounding clamp for MCBN conductor range #6 SOL to 1/0 STR for pedestal diameter 2" round

- N. IEEE Universal Beam Grounding Clamp:
1. For bonding structural steel (ex: I-beams) into bonding network
 2. Universal, fits on a wide range of standard (angled) and wide flange (parallel) structural steel beams.

3. Provide a mounting pad suitable for a two-hole compression lug.
4. Installs quickly and easily with standard 1/4" key hex wrench tooling.
5. UL 467 Listed and CSA 22.2 Certified for grounding and bonding suitable for direct burial in earth or concrete.
6. Comply with vibration tests per MIL-STD-202G (METHOD 201A).
7. (CUSTOMER) approved Manufacturers for beam grounding clamps:
 - a. Panduit
 - b. (CUSTOMER) approved Equivalent
8. (CUSTOMER) approved parts for beam grounding clamps are as follows:

Part Number	Description
GUBC500-6	Panduit Universal Beam Grounding Clamp for copper conductor sizes ranging from #6 AWG to 500 kcmil and flange thickness from .25" to .675". Stud size is 1/2" with hole spacing for two hole lug being 1.75" and thread size from 1/2 to 13.

- O. Split Bolt for Bonding Cable Trays:
1. Made from high strength copper alloy to resist corrosion and provide premium electrical and mechanical performance.
 2. Wire range-taking capability minimizes inventory requirements.
 3. Nut hex provides correct fit with socket, box, or open end wrenches resulting in proper torquing of electrical connection.
 4. Pressure bar provides secure connection on a full range of conductor combinations used with each connector assuring premium wire pull-out strength.
 5. UL Listed and CSA Certified with AWG conductor for use up to 600 V and temperature rated 90°C.
 6. Available in tin-plated version for bonding to galvanized wire baskets and Flex Tray.
 7. (CUSTOMER) approved Manufacturers:
 - a. Panduit
 - b. (CUSTOMER) approved equivalent
 - c.
 8. (CUSTOMER) approved parts for split lugs to bond wire basket tray:

Part Number	Description
SBC3-C	Panduit split lug for #8 AWG to #4 AWG code conductors
SBCT3-C	Panduit split lug for #8 AWG to #4 AWG code conductors - tinned for use with galvanized basket tray delivery systems

- P. Auxiliary Cable Brackets (Conductor Pathway):
1. Used for mounting telecommunications bonding conductors outside of cable tray.
 2. Maintain minimum 2" separation between bonding conductors and all other types of cabling per TIA 607-B.
 3. Bonds ladder rack, wire basket sections together without drilling holes or applying other split-bolt clamps.
 4. Supports grounding conductors in the telecommunications room, allows separation of grounding conductors from other cables.
 5. Holds up to four conductors in sizes up to 750 kcmil.
 6. Bonds to all 1" and 2" ladder rack rails.

7. Paint piercing teeth provide electrical continuity between cable pathway sections while minimizing debris.
8. Front and back mounting screw options allow easy installation and visual inspection.
9. Can be mounted above or below the cable pathway system for flexibility.
10. Meet requirements TIA-607-B.
11. Have available bonding jumper kits to bond sections of basket tray or ladder rack.
12. (CUSTOMER) approved Manufacturers:
 - a. Panduit
 - b. (CUSTOMER) approved equivalent
13. (CUSTOMER) approved brackets for running bonding backbones parallel to ladder rack or Flex Tray:

Part Number	Description
GACB-2	Auxiliary cable bracket; 1.63" (41.4mm) width, 3.95" (100.3mm) height, 5.22" (132.6mm) depth; provided with one mounting screw.
GACBJ612U	Auxiliary cable bracket jumper for bonding pathway sections; #6 AWG (16mm ²); 12.0" (305mm) length; factory terminated on both ends with straight, two-hole, long barrel compression lugs; provided with .16 oz. (5cc) of antioxidant and four mounting screws.

Q. Wall-mount Busbars (TGB and TMGB and labeling):

1. Meet BICSI and TIA-607-B requirements for network systems grounding applications.
2. Employ BICSI hole spacing to fit LCC-W series 2-hole lugs.
3. Be made of high conductivity copper and tin-plated to inhibit corrosion.
4. Come pre-assembled with brackets and insulators attached for quick installation.
5. Use Panduit component labels, sold separately, to identify busbars to meet TIA/EIA-606-A.
6. (CUSTOMER) approved Manufacturers:
 - a. Panduit
 - b. (CUSTOMER) approved equivalent
7. (CUSTOMER) approved wall-mount grounding busbars are as follows:

Part Number	Description
GB2B0306TPI-1	Telecommunications grounding busbar (TGB) with 6 number of mounting positions with 1/4" stud hole and with 5/8" hole spacing, and 3 number of positions with 3/8" stud hole with 1" hole spacing
GB2B0312TPI-1	Telecommunications grounding busbar (TGB) with 12 number of mounting positions with 1/4" stud hole with 5/8" hole spacing, and 3 number of positions with 3/8" stud hole with 1" hole spacing
GB4B0624TPI-1	Telecommunications main grounding busbar (TMGB) with 24 number of mounting positions with 1/4" stud hole with 5/8" hole spacing, and 6 number of positions with 3/8" stud hole with 1" hole spacing
GB4B1028TPI-1	Telecommunications main grounding busbar (TMGB) with 28 number of mounting positions with 1/4" stud hole with 5/8" hole spacing, and 10 number of positions with 3/8" stud hole with 1" hole spacing
LTYK	Busbar label kit includes one printed tag and on flame retardant cable tie.

R. Vertical Grounding Strip Busbars for New Install Racks and Cabinets:

1. Provides clean bond to any rack mounted equipment regardless of whether or not equipment has an integrated grounding terminal.

2. Bonds up to 45 RU per rack.
3. Comes in EIA Universal mounting hole pattern.
4. Complies with US and International grounding requirements.
5. Comes in threaded rail and cage nut versions.
6. (CUSTOMER) approved Manufacturers:
 - a. Panduit
 - b. (CUSTOMER) approved equivalent
7. (CUSTOMER) approved rack and cabinet mount vertical busbars for new installs:

Part Number	Description
RGS134-1Y	Grounding strip for threaded rails; 78.65" (2m) length; .67" (17mm) width; .05" (1.27mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker and three each #12-24 x 1/2" and M6 x 12mm thread-forming screws.
RGS134B-1	Grounding strip for use with cage nut rail fasteners; 78.70" (2m) length; .67" (17mm) width; .05" (1.27mm) thickness; provided with .16 oz. (5cc) of antioxidant, one grounding sticker, three cage nut bonding studs, eight #12-24 bonding nuts and three strip clips

- S. Retrofit Cabinet and Rack Grounding Kits for Remediation of Un-grounded Legacy Racks and Cabinets:
1. Provide a dedicated ground system to maintain system performance and protect network equipment when equipment is already installed.
 2. Hardware that incorporates paint piercing serrations to create a bond point between the cabinet rail, grounding busbar and lug.
 3. Hardware installable without removal of existing installed equipment.
 4. Cabinet kits optimized for installation on 19" cabinets that meet EIA-310, with functioning equipment are already mounted.
 5. A complete system of integrated and matched components
 6. Engineered to comply with US and International grounding requirements.
 7. Rack kits optimized for installation on 19" racks that meet EIA-310, with functioning equipment, and are deployed in the field
 8. Incorporates thread-forming screws to eliminate the need to manually remove paint from the rack.
 9. (CUSTOMER) approved Manufacturers:
 - a. Panduit
 - b. (CUSTOMER) approved equivalent
 10. (CUSTOMER) approved rack and cabinet mount grounding retrofit kits:

Part Number	Description
CGR630U	Retrofit grounding kit for installation on ungrounded existing cabinets with threaded #12-24 or M6 rail fasteners and rail depth up to 30" (.75m); includes one RGRB19U grounding busbar kit and one CGJ630U front to back rail jumper kit
CGR630UB	Retrofit grounding kit for installation on ungrounded existing cabinets with cage nut rail fasteners and rail depth up to 30" (.75m); includes one RGRB19U grounding busbar kit and one CGJ630UB front to back rail jumper kit
RGRKCBNJY	Rack grounding kit to ground an existing rack with equipment already mounted; includes one RGRB19U busbar, one HTCT250-2-1 HTAP, and one RGREJ696Y grounding jumper

- T. Rack Bonding Conductor Kits (RBC):

1. Bonds the rack or cabinet to the telecommunications grounding busbar (TGB or TMGB).
2. Jumper kits available with both ends factory terminated to provide a bolt-on solution.
3. Jumper kits available with one end factory terminated to attach to the rack or cabinet; free end accommodates unique length requirements.
4. Engineered to comply with US and international grounding requirements.
5. (CUSTOMER) approved Manufacturers:
 - a. Panduit
 - b. (CUSTOMER) approved equivalent
6. (CUSTOMER) approved rack jumper (RBC) kits:

Part Number	Description
GJ672UH	Terminated on both ends for smaller telecommunications rooms where racks have individual connections directly to the TMB. One 72" length #6 AWG green wire with yellow horizontal stripe. Jumper is pre-terminated on one end with LCC6-14JAWH-L and the other end with LCC6-14JAW-L. Comes in lengths 72", 96", 120", 144", 168", 192", 216", 240", 264", and 288". For other lengths substitute "72" in part number with desired length
GJS6120U	Terminated on one end for larger telecommunications rooms where racks are individually bonded to underfloor or overhead bonding backbone with an HTAP connection. One 120" length #6 AWG green wire with yellow horizontal stripe. Jumper is pre-terminated on one end with LCC6-14JAW-L. For 180" length substitute "120" in part number with "180"
ASSOCIATED HARDWARE FOR RBC KITS	
HDW1/4-KT	Stainless steel mounting hardware for busbar; two 1/4-20 hex bolts, two 1/4-20 hex nuts, four 1/4 flat washers and two 1/4 Belleville compression washers. Mounting hardware for rack or cabinet; two #12-24 thread-forming screws and two M6 thread-forming screws.
HDW3/8-KT	Stainless steel mounting hardware for busbar; two 3/8-16 hex bolts, two 3/8-16 hex nuts, four 3/8 flat washers and two 3/8 Belleville compression washers. Mounting hardware for rack or cabinet; two #12-24 thread-forming screws and two M6 thread-forming screws
HDW1/4-A-KT	Stainless steel mounting hardware for busbar; two 1/4-20 hex bolts, two 1/4-20 hex nuts, four 1/4 flat washers and two 1/4 Belleville compression washers. Mounting hardware for rack or cabinet; two #10-32 thread-forming screws and two M5 thread-forming screws
HDW3/8-A-KT	Stainless steel mounting hardware for busbar; two 3/8-16 hex bolts, two 3/8-16 hex nuts, four 3/8 flat washers and two 3/8 Belleville compression washers. Mounting hardware for rack or cabinet; two #10-32 thread-forming screws and two M5 thread-forming screws

- U. Electrostatic Discharge (ESD) Port Kits and Wrist Strap:
1. For dissipating electro-static buildup prior to maintenance work on network equipment.
 2. Accommodate standard ESD wrist strap 4mm plug.
 3. Wrist strap provides rapid and continuous drain of electrostatic charge between a person and the surface to which the wrist strap is bonded, thus preventing damaging static discharge into equipment.
 4. Can be mounted to front or back of rack or cabinet for convenient access.
 5. Bent 45° to act as a hook to hold wrist strap when not in use.
 6. Two-hole configuration provides anti-rotation and prevents loss of bond.
 7. Barrel permanently marked with the protective earth (ground) symbol.
 8. Engineered to comply with US and International grounding requirements.
 9. Versions for threaded racks rails or cabinet cage nuts.
 10. (CUSTOMER) approved Manufacturers:
 - a. Panduit

- b. (CUSTOMER) approved equivalent
11. (CUSTOMER) approved ESD port kits:

Part Number	Description
RGESD2-1	For #12-24 or M6 rail fasteners: Two-hole ESD port with 5/8" hole spacing; provided with an ESD protection sticker, .16 oz. (5cc) of antioxidant, and two each #12-24 x 1/2" and M6 x 12mm thread-forming screws
RGESD2B-1	For cage nut rail fasteners: Two-hole ESD port with 5/8" hole spacing; provided with an ESD protection sticker, .16 oz. (5cc) of antioxidant, two cage nut bonding studs and two #12-24 bonding nuts
RGESDWS	Adjustable fabric ESD wrist strap with 6' coil cord, banana plug, 1 megaohm resistor and 4mm snap.

V. Equipment Jumper Kits (Unit Bonding Conductor or "UBC"):

1. Used to ground large, chassis-style rack mounted equipment that have built-in grounding pads or terminals.
2. Bond network equipment to grounding strip or grounding busbar.
3. Jumper kit available with both ends factory terminated to provide a bolt-on solution.
4. Jumper kit available with one end factory terminated to attach to the grounding strip or grounding busbar; free end accommodates unique equipment terminations.
5. Use jumpers with 90° bent lug, on grounding strip side, for high density grounding requirements up to one ground point per RU.
6. Use jumpers with 45° bent lugs on grounding strip side, for improved cable management.
7. Engineered to comply with US and International grounding requirements.
8. (CUSTOMER) approved Manufacturers:
 - a. Panduit
 - b. (CUSTOMER) approved equivalent
9. (CUSTOMER) approved equipment jumper (UBC) kits:

Part Number	Description
GJS6 series	#6 equipment jumper factory terminated on one end for switches, cabinets and 4 post racks. Exact part number depends on length
RGE series	Factory terminated jumpers that are terminated on both ends . Exact part number depends on AWG size, length and angle of two hole lugs

W. Surge Suppressor Jumper Kit:

1. Bonds power or data line surge suppressor to grounding strip or grounding busbar.
2. Both ends factory terminated to provide a bolt-on solution.
3. Engineered to comply with US and International grounding requirements.
4. (CUSTOMER) approved Manufacturers:
 - a. Panduit
 - b. (CUSTOMER) approved equivalent
5. (CUSTOMER) approved surge suppressor jumper kits:

Part Number	Description
SSGK-1	#10 AWG (6mm ²) jumper; 24" (.61m) length; factory terminated on both ends; one-

	hole lug on surge suppressor to two-hole lug on grounding strip/busbar side; provided with .16 oz. (5cc) of antioxidant and two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread-forming screws
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X. Armored Cable Grounding Kit:

1. Provides a secure bond to the armor sheath on indoor and indoor/outdoor fiber optic cables at both cassette and enclosure ends.
2. Worm-gear design evenly distributes forces across the armor.
3. Made from steel and aluminum material is compatible with common armor for long term reliability.
4. Black insulating cover protects and hides the connection for an aesthetically pleasing work area.
5. Complies with industry requirements ensuring a high level of reliability and safety.
6. (CUSTOMER) approved Manufacturers:
 - a. Panduit
 - b. (CUSTOMER) approved equivalent
7. (CUSTOMER) approved armored cable grounding kits:

Part Number	Description
ACG24K	#6 AWG (16mm ²) jumper for armored cable diameter up to 0.84" (21.3mm); 24" (609.6mm) length; factory terminated on one end with LCC6 two-hole copper compression lug and the other end with grounding terminal; provided with two each #12-24 and M6 thread-forming screws and a black polypropylene terminal cover
ACG24K-500	#6 AWG (16mm ²) jumper for armored cable diameter 0.85" (21.3mm) to 1.03" (26.2mm); 24" (609.6mm) length; factory terminated on one end with LCC6 two-hole copper compression lug and the other end with grounding terminal; provided with two each #12-24 and M6 thread-forming screws and a black polypropylene terminal cover
ACGK	Armored cable grounding kit. Contains one grounding terminal for #6 AWG grounding conductor, and one #10 mechanical clamp for cable diameters in 9/16" – 1 1/16" diameter range.

Y. Miscellaneous Bonding Accessories:

1. Anti-oxidation Paste (contact aid) For Copper to Copper and Copper to Steel Connections
2. Anti-oxidation Paste (contact aid) For Aluminum Pad-to-Pad or Thread-to-Thread Aluminum Connections
3. Green thread-forming bonding screws for bonding smaller equipment on threaded rack rails through the equipment mounting flange.
4. Green bonding cage nuts from bonding smaller equipment on cage nut rails through the equipment mounting flange.
5. Thread forming screws for bonding two hole lugs to vertical busbars on threaded rack rails.
6. Green paint piercing grounding washers for assuring electrical continuity between painted parts of equipment racks as described in TIA 607-B Standard.
7. Bonding hardware kits (studs) for forming low-resistance bond between the rack or cabinet and painted rack mounted appliances and equipment.
8. (CUSTOMER) approved Manufacturers:
 - a. Panduit
 - b. (CUSTOMER) approved equivalent
9. (CUSTOMER) approved miscellaneous bonding/grounding components and accessories:

Part Number	Description
CMP-300-1	Contact aid (anti-oxidant paste) for copper-to-copper and copper-to-steel connections in 8 oz container. Operating temperature range -40°F (-40°C) to 350°F (177°C). Good for all voltages and suitable for grounding. Also may be used for anti-seizing thread lubricant
CMP-100-1	Contact aid (anti-oxidant paste) for pad-to-pad or thread-to-thread aluminum connections made on aluminum conductor in 8 oz container. Operating temperature range -40°F (-40°C) to 400°F (204°C).
RGTBSG-C	Green thread-forming bonding screw, #12-24 x 1/2" for mounting smaller equipment and bonding to rack/cabinet racks through equipment mounting flange
RGTBS1032G-C	Green thread-forming bonding screw, #10-32 x 1/2" for mounting smaller equipment and bonding to rack/cabinet racks through equipment mounting flange
CNB4K	Green bonding cage nut, includes 4 #12-24 bonding cage nuts (.06 – .11 thick panel) and 4 #12-24 x 1/2" bonding screws with #2 Phillips/slotted combo hex head (use 5/16" or 8mm socket). Ideal for patch panel applications
CNBK	Green bonding cage nut, includes 50 #12-24 bonding cage nuts (.06 – .11 thick panel) and 50 #12-24 x 1/2" bonding screws with #2 Phillips/slotted combo hex head (use 5/16" or 8mm socket)
RGTS-CY	Thread-forming grounding screw, #12-24 x 1/2" for bonding two-hole grounding lugs to rack/cabinet vertical busbars
RGTS1032-C	Thread-forming grounding screw, #10-32 x 1/2" for bonding two-hole grounding lugs to rack/cabinet vertical busbars
RGW-100-1Y	100 paint piercing bonding washers for 3/8" (M8) stud size; .875" (22.2mm) O.D.; provided with .16 oz. (5cc) of antioxidant.
TRBSK	Bonding stud kit for threaded #12-24 rail fasteners; includes 25 bonding studs and 50 bonding nuts for bonding painted equipment and appliances to rack/cabinet rails and vertical busbars
CGNBSK	Bonding stud kit for cage nut rail fasteners; includes 25 bonding studs and 50 bonding nuts for bonding painted equipment and appliances to rack/cabinet rails and vertical busbars

PART 3 EXECUTION

3.1 INSTALLATION

A. General:

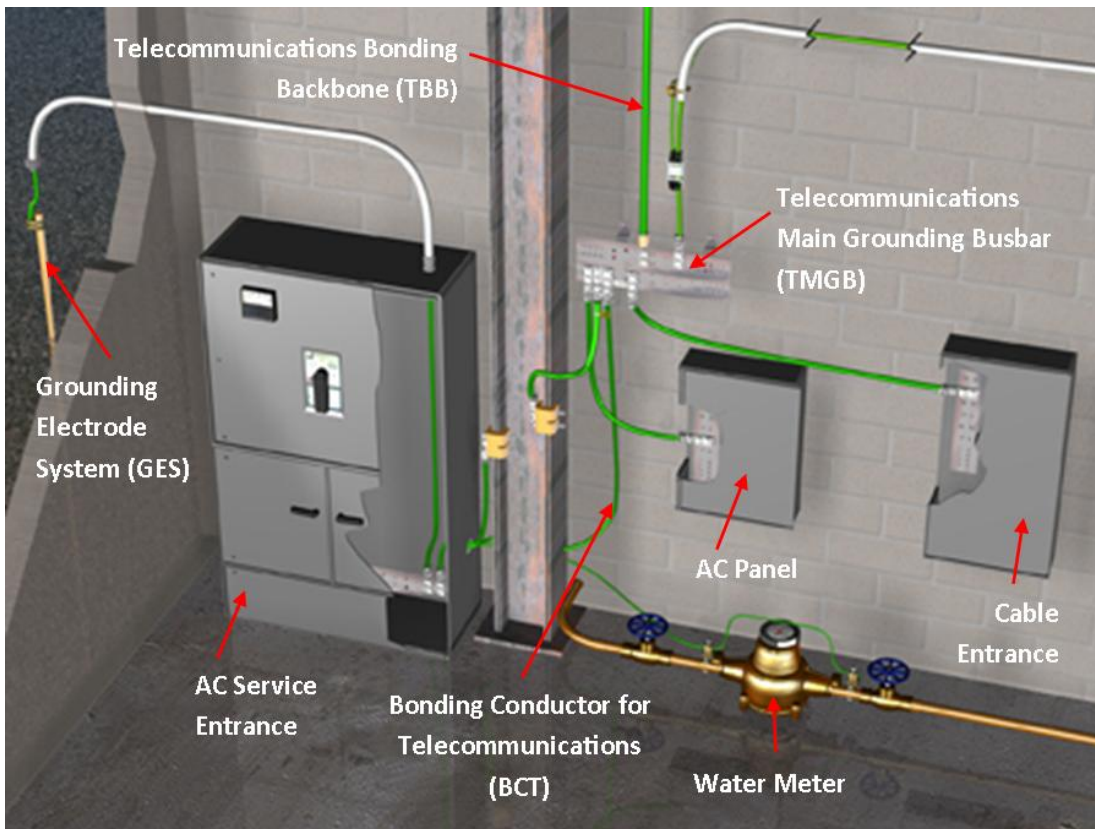
1. This Specification document describes a generic enterprise communications bonding and grounding system for the construction of a complete and functioning grounding system without prior knowledge of the particular facilities where it will be used. It is the responsibility of the installing contractor to adapt these general guidelines and principles to the requirements of the actual environments where the systems are to be implemented.
2. System shall provide equipment ground connections (bonds) from the premises entrance facility and outside-plant earthing system to each telecommunication room telecommunication ground busbar, through the racking systems to bond the network equipment.
3. Entire grounding link from equipment to earth should be visually verifiable except where hidden by walls, conduit or pathways.
4. Installing contractor shall label all elements of the communications bonding network according to guidelines defined in TIA-607-B and ANSI/TIA 606-B.
5. It is the responsibility of the installer to be knowledgeable of all previously cited Standards and Codes and to bring to the attention of (CUSTOMER) any conflicts or discrepancies to achieve a fully functioning, standards-compliant earthing system.
6. Contractors working around, or adding to existing legacy systems shall bring to the attention of (CUSTOMER) previously installed network

elements that may not comply with modern grounding requirements for possible remediation.

- B. Telecommunications Bonding Backbone (TBB):
1. Bonding and grounding conductors may be insulated or un-insulated and shall not decrease in size as the grounding path moves closer to earth.
 2. Connections (bonds) between the telecommunications grounding network and associated electrical panels shall be done by a qualified electrician in accordance with guidelines in TIA 607-B and applicable electrical codes.
 3. Bonding Conductors should be continuous and routed in the shortest possible straight line path, avoiding changes in elevation and sharp bends.
 4. TBB conductors shall be protected from mechanical damage and built so as to minimize splicing. Where splicing is unavoidable they shall be done using irreversible compression splices (C-TAPS) built to that purpose. See the "Materials" section of this document for appropriate compression splices.
 5. TBB in multi-story buildings with multiple risers (multiple TBBs) shall employ a grounding equalizer (GE) between vertical grounding backbones at the top floor of the building and minimally at every third floor in between to the lowest floor level. The GE shall be no smaller than the largest sized TBB.
 6. Routing grounding conductors through ferrous metal conduit should be avoided, but if it is necessary due to building constraints, any grounding conductor running through ferrous conduit longer than 3 feet shall be bonded at the end using appropriately sized HTAP and Conduit grounding clamps as described TIA 607-B using appliances described for that purpose in the "Materials" section of this document.
 7. Conductors used to bond TBB to conduit ends shall be of #6 AWG size or larger.
 8. Conductor sizing shall be based upon project specification (drawings and notes) for that installation. These sizes are based on TBB length per TIA 607-B recommendations. Contractor shall bring to the attention of (CUSTOMER) anywhere TBB project specified sizing appears insufficient per the Table below:

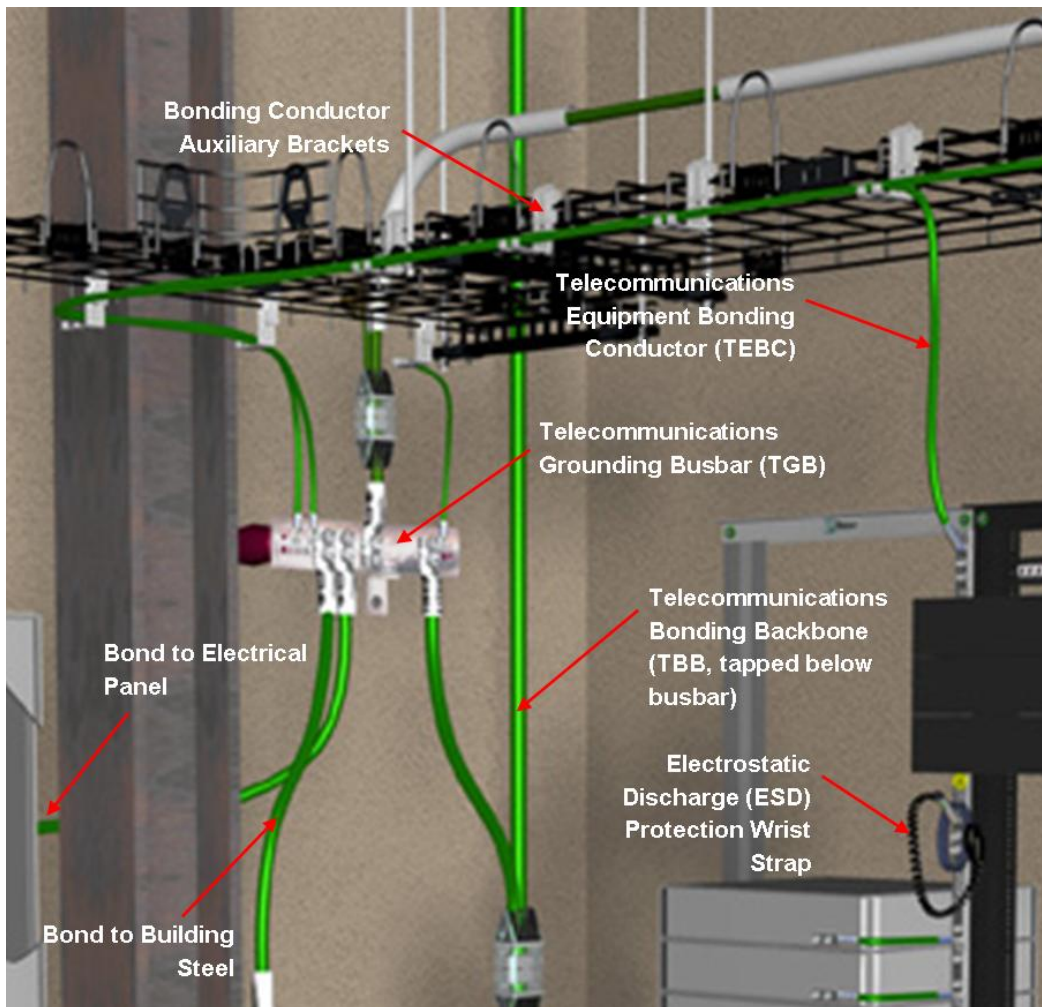
Sizing of the TBB	
TBB Length in Linear meters (feet)	TBB Size (AWG)
Less than 4 (13)	6
4-6 (14-20)	4
6-8 (21-26)	3
8-10 (27-33)	2
10-13 (34-41)	1
13-16 (42-52)	1/0
16-20 (53-66)	2/0
20-26 (67-84)	3/0
26-32 (85-105)	4/0
32-38 (106-125)	250 kcmil
38-46 (126-150)	300 kcmil
46-53 (151-175)	350 kcmil
53-76 (176-250)	500 kcmil
76-91 (251-300)	600 kcmil
Greater than 91 (301)	750 kcmil

- C. Entrance Facilities and Telecommunications Main Grounding Busbar (TMGB):
1. TMGB shall be located in the entrance facility, near the electrical panel to which it will be bonded but installed to maintain clearances required by applicable electrical codes.
 2. TMGB shall be sized according to the anticipated number of bonded connections needed
 3. TMGB shall have tinned surface to restrain oxidation and be cleaned and antioxidant paste applied prior to fastening conductors.
 4. Connectors on TBB which attach to TMGB shall be of two-hole, long-barrel compression lugs of the LCC series as specified in the "Materials" section of this document.
 5. Building steel within six feet of the communications grounding system should be bonded into the system with appropriate hardware listed in "Materials" section of this document.
 6. All cables containing a metallic shield or armor shall have that shield properly bonded into the communications grounding system using the appropriately sized Armored Cable Grounding Kit listed in the "Materials" section of this document.
 7. The illustration below depicts for reference the general location and layout of the TMGB and associated grounding elements in a typical entrance facility.



- D. Telecommunications Rooms and Telecommunications Grounding Busbar (TGB):

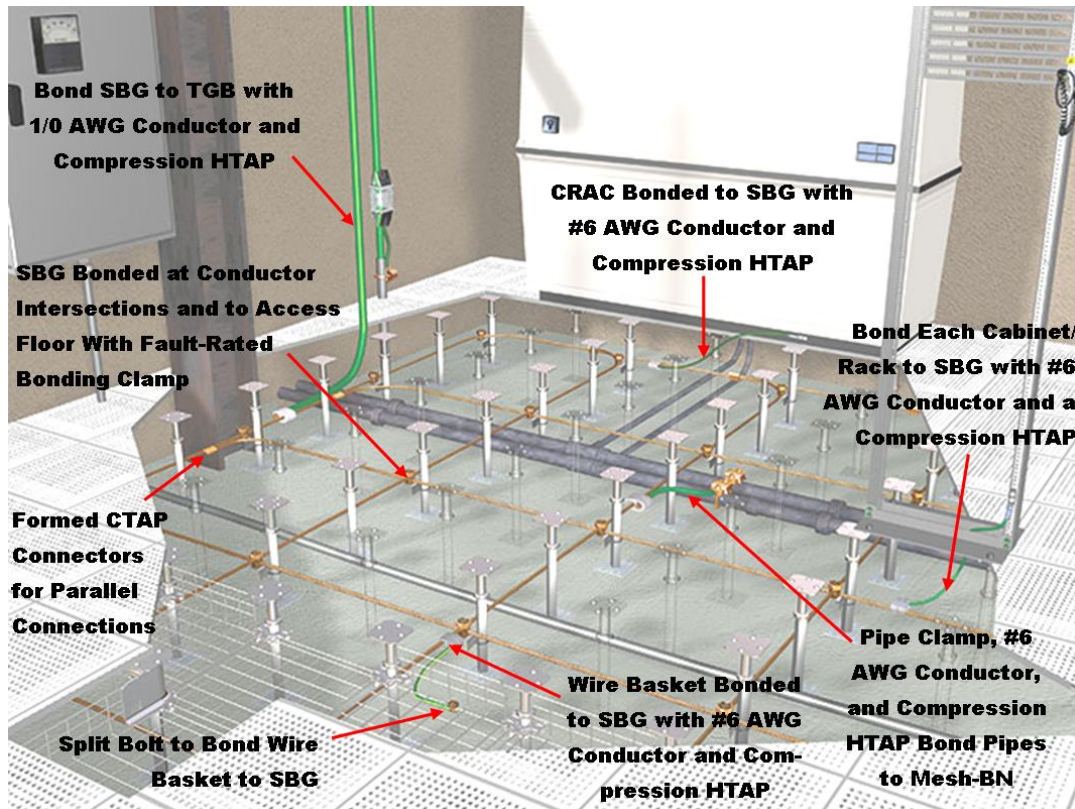
1. Each telecommunications room shall have its own TGB to which equipment and dead steel (building steel and support structures) in that room are bonded.
2. The TGBs shall have a tinned surface to inhibit oxidation and be sized according to the anticipated number of bonded connections that will be needed.
3. TGBs shall be sized according to the anticipated number of bonded connections needed.
4. TMGs shall have tinned surfaces to restrain oxidation and shall be cleaned and have an antioxidant paste applied to both bonding surfaces prior to fastening conductors.
5. Connectors on backbone and rack/cabinet bonding conductors which attach to TGB shall be of two-hole, long-barrel compression lugs of the LCC series as specified in the "Materials" section of this document.
6. Building steel within six feet of the communications grounding system should be bonded into the system with beam clamps and other hardware appropriate to that purpose listed in "Materials" section of this document.
7. Racks and cabinets shall have **individual** Rack Bonding Conductors (RBC) bonding to the Telecommunications Equipment Bonding Conductor (TEBC) or underfloor "Supplemental Bonding Grid - DAISY CHAINING OR SERIAL CONNECTIONS OF ONE RACK OR CABINET TO ANOTHER WILL NOT BE ACCEPTED.
8. In smaller Telecommunications Rooms (3-5 racks) it is acceptable to have telecommunications equipment bonding conductors (TEBC) that go directly from each individual rack to the TGB. DAISY CHAINING OF RACKS WILL NOT BE ACCEPTED.
9. Rack Bonding Conductors (RBC) or above rack row grounds (TEBC) shall be installed to maintain a minimum of 2" separation from all other types of cable - power or communications.
10. To maintain this segregation of cables some telecommunications rooms may lend themselves to the installation of Auxiliary Conductor Brackets for routing bonding conductors outside of, yet parallel to ladder rack or basket tray. See "Auxiliary Brackets" in "Materials" section of this document.
11. Bonding conductor support systems like auxiliary brackets shall be spaced no further apart than three foot intervals.
12. All cables containing metallic shielding or armor shall be properly bonded into the communications grounding system using the appropriately sized Armored Cable Grounding Kit listed in the "Materials" section of this document.
13. The illustration below depicts for reference the general location and layout of a typical telecom room and associated bonding connections into the TGB.



Telecommunications Grounding in Small TR—Note in this illustration individual Telecommunications Equipment Bonding Conductors (TEBC) go direct from each rack to the busbar

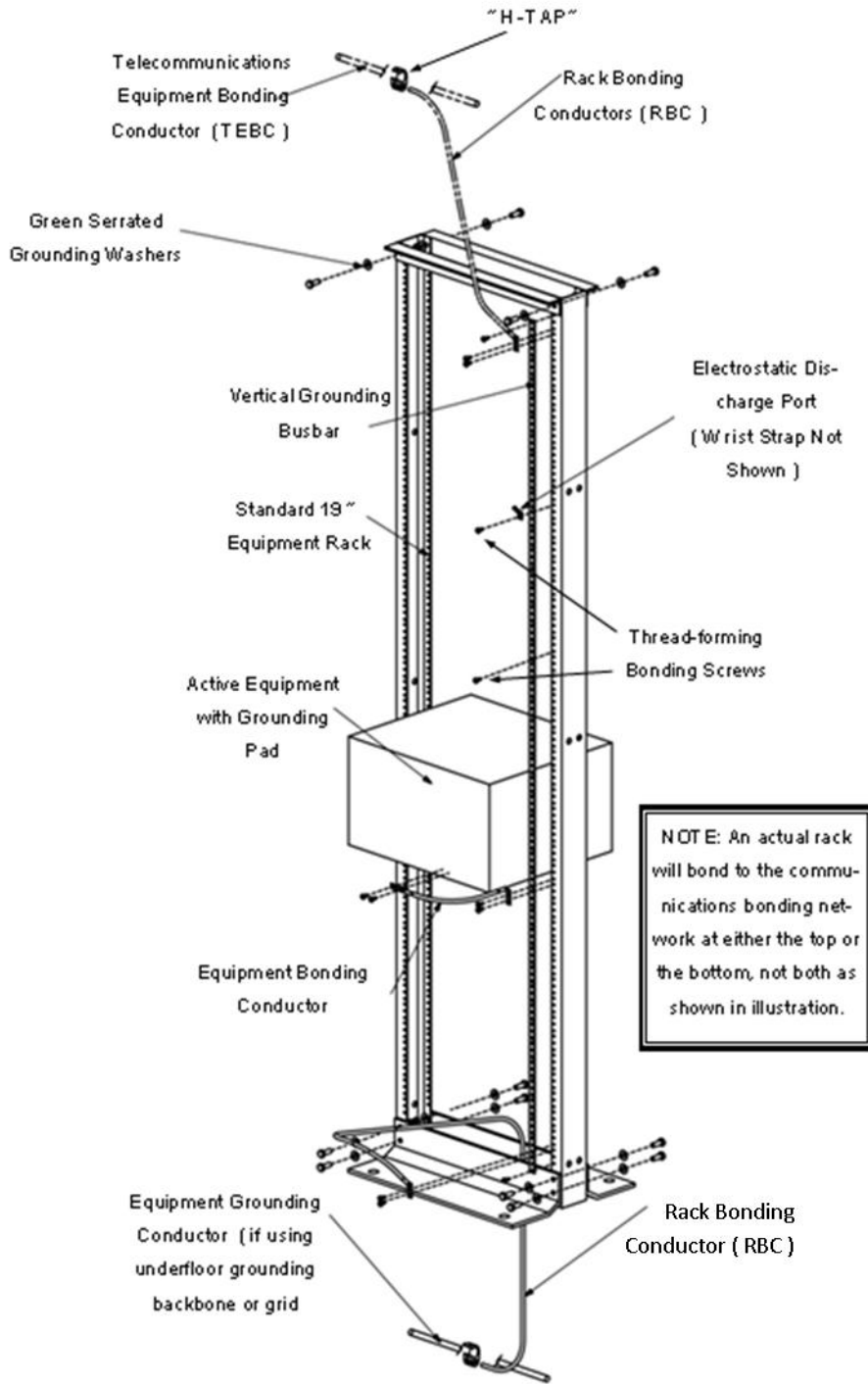
- E. Supplemental Bonding Grid (SBG) (a.k.a. Underfloor Grounding Grids):
1. Large Equipment Rooms and Data Centers may have Mesh Bonding Network or Mesh-BN which consist of the information technology equipment (ITE), racks and cabinets, underfloor supplemental bonding grids (SBG, a.k.a. underfloor bonding grids), and pathways
 2. Flooring system must be made electrically continuous, with the grid bonded a minimum of every fifth pedestal in each direction as per TIA 607-B Standard, using a minimum size #6 AWG stranded copper conductor and the pedestal clamps listed in the "Materials" section of this document. Specifications for individual (CUSTOMER) projects requiring larger conductor sizes or greater clamp density shall take precedent over these guidelines.
 3. Underfloor SBG shall bond to the TMGB or TGB in the computer room with a conductor of 1/0 AWG or larger.
 4. Racks and cabinets shall bond to the SBG with a conductor size of #6 AWG or larger.
 5. Each rack or cabinet will have individual bonding conductors into the grounding grid. Serial connections (or "daisy-chaining") between communications bays is strictly forbidden and will not be accepted.

6. Power Distribution Units (PDU) shall bond into the Mesh-BN per requirements of NEC 250.122 and per manufacturers' recommendations.
7. Heating, ventilating and air-conditioning (HVAC) shall have bonding conductors into the underfloor grid of #6 AWG or larger.
8. Each HVAC unit shall have its own connection and may not be daisy-chained or attached serially.
9. Each steel column in the communications room shall bond into the Mesh-BN with a conductor of minimum size #4 AWG.
10. All metal cable trays shall be bonded into the grid with a minimum conductor size of #6 AWG or larger. These may be bonded in series.
11. All metallic conduits, water pipes and air ducts shall be bonded to the grid with a minimum conductor size of 6 AWG or larger. These may be bonded in series.
12. The following graphic illustrates for reference a typical underfloor SBG and the bonds made to it.



- F. Bonding within Racks and Cabinets:
1. Racks and Cabinets shall be bonded into the communications bonding network with conductors of #6 AWG or larger.
 2. Depending on size of the telecommunications room, Rack Bonding Conductors (RBC) may tap into underfloor or overhead grounding conductors, or for smaller TRs (3-5 racks or cabinets), may go directly from the rack to the wall mounted busbar.
 3. Racks, cabinets and similar enclosures shall not be attached serially (daisy-chained) but must have individual RBC into the grounding system.

4. Newly installed racks and cabinets shall have vertical grounding busbars installed along one rail to provide clean bonding landing point for all rack mount equipment. For part numbers vertical busbars see "Materials" section of this document. Grounding busbars shall not be isolated from the rack or cabinet.
5. All painted components of racks/cabinets shall be assembled using serrated grounding washers and thread-forming screws to ensure electrical continuity between the different structural components of the rack/cabinet.
6. Larger equipment (chassis switches) with integral grounding terminals or pads shall be bonded to the vertical busbar with equipment grounding kits attached to those terminals and bonding them to the rack-mounted busbars. For kit part numbers see the "Materials" section of this document.
7. Anywhere two metallic surfaces are to be bonded, contractor shall clean the contact areas of paint or oxidation using abrasive pads, and apply film of anti-oxidation compound between surfaces prior to bonding.
8. All cable fittings shall be of two-hole (LCC series) compression-type. Mechanical screw-lugs on racking systems will not be accepted and must be removed and replaced at contractor's expense.
9. All screws used to affix compression lugs to rack-mounted vertical busbars shall be of the thread forming type made specifically for electrical bonding.
10. Smaller equipment (servers, TOR switches) not having integral grounding pads must be bonded to the rack through the equipment mounting flanges using green thread-forming grounding screws with serrations under the head to cut through paint, coatings and oxidation that may be present on the equipment flange. Such equipment shall have minimally one grounding screw per piece of equipment.
11. Existing (installed) racking systems containing live active equipment may be retrofitted for Standards-compliant bonding using rack retrofitting kits listed in the "Materials" section of this document.
12. ESD (electro-static discharge) ports and wrist straps shall be provided minimally every other rack or bay to be within reach of any active equipment. On larger 4-post racks or cabinets - ESD ports and wrist straps shall be installed on the front and back to be accessible when servicing any active equipment.
13. As a condition of employment, any internal or contracting technicians servicing active equipment must be wearing a properly grounded wrist strap to dissipate ESD charges prior to touching any (CUSTOMER) active equipment.
14. The following illustration demonstrates how the racks shall be bonded:



3.2 FIELD QUALITY CONTROL

- A. On installations confined to a single telecommunications room, the installing contractor shall visually verify continuity of communications bonding system from equipment, through racking systems, to overhead or underfloor backbone to the wall mounted busbar in that telecommunications room.

- B. Contractor shall further verify the use of all appropriate bonding accessories in the racking systems such as grounding washers, thread-forming grounding screws and the presence of electro-static discharge ports and wrist straps within reach of all equipment to be maintained.
- C. On greenfield (new) projects involving installation of a building-wide telecommunications backbone, installing contractor is further responsible for visually verifying sizing and sound installation of the telecommunications bonding backbone including presence of properly sized and installed grounding equalizer conductors between backbones contained in separate risers.
- D. Inspecting Contractor shall verify that any conduit longer than 3 feet through which a grounding conductor passes is properly bonded to the grounding conductor as described in this document.
- E. During inspections contractor shall verify compliance with all stipulations specified in this document and compliance with all regulatory references (Standards and Codes) cited.
- F. All opens or gaps in the bonding system during final inspections will be recorded in the inspection report and remedied.
- G. During inspections, contractor shall check all grounding and bonding system conductors and connections for tightness and proper installation, including checking proper dies were used on compression taps and fittings by checking embossed die numbers on those connections.
- H. (CUSTOMER) may request a test of 10% of bonded connections within the grounding system with a volt-ohm meter. Resistance tests taken on either side of a compression or exothermic bond shall be less than .2 (2/10) of one ohm in resistance.
- I. Bonded joints to be tested may be random or individually tagged by a representative of (CUSTOMER).
- J. Contractor shall Test system at bonded points indicated and provide results in report form.
- K. Based upon test results, (CUSTOMER) reserves the right to request testing on 100% of exothermic and compression bonds within the installed grounding system.
- L. All bonded connections failing the test described above shall be remedied and retested by the installation contractor at contractor's expense.

END OF SECTION



CSI SECTION 270539

SURFACE RACEWAY FOR COMMUNICATIONS SYSTEMS

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a standard specification applicable to commercial building structured cabling applications.

The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines.

The information contained in this document is based on our experience to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be used with their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements consult the factory. This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supersedes and voids all previous literature, etc.

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SECTION 1: Introduction

System Description

Surface Raceway and Vertical Outlet Poles refers to a surface raceway system used for branch circuit wiring and/or data network, voice, video and other low-voltage cabling. Surface raceway shall be used in solid wall applications or for applications where moves, adds and changes are very typical to the workflow.

The raceway system shall consist of raceway, appropriate fittings and accessories to complete installation per electrical drawings. Non-metallic surface raceway is to be utilized in dry interior locations only as covered in Article 352, part B of the NEC, as adopted by the NFPA and as approved by the ANSI.

Equivalent Products

Panduit shall manufacture all raceway products, including but not limited to those listed below. The raceway shall conform to the following manufacturing and compatibility requirements and there will be *no substitutions* allowed.

SECTION 2: Single-Channel Products

LDPH Raceway

[LDPH3 (.75" x .41") / LDPH5 (1.02" x .55") / LDPH10 (1.52" x .86")]

Raceway

The raceway shall be a two-piece design. Total width shall be .75" by .41" deep for LDPH3, 1.02" by .55" deep for LDPH5 and 1.52" by .86" deep for LDPH10 with all having an approximate wall thickness of .055". The raceway shall be available in 8' and 10' lengths. The raceway (LDPH) shall have hinge attaching the cover to the base. The raceway shall have tamper resistant characteristics inherit with the design of the latch. The raceway shall be manufactured of rigid PVC compound. The raceway shall have a smooth texture, and be available in four colors: off-white (IW), electric ivory (EI), white (WH) and international gray (IG).

Fittings

A full complement of fittings (LDPH series) must be available including but not limited to flat, internal and external elbows, divided tees and entrance fittings, couplers, and end caps. The fittings shall provide a means for connecting to the raceway and shall be capable of maintaining a 1" minimum cable bend radius. Applicable fittings shall be of either cover only design (for low voltage cabling only), or base and cover design in order to maintain complete enclosure, and to eliminate mitering. The fittings shall be manufactured from a rigid PVC (or ABS/PC) compound. The fittings shall have a matte texture and be available in four colors: off-white (IW), electric ivory (EI), white (WH) and international gray (IG) to match the raceway. They shall overlap the raceway to hide uneven cuts.

Accessories

Junction boxes and faceplates shall be available for mounting standard devices. The junction boxes shall be available in standard, deep, and extra deep versions. The faceplates shall allow for terminating of standard electrical devices, both duplex and rectangular styles. In addition there must be faceplates designed to accept Panduit communications modules for data terminations. The faceplates may accommodate up to 6 jacks and shall be modular in design to accept UTP, Coax, ST, SC, and Fiber- Jack type of connectors. They shall be available in off-white (IW), electric ivory (EI), white (WH) and international gray (IG) to match the raceway.

Materials

The raceway and all system components must be UL Listed and exhibit non-flammable self-extinguishing characteristics, tested to comparable specifications of UL94V-0.

LDPH Part Numbers

Part Number	Description	Bend Radius Control	Size
LDPH3**8-A	Hinged LDPH Raceway	--	8'
LDPH5**8-A	Hinged LDPH Raceway	--	8'
LDPH10**8-A	Hinged LDPH Raceway	--	8'
CFX5**-X	Coupler fitting for use with LDPH5	Yes	
RAFX5**-X	Right angle fitting for use with LDPH5	Yes	
ICFX5**-X	Inside corner fitting for use with LDPH5	Yes	
OCFC5**-X	Outside corner fitting for use with LDPH5	Yes	
TFX5**-X	Tee fitting for use with LDPH5	Yes	
CRFX5**-X	4 way cross fitting for use with LDPH5	--	
ECFX5**-X	End cap fitting for use with LDPH5	--	
DCEFX**-X	Drop ceiling/entrance end fitting	--	

** - designates color option

LD Raceway

[LD3 (.77" x .46") / LD5 (1.01" x .58") / LD10 (1.51" x .94")]

Raceway

The raceway shall be a one-piece design. Total width shall be .77" by .46" deep for LD3, 1.01" by .58" deep for LD5, and 1.51" by .94" deep for LD10 with all having an approximate wall thickness of .055". The raceway shall be available in 6', 8' and 10' lengths. The raceway (LD) shall have an integral hinge attaching the cover to the base. The raceway shall be manufactured of rigid PVC compound. The raceway shall have a smooth texture, and be available in four colors: off-white (IW), electric ivory (EI), white (WH) and international gray (IG).

Fittings

A full complement of fittings (LD series) must be available including but not limited to flat, internal and external elbows, divided tees and entrance fittings, couplers, and end caps. Applicable fittings shall be of either cover only design or cover & base design if required to provide bend radius control. The fittings shall be manufactured from high impact polystyrene (HIPS). The fittings shall have a matte texture and be available in four colors, off-white (IW), electric ivory (EI), white (WH) and international gray (IG) to match the raceway. They shall overlap the raceway to hide uneven cuts.

Accessories

Junction boxes and faceplates shall be available for mounting standard devices. The junction boxes shall be available in standard, deep, and extra deep versions. The faceplates shall be designed to accept Panduit communications modules for data terminations. The faceplates may accommodate up to 6 jacks and shall be modular in design to accept UTP, Coax, ST, SC, and Fiber-Jack type of connectors. They shall be available in off-white (IW), electric ivory (EI), white (WH) and international gray (IG) to match the raceway.

Materials

The raceway and all system components must exhibit non-flammable self-extinguishing characteristics, tested to comparable specifications of UL94V-0

LD Part Numbers

Part Number	Description	Bend Radius Control	Size
LD3**8-A	One-piece latching surface raceway.	--	8'
LD5**8-A	One-piece latching surface raceway.	--	8'
LD10**8-A	One-piece latching surface raceway.	--	8'
CF5**-E	Coupler fitting for use with LD5 raceway.	Yes	
ICF5**-E	Inside corner fitting for use with LD5 raceway	Yes	
OCF5**-E	Outside corner fitting for use with LD5 raceway	Yes	
RAF5**-E	Right angle fitting for use with LD5 raceway	Yes	
TF5**-E	Tee fitting for use with LD5 raceway	Yes	
ECF5**-E	End cap fitting for use with LD5 raceway	--	
CRFC5**-X	4-way cross fitting for use with LD5 raceway	--	
DCF5**-X	Drop ceiling/entrance end fitting	--	
JBX3510**-A	Single gang two-piece snap together outlet box	--	

** - designates color option

OFFICE FURNITURE RACEWAY

[1.88" by 1.71"]

Raceway

The raceway shall be a one-piece design. Total width shall be 1.88" by 1.71" deep having an approximate wall thickness of .080". The raceway shall be available in 6' lengths. The raceway (OFR) shall have an integral hinge attaching the cover to the base. The raceway shall be manufactured of rigid PVC compound. The raceway shall have a smooth texture, and be available in four colors: office beige (OB), office gray (OG), office slate (OS) and medium tone (MT).

Fittings

A full complement of fittings (OFR series) must be available including but not limited to flat, internal and external elbows, tees, wall entrance fittings, couplers, communication poles, and end caps, corner raceway and cover, vertical raceway, spill-over fittings. Applicable fittings shall be of cover & base design to provide cable concealment and bend radius control. The fittings shall be manufactured from high impact polystyrene (HIPS). The fittings shall have a smooth texture, and be available in four colors, office beige (OB), office gray (OG), office slate (OS) and medium tone (MT) to match the raceway. They shall overlap the raceway to hide uneven cuts.

Accessories

Desk mount boxes and snap-on faceplates shall be available for mounting standard devices. The faceplates shall be designed to accept Panduit communications modules for data terminations. The faceplates may accommodate up to 4 jacks and shall be modular in design to accept UTP, Coax, ST, SC, and Fiber-Jack type of connectors. They shall be available in four colors: office beige (OB), office gray (OG), office slate (OS) and medium tone (MT) to match the raceway.

Materials

The raceway and all system components must exhibit non-flammable self-extinguishing characteristics, tested to comparable specifications of UL94V-0.

Office Furniture Part Numbers

Part Number	Description	Size
OFR20**6	Office Furniture Raceway	6'
OFRC70**6	Corner Raceway Base	6'
OFRC70**6	Corner Raceway Cover	6'
OFVR5**6	Vertical Raceway	6'
OFR20CP**8	Communication Pole	8'
CFR20OFRC70**4	Four Cubicle Drop	
OFR20OFRC70**2	Two Cubicle Drop	
OFR20OFRC70**1	One Cubicle Drop	
OFRCR70EC**	End Cap Fitting	
OFR20SO**	Spill Over Fitting	
OFR20DMB**	Desk Mount Box	
OFR20MPT**	Mid Panel Tee Fitting	
OFR20WE**	Wall Entrance Fitting	
OFR20RA**	Right Angle Fitting	
OFR20T**	Tee Fitting	
OFR20CR**	Cross Fitting	
OFR20IC**	Inside Corner Fitting	
OFR20OC**	Outside Corner Fitting	
OFR20CC**	Coupler Fitting	
OFR20EC**	End Cap Fitting	
OF70FV4**	Vertical Sloped Communication Snap On Faceplate	
OF70FH4**	Horizontal Sloped Communication Snap On Faceplate	

** - designates color option

SECTION 3: Multi-Channel Products

LD2P Raceway

[(1.51" x 0.86")]

Raceway

The raceway shall be a one-piece design. The raceway shall maintain separation of the power and data channels. Raceway dimensions shall be 1.51" wide by 0.86" deep with an approximate wall thickness of 0.055". The raceway shall be available in 8' and 10' lengths.

The raceway (LD2P10) shall have two wiring channels separated by an integral barrier. The raceway also must have an integral hinge attaching the cover to the base. The raceway shall have tamper resistant characteristics inherent with the design of the latch. The raceway shall be manufactured of rigid PVC compound. The raceway shall have a smooth texture, and be available in four colors: off-white (IW), electric ivory (EI), white (WH) and international gray (IG).

Fittings

A full complement of fittings (LD2P10 series) must be available including but not limited to flat, internal and external elbows, divided tees and entrance fittings, couplers, and end caps. The fittings shall provide a means for connecting to the raceway and shall be capable of maintaining a 1" minimum cable bend radius. Applicable fittings shall be of base and cover design in order to maintain complete enclosure, maintain separation of power and data channels, and to eliminate mitering. The fittings shall be manufactured from a rigid PVC (or ABS/PC) compound. The fittings shall have a matte texture and be available in four colors: off-white (IW), electric ivory (EI), white (WH) and international gray (IG) to match the raceway. They shall overlap the raceway to hide uneven cuts.

Accessories

Divided junction boxes and faceplates shall be available for mounting standard devices. The junction boxes shall be available in both standard and deep versions. The shallow junction boxes must have a divider wall to maintain separation of power and data cables and allow for termination of both services in one junction box. The deep boxes shall have a divider wall to be used similar to the shallow box. In addition, an insert to allow for the perpendicular routing through of cables to additional boxes shall be available. The faceplates shall allow for terminating of standard electrical devices, both duplex and rectangular styles, and accept Panduit inserts for data terminations. The faceplates may accommodate up to 6 jacks and shall be modular in design to accept UTP, Coax, ST, SC, FC and Fiber Jack type of connectors. They shall be available in off-white (IW), electric ivory (EI), white (WH) and international gray (IG) to match the raceway.

Materials

The raceway and all system components must be UL Listed up to 600V and CSA certified up to 300V and exhibit non-flammable self-extinguishing characteristics, tested to comparable specifications of UL94V-0.

LD2P Part Numbers

Part Number	Description	Bend Radius Control	Size
LD2P10**8-A	LD2P10 Raceway	-	8'
LD2P10**10-A	LD2P10 Raceway	-	10'
CFX10**-X	Coupler Fitting	-	-
ICFX10**-X	Inside Corner Fitting	Yes	-
OCFX10**-X	Outside Corner Fitting	Yes	-
RAFX10**-X	Right Angle Fitting	Yes	-
ECFX10**-X	End Cap Fitting	-	-
TFXD10**-X	Tee Fitting (divided)	Yes	-
EEFX**	Entrance End Fitting	Yes	-

** - designates color option

Cove Raceway [(3.50" by 3.50")]

Raceway

The raceway shall be a two-piece design with a base and snap-on cover. The raceway shall maintain complete separation of the power and data channels. Total width shall be 3.50" by 3.50" deep with an approximate wall thickness of 0.10".

The base (WCM35B) shall have its own cover and features for mounting device brackets, hanging boxes, and wire retainers. Divider walls, which snap onto the base to form additional wiring channels, must be available. The base shall be manufactured of rigid PVC compound. The base shall have a smooth texture, and be available in off-white (IW).

The cover (WCM35C) shall have flanges for snapping onto the base. The cover shall be manufactured of a rigid PVC compound. The cover shall be available in off-white (IW). The cover shall match the finish and the color of the base. The cover shall also be paintable with latex paint.

The divider wall (WCM35DW) shall have flanges, which snap onto the cove base. The divider shall be manufactured of a rigid PVC compound. The divider shall have a smooth texture and be international gray (IG) in color.

Fittings

A full complement of fittings (Cove series) must be available including but not limited to flat, internal, and external elbows, tees with inserts to separate power and data cabling, cover couplers and end caps. A transition fitting shall be available to adapt to Panduit T-45, LDP10, LDP5 and LDP3 series raceways. The fittings shall provide a means for connecting to the raceway base and shall be capable of maintaining a 1" minimum cable bend radius. The fittings shall be manufactured from a rigid PVC (or ABS/PC) compound. The fittings shall have a matte texture and be available in off-white (IW) to match the base and cover. They shall overlap the cover and base to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitering.

Accessories

Faceplate adapters and hanging boxes shall be available for mounting NEMA 70mm standard devices in-line within the raceway. Faceplates may be a Pan-Way faceplate to match and fit flush with the device bracket, or any NEMA standard 70mm faceplate. Data faceplates may accommodate up to 6 jacks and shall be modular in design to accept UTP, Coax, ST, SC, and Fiber-Jack type of connectors. They shall be available in off-white (IW) to match the raceway base and cover.

Materials

The raceway and all system components must be UL Listed and exhibit flame-retardant self-extinguishing characteristics, tested to comparable specifications of UL94 (V-0). The raceway base, cover, and divider shall be available in 8' and 10' lengths. Surface non-metallic raceway is to be utilized in dry interior locations only as Covered in Article 388 of the National Electrical Code (2002), as adopted by the National Fire Protection Association and as approved by the American National Standards Institute. The Raceway System must be listed by Underwriters Laboratories UL-5A under File Nos. E95425 (raceway) and E116129 (fittings) and by Canadian Standards Association C22.2 No. 62-93, 300VAC File No. LR86285

Cove Raceway Part Numbers

Part Number	Description	Bend Radius	
		Control	Length
WCM35BIW8	Cove Raceway Base 8ft	-	8'
WCM35CIW8	Cove Raceway Cover 8ft	-	8'
WCM35DW8	Cove Raceway Divider Wall 8ft	-	8'
WCM35WR-X	Cove Raceway Wire Retainer	-	-
WCM35ICIW	Cove Raceway Inside Corner Fitting	Yes	-
WCM35OCIW	Cove Raceway Outside Corner Fitting	Yes	-
WCM35TRIW	Cove Raceway Transition Fitting	Yes	-
WCM35ECIW	Cove Raceway End Cap	-	-
WCM35CCIW-X	Cove Raceway Cover Coupler	-	-
WCM35TIW	Cove Raceway Tee Fitting	Yes	-
WCM35TI	Cove Raceway Tee Fitting Insert	Yes	-
WCM35BFIW	Cove Raceway Back Feed Fitting	Yes	-

T-45 Raceway

[(2.38" by 1.25")]

Raceway

The raceway shall be a two-piece design with a base and snap-on hinging cover. The raceway shall maintain complete separation of the power and data channels. Raceway dimensions shall be 2.38" wide by 1.25" deep with an approximate wall thickness of 0.075".

The base (T45B) shall have its own cover (T45C) and features for wire retainers and hinged data brackets. Divider walls, which snap onto the base to form additional wiring channels, must be available. The base shall be manufactured of rigid PVC compound. The base shall have a smooth texture, and be available in two colors: off-white (IW) and electric ivory (EI).

The cover (T45C) shall have flanges for snapping onto the base and hinging from either side of the base. The cover shall be manufactured of a rigid PVC compound. The cover shall be available in two colors: off-white (IW) and electric ivory (EI). The cover shall match the finish and the color of the base.

The divider wall (T45DW) shall have flanges, which snap onto the T-45 base. The divider shall be manufactured of a rigid PVC compound. The divider shall have a smooth texture and be international gray (IG) in color.

Fittings

A full complement of fittings (T-45 series) must be available including but not limited to flat, internal, and external elbows, tees with inserts to separate power and data cabling, entrance fittings, cover couplers and end caps. An in-line reducer fitting shall be available to adapt to Panduit LD2P10 series raceways. The fittings shall provide a means for connecting to the raceway base and shall be capable of maintaining a 1" minimum cable bend radius. The fittings shall be manufactured from a rigid PVC compound. The fittings shall have a smooth texture and be available in two colors: off-white (IW) and electric ivory (EI) to match the base and cover. Aside from the end cap, they shall overlap the cover and base to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitering.

Accessories

Hinged data brackets shall be available for mounting Pan-Net communication outlets in-line within the raceway. An offset two-piece termination box shall be available for positioning power or data devices adjacent to the raceways. Faceplates may be a Pan-Way Snap-On faceplate or any NEMA standard 70mm faceplate. Data faceplates may accommodate up to 4 jacks and shall be modular in design to accept UTP, Coax, ST, SC, FC and Fiber Jack type of connectors. One and two gang surface mount

outlet boxes shall be available for power or data devices. Fast-Snap outlet boxes shall accept Pan-Way Snap-On faceplates. Other Pan-Way outlet boxes shall accept any NEMA standard 70mm faceplate. They shall be available in off-white (IW) and electric ivory (EI) to match the raceway base and cover.

Materials

The raceway and all system components must be UL-5A Listed, UL Listed up to 600V and CSA certified up to 300V and exhibit non-flammable self-extinguishing characteristics, tested to comparable specifications of UL94V-0. The raceway base, cover, and divider shall be available in 8' and 10' lengths.

T-45 Part Numbers

Part Number	Description	Bend Radius Control	Size
T45B**8	T-45 Base (8' Long)	-	8' & 10'
T45C**8	T-45 Cover (8' Long)	-	8' & 10'
T45DW8	T-45 Divider Wall (8' Long)	-	8' & 10'
T45IC**	Inside Corner Fitting	Yes	-
T45OC**	Outside Corner Fitting	Yes	-
T45RA**	Right Angle Fitting	Yes	-
T45RLD**	In-Line Reducer to LD10, LDP10 or LD2P10 Raceways	-	-
T45TRI	Transition Fitting	Yes	-
T45T**	Tee Fitting	Yes	-
T45TDT	Tee Divided Insert (Top)	-	-
T45EC**	End Cap Fitting	-	-
T45EE**	Entrance End Fitting	Yes	-
T45BC**-X	Base Coupler Fitting	-	-
T45CC**-X	Cover Coupler Fitting	-	-
T45WR-X	Wire Retainer	-	-
T45WC**	Work Station Outlet Center Offset Bx for Screw-On Elec./Comm. Faceplate	-	-
T45WC2**	Work Station Outlet Center Offset Bx for Snap-On Elec./Comm. Faceplate	-	-
T45HDB**	Hinged Data Bracket	-	-

** - designates color option

T-70 Raceway

[(4.07" by 1.77")]

Raceway

The raceway shall be a two-piece design with a base and snap-on cover. The raceway shall maintain complete separation of the power and data channels. Raceway dimensions shall be 4.07" wide by 1.77" deep with an approximate wall thickness of .10".

The base (T70B) shall have a 70mm opening, its own 70mm cover, mounting device brackets, hanging boxes, wire retainers and snap on faceplates and features for accepting any data or electrical 70mm faceplates without the use of a proprietary adapter or "special" width faceplates. Divider walls, which snap onto the base to form additional wiring channels, must be available. The base shall be manufactured of rigid PVC compound. The base shall have a smooth texture, and be available in three colors: off-white (IW), electric ivory (EI) and white (WH).

The cover (T70C) shall have flanges for snapping onto the base. The cover shall be manufactured of a rigid PVC compound. The cover shall be available in three colors: off-white (IW), electric ivory (EI) and white (WH). The cover shall match the finish and the color of the base and have a tamper resistant cover latch. Product shall require the use of a tool (i.e. straight blade screwdriver) inserted into the raceway cut end to disengage the cover latch from the base.

The divider wall (T70DW) shall have flanges, which snap onto the T-70 base. The divider shall be

manufactured of a rigid PVC compound. The divider shall have a smooth texture and be international gray (IG) in color.

Fittings

A full complement of fittings (T-70 series) must be available including but not limited to flat, internal, and external elbows, tees with inserts to separate power and data cabling, entrance fittings, cover couplers, base couplers, and end caps. A transition fitting shall be available to adapt to Panduit T45, LDP10, LDP5 and LDP3 series raceways. The fittings shall provide a means for connecting to the raceway base and shall be capable of maintaining a 1" minimum cable bend radius. The fittings shall be manufactured from a rigid PVC (or ABS/PC) compound. The fittings shall have a matte texture, on the top surfaces, and be available in off-white (IW), electric ivory (EI) and white (WH) to match the base and cover. They shall overlap the cover and base to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitering.

Accessories

Device brackets and hanging boxes shall be available for mounting standard devices in-line within the raceway. An offset two-piece termination box shall be available for positioning power devices adjacent to inline data terminations. Faceplates may be a Pan-Way Snap-On faceplate to match and fit flush with the device bracket, or any NEMA standard 70mm faceplate. Data faceplates may accommodate up to 6 jacks and shall be modular in design to accept UTP, Coax, ST, SC, FC and Fiber Jack type of connectors. They shall be available in off-white (IW), electric ivory (EI) and white (WH) to match the raceway base and cover.

Material

The raceway and all system components must be UL Listed up to 600V and CSA certified up to 300V and exhibit non-flammable self-extinguishing characteristics, tested to comparable specifications of UL94V-0. The raceway base, cover, and divider shall be available in 8' and 10' lengths.

T-70 Part Numbers

Part Number	Description	Bend Radius Control	Size
T70B**8	T-70 Base (8' Long)	-	8' & 10'
T70C**8	Cover (8' Long)	-	8' & 10'
T70DW8	Divider Wall (8' Long)	-	8' & 10'
T70IC**	Inside Corner (Base and Cover)	Yes	-
T70OC**	Outside Corner (Base and Cover)	Yes	-
T70RA**	Right Angle (Base and Cover)	Yes	-
T70TR**	Transition Fitting (Base and Cover)	Yes	-
T70TRC**	Transition Fitting (Cover Only)	Yes	-
T70T**	Tee Fitting (Base and Cover)	Yes	-
T70TDT	Tee Divided Insert (Top)	Yes	-
T70TDC	Tee Divided Insert (Center)	Yes	-
T70TDB	Tee Divided Insert (Bottom)	Yes	-
T70EC**	End Cap	-	-
T70EE**	Entrance End	Yes	-
T70BC**-X	Base Coupler	-	-
T70CC**-X	Cover Coupler	-	-
T70DB-X	Device Bracket	-	-
T70WR-X	Wire Retainer	-	-
T70PC**	Pre-Cut Snap-On Cover Modular Furniture	-	-
T70S-X	Surface Mount Box Spacer Plate	-	-
T70HB-X	Hanging Box	-	-
T70HB3-X	3 Sided Hanging Box	-	-
T70WC**	WORKSTATION OUTLET CENTER(tm)	-	-
	Screw-On faceplate		
T70WC2**	WORKSTATION OUTLET CENTER(tm) Snap-On faceplate	-	-
T70FSB	Fiber Spool Bracket	-	-

** - Designates color option

TG-70 Raceway

[(5.32" by 2.68")]

Raceway

The raceway shall be a two-piece design with a base and snap-on cover. The raceway shall maintain complete separation of the power and data channels. Total width shall be 5.32" by 2.68" deep with an approximate wall thickness of .125". The base shall have a 70mm opening, its own 70mm cover and features for mounting device brackets, hanging boxes, wire retainers and snap on faceplates. Divider walls, which snap onto the base to form additional wiring channels, must be available. The base shall be manufactured of rigid PVC compound. The base shall have a smooth texture, and be available in two colors, off-white (IW) and electric ivory (EI) and tamper resistant cover latch. Product requires the use of a tool (i.e. straight blade screwdriver) inserted into the raceway cut end to disengage the cover latch from the base.

Fittings

A full complement of fittings (TG series) must be available including but not limited to flat elbows, internal and external elbows with adjustable angles, tee with insert to separate power and data cabling, cover couplers, base couplers, and end caps. A snap-on transition fitting shall be available to adapt to Panduit T-45, LDP10, LDP5 and LDP3 series raceways. The fittings shall provide a means for connecting to the raceway base and shall be capable of maintaining a 40mm minimum cable bend radius. The fittings shall be manufactured from a rigid PVC (or ABS/PC) compound. The fittings shall have a smooth texture and be available in two colors, off-white (IW) and electric ivory (EI), to match the base and cover. They shall overlap the cover and base to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitering.

Accessories

Device brackets and hanging boxes shall be available for mounting standard devices in-line within the raceway. Faceplates may be a Pan-Way Snap-On faceplate to match and fit flush with the device bracket, or any NEMA standard 70mm faceplate. Data faceplates may accommodate up to 6 jacks and shall be modular in design to accept UTP, Coax, ST, SC, and Fiber-Jack type of connectors. They shall be available in off-white (IW) and electric ivory (EI) to match the raceway base and cover.

Materials

The raceway and all system components must be UL Listed up to 600V and CSA certified up to 300V and exhibit non-flammable self-extinguishing characteristics, tested to comparable specifications of UL94V-0. The raceway base, cover, and divider shall be available in 8' and 10' lengths.

TG-70 Part Numbers

Part Number	Description	Bend Radius Control	Length
TG70**8	TG-70 Raceway Base and Cover (8' long)	-	8' & 10'
T70C**8	TG-70 Replacement Raceway Cover (8' long)	-	8' & 10'
TGDW8	TG Divider Wall (8' long)	-	8' & 10'
TGIC**	TG Inside Corner Fitting (Base and Cover)	Yes	-
TGOC**	TG Outside Corner Fitting (Base and Cover)	Yes	-
TGRA**	TG Right Angle Fitting (Base and Cover)	Yes	-

TGT**	TG Tee Fitting (Base and Cover)	Yes	-
TGTD	TG Tee Divider Insert Fitting	Yes	-
TG70BC*	TG-70 Base Coupler Fitting	-	-
*-X			
T70CC**-	TG-70 Cover Coupler Fitting	-	-
X			
TGEC**	TG End Cap Fitting	-	-
T70DB-X	Device Bracket	-	-
TG70HB3	TG-70 3 Sided Hanging Box	-	-
-X	(Box and Divider Wall)	-	-
TG70WR-	TG-70 Wire Retainer	-	-
X			
TGTR**	TG Transition Fitting (Cover and Insert)	Yes	-
T70P**	106 Duplex Snap-On Faceplate	-	-
T70PG**	Rectangular Snap-On Faceplate	-	-
CP106**	106 Duplex Screw-On Faceplate	-	-
CPG**	Rectangular Screw-On Faceplate	-	-

** - Designates color option

Twin-70 Raceway

[(7.23" by 1.77")]

Raceway

The raceway shall be a three-piece design with a base and two snap-on covers which provide access to each channel independently. The raceway shall maintain complete separation of the power and data channels. Raceway dimensions shall be 7.23" wide by 1.77" deep with an approximate wall thickness of .10".

The base (T702B) shall have two wiring channels separated by an integral barrier and features in both channels for mounting device brackets. Each channel shall have a 70mm opening and its own 70mm cover. Divider walls, which snap onto the base to form additional wiring channels, must be available. The base shall be manufactured of rigid PVC compound. The base shall have a smooth texture, and be available in three colors: off-white (IW), electric ivory (EI) and white (WH).

The covers (T70C) shall have flanges for snapping onto the base. The cover shall be manufactured of a rigid PVC compound. The cover shall be available in three colors: off-white (IW), electric ivory (EI) and white (WH). The cover shall match the finish and the color of the base.

Additional divider walls (T70DW) shall have flanges, which snap onto the Twin-70 base and shall be removable. The divider shall be manufactured of a rigid PVC compound. The divider shall have a smooth texture and be international gray (IG) in color.

Fittings

A full complement of fittings (Twin-70 series) must be available including but not limited to flat, internal, and external elbows, tees, entrance fittings, cover couplers, base couplers, and end caps. A transition fitting shall be available to adapt to Panduit LDP10, LDP5, LDP3, T-70, and LD2P10 series raceways. The fittings shall provide a means for connecting to the raceway base and shall be capable of maintaining a 1" minimum cable bend radius. The fittings shall have two separate covers in order to maintain complete separation of power and data channels; exceptions would be the tee and entrance end fittings. The fittings shall be manufactured from a rigid PVC (or ABS/PC) compound. The fittings shall have a matte texture, on top surfaces, and be available in three colors, off-white (IW), electric ivory (EI) and white (WH) to match the base and cover. They shall overlap the cover and base to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitering.

Accessories

Device brackets shall be available for mounting standard devices in-line within the raceway. Faceplates may be a Pan-Way Snap-On faceplate to match and fit flush with the device bracket, or any NEMA standard 70mm faceplate. Data faceplates may accommodate up to 6 jacks and shall be

modular in design to accept UTP, Coax, ST, SC, FC and Fiber-Jack type of connectors. They shall be available in off-white (IW), electric ivory (EI) and white (WH) to match the raceway base and cover.

Materials

The raceway and all system components must be UL Listed up to 600V and CSA certified up to 300V and exhibit non-flammable self-extinguishing characteristics, tested to comparable specifications of UL94V-0. The raceway base, cover, and divider shall be available in 8' and 10' lengths.

Twin-70 Part Numbers

Part Number	Description	Bend Radius Control	Size
T702B**8	Twin-70 Base (8' Long)	-	8' & 10'
T70C**8	Cover (8' Long)	-	8' & 10'
T70DW8	Divider Wall (8" Long)	-	8' & 10'
T702IC**	Inside Corner (Base and Cover)	Yes	-
T702OC**	Outside Corner (Base and Cover)	Yes	-
T702RA**	Right Angle (Base and Cover)	Yes	-
T702TR**	Transition to T-70 (Base and Cover)	Yes	-
T702TRL*	Transition to LD profile raceway (Base and Cover)	Yes	-
T702TRI	Transition Divided Insert	Yes	-
T702EC**	End Cap	-	-
T702T**	Divided Tee (Base, Cover and Insert)	Yes	-
T702EE**	Entrance End	Yes	-
T702BC**	Base Coupler	-	-
-X			
T70CC**-X	Cover Coupler	-	-
T70DB-X	Device Bracket	-	-
T70WR-X	Wire Retainer	-	-
T70S-X	Surface Mount Box Spacer Plate	-	-
T70FSB	Fiber Spool Bracket	Yes	-

** - Designates color option

SECTION 4: Power and Communication/Communication Only Poles

Overview

Power and communication pole refers to a dual channel, floor-to-ceiling pole that provides convenient access to power and communication outlets. The power and communication pole provides a floor space efficient and MAC friendly solution to power and communication access in open office, education, retail, factory, or warehouse applications.

Communication only pole refers to a single channel, floor-to-ceiling pole that provides convenient access to communication outlets. The communication only pole provides a floor-space efficient solution to communication access in open office, education, retail, factory or warehouse applications.

Pan-Pole Power and Communication Poles

[(2.90" by 1.77")]

Power and Communication Channels

The Power and Communications Pole channel shall be aluminum, in either off-white (IW) or electric ivory (EI) color, with a cross sectional area of 2.90" X 1.77" with two

separate compartments. One compartment is to be factory wired with two (2) duplex-style 20A, 125V NEMA 5-20R grounding-type specification grade receptacles, and colored, to match the pole finish. Receptacles must be UL tested to meet the performance requirements of Fed. Spec. W-C695G General Specification for Electrical Power Connectors and conform to NEMA specification WD 1-7.01 to 7.10 "Heavy Duty General Use Grounding Receptacle". Receptacles shall also be UL Listed and be in compliance with UL-498.

The harness is to be single circuit (2 conductor plus ground) with #12 AWG solid type THHN conductors, factory assembled to the receptacles. Six inch (6") conductor leads are to be furnished for termination to the overhead wiring system. A power entry box with 1/2" and 3/4 " conduit breakouts and 8" removable plate must be provided at the top of the power compartment to facilitate the hard wiring of the pole harness.

The second compartment is to be for field installation of telephone or data network cabling. A non-metallic cover, which is removable and is easily cut to create an opening for installation of communications faceplates, shall be provided to enclose the channel. The channel shall accept Snap-On communication faceplates or a standard faceplate bracket capable of mounting a NEMA standard single-gang communications faceplate. The channel shall be capable of mounting up to 6 communication faceplates, providing up to 24 communication ports.

Communication Only Channel

The Communications Only Pole shall be aluminum, in either off-white (IW) or electric ivory (EI) color, with a cross sectional area of 2.90" x 1.77" with one compartment. The compartment is to be for field installation of telephone or data network cabling. A non-metallic cover that is removable and easily cut to create an opening for installation of communications faceplates shall be provided to enclose the

channel. The channel shall accept Snap-On communication faceplates or a standard faceplate bracket capable of mounting a NEMA standard single-gang communications faceplate. The channel shall be capable of mounting up to 6 communication faceplates, providing up to 24 communication ports.

Mounting Hardware and Fittings

A full complement of mounting hardware and fittings for the Power and Communications Pole and Communications Only Pole shall be provided. These shall include, but are not limited to, entrance end fitting, which protects cable bend radius, for the top of the pole, ceiling trim plate, pole mounting bracket, Velcro carpet gripper pad, and adhesive pad.

Field Modification of Power and Communications Pole

The power and communications pole must be UL listed for field modifications, changes and additions of receptacles, devices, and circuits. Field installed power device addition kits shall be available to add duplex receptacles and shall be provided with plates that are color matched to the appropriate power and communications pole.

Snap-On Communication Faceplates

Snap-On single-gang communication faceplates must be available to mount workstation device faceplates, inserts and specialty mounting bezels. The power pole manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP (including Categories 5, 5e and 6*), STP (150 ohm), Fiber Optic, Coaxial, and other cabling types. The workstation inserts shall also have available a complete line of port and station identification labels in a variety of colors that meet the requirements for ANSI/EIA/TIA 606-A.

Pan-Pole Power and Communication Pole Part Numbers

Part number	Description	Size
PCPA11R20**	Power & Communications Pole	11' L
PCPA13R20**	Power & Communications Pole	13' L
PCPA11**	Communications Pole	11' L
PCPA13**	Communications Pole	13' L
PCPAKR20**	Power Addition Kit with 20A Duplex Receptacle	
PCPAKR**	Power Addition Kit without receptacle	
T70SDB-X	Standard Faceplate Mounting Bracket (for Communication)	

** - designates color option



CSI SECTION 270553

IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a standard specification applicable to commercial building structured cabling applications.

The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines.

The information contained in this document is based on our experience to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be used with their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements consult the factory. This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supercedes and voids all previous literature, etc.

It is highly recommended and the issuers responsibility to have any RFQ documents, including those based on this general format, reviewed by the issuing company's professional advisors before it is released to the public. In no way may this document be used in a manner that is detrimental to the interests of Panduit and/or its subsidiaries

Identification and Labeling

1. The contractor shall develop and submit for approval a labeling system for the structured cabling installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the structured cabling system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the structured cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
2. All label printing will be machine generated by Panduit Easy-Mark labeling software and Panduit desktop and hand-held printers using indelible thermal transfer ribbons or cartridges. Panduit self-laminating labels or Turn-Tell™ labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.
3. Computer Printable Labels
 - a. Machine generated labels provide clear communication. Labels are designed for specific data center infrastructure applications insuring a proper fit and long life.
 - b. Data cables shall be identified with self-laminated cable markers that can be rotated for visibility from any angle, and allow repositioning on the cable to align legends for improved aesthetics. (Turn-Tell Labels)
 - c. Cabinets and equipment shall be identified with thermal transfer printed, die-cut, microcellular foam with a polyester printable surface and high-tack adhesive. (Raised Panel Labels)
 - d. Fiber Optic cables shall be identified with non-adhesive, thermal transfer printable, flag style markers that permit the repositioning of the marker for greater visibility and improved aesthetics. (Flag Labels)
 - e. Cable bundles shall be identified with non-adhesive thermal transfer printable marker plates attached with nylon cable ties or hook and loop ties. Marker plates shall offer crisp, clear legends and shall meet requirements for MIL-STD-202G, Notice 12 Method 215J. (Thermal Transfer Printable Marker Plates)
4. Easy-Mark Labeling Software
 - a. The Labeling Software insures that data center infrastructure identifiers conform to applicable Standards.
 - b. Labels and identifiers shall be produced with labeling software that guides the user through the process of creating labels used throughout the data center providing faster and more reliable infrastructure identification. (Easy-Mark Labeling Software)
 - c. Labels and identifiers shall be produced with labeling software that facilitates quick and easy extraction of identifiers from CAD drawings saving time and reducing errors caused by manual entry of data into labeling software. (Cad-Connect Labeling Software)
5. LS8EQ Portable Printing System
 - a. The LS8EQ printer produces durable, clear identification labels on site.
 - b. Labels and identifiers shall be printed on hand-held thermal transfer printer increasing labeling productivity. Printer labels shall be contained in fast loading label cassette

containing an integrated memory device for automatic formatting, recall of last legend and number of labels remaining on the cassette. The printer shall provide a partial cut feature to allow the flexibility of tear-apart strips of labels for quicker installation.

- c. Labels and identifiers shall be printed on a compact and rugged portable thermal transfer printer that fits in one hand. The printer shall have a large, backlit display, QWERTY keyboard, USB interface for importing data and printing labels from a wireless laptop or desktop computer. Printer shall simplify the creation of labels for network components through built-in data center labeling tools. Printer labels shall be contained in fast loading label cassette containing an integrated memory device for automatic formatting, recall of last legend and number of labels remaining on the cassette. The printer shall provide a partial cut feature to allow the flexibility of tear-apart strips of labels for quicker installation. (LS8EQ)
6. Physical Network Security Devices
 - a. Physical Network Security devices insure that network connection points are protected from unauthorized or unintended access or disconnection.
 - b. RJ45 Plug Lock In Device
 - c. RJ45 Plug Block-out Device
 - d. SC Connector Block-out Device
 - e. LC Connector Lock In Device
 - f. LC Connector Block-out Device
 7. Facility Safety Signs
 - a. Provide clear, concise communication of facility hazards and infrastructure mechanical systems.
 - b. Snap-on Pipe Markers
 8. Electrical Safety Signs
 - a. Clearly define electrical hazards and power paths.
 - b. Arc Flash Warning Signs

Infrastructure Identification

Located throughout the Network are physical infrastructure components that support IT equipment providing essential services to critical business applications.

Any disruption of the physical infrastructure could cause interruption to business applications resulting in thousands to millions of dollars of cost and lost revenue. Disruption of the physical infrastructure can be caused by moves, additions, changes, or system failures.

The advantage of a properly identified infrastructure is that system components can be quickly and accurately identified so that the infrastructure and business service are restored.

Several industry standards define the identification of the network physical infrastructure:

TIA-942—Telecommunications Infrastructure Standard for Data Centers

This standard covers the detailed design and installation requirements of data center infrastructure. Labeling and administration are not a part of the standard. The user of the standard is referred to TIA/EIA-606-A for guidance on this subject.

TIA/EIA-606B—Administration Standard for Telecommunication Infrastructure

Accommodates the scalable needs of telecommunications infrastructure systems allowing modular implementation of different elements of the standard. Specifies identifier formats, labeling formats, and requirements of labels in the enterprise.

NFPA 70E-2004—Standard for Electrical Safety in the Workplace

NFPA 70E describes safe work practices for electrical construction and maintenance.

The following solutions provide the proper identification and labeling of critical data center infrastructure components based on information from the above Standards and from industry best practices.

TIA/EIA-606-B

The TIA/EIA-606-B standard establishes guidelines for owners, end users, manufacturers, consultants, contractors, designers, installers, and facilities administrators involved in the administration of the telecommunications infrastructure.

Four classes of administration are specified in the standard, to accommodate diverse degrees of complexity present in the telecommunications infrastructure. The specifications for each class include requirements for identifiers, records, and **labeling**.

Class 1 addresses the administration needs of a premises that is served by a single telecommunications space (TS) containing its telecommunications equipment. Required in Class 1 administration are identifiers for the TS, cabinets or racks, patch panels and termination blocks, ports or termination block positions, patch cables, cabling subsystem 1 links or horizontal links, equipment and workspace outlets, consolidation points, zone enclosures, splices, and all telecommunications grounding and bonding systems.

Class 2 administration provides for telecommunications infrastructure administration needs of a single building or tenant that is served by a single or multiple TSs within a single building. Class 2 administration includes all elements of Class 1 administration, plus identifiers for cabling subsystem 2 and 3 or backbone cabling, cabling subsystem 2 and 3 ports, and firestopping locations.

Class 3 administration addresses the needs of a campus, including its buildings and outside plant elements. Class 3 administration includes all elements of Class 2 administration, plus identifiers for buildings and inter-building cabling. Administration of pathways and spaces, and of outside plant elements is recommended.

Class 4 administration addresses the needs of a multi-campus system. Class 4 administration includes all elements of Class 3 administration, plus an identifier for each site, and optional identifiers for wide area network connections.

Telecommunication Space Labeling

Each TS should be identified with a scheme that defines the location of the space. The location should be defined with the floor and room number or other room designation.

A typical telecommunication space would have the following scheme:

1DC2

THIS IDENTIFIER WOULD DEFINE THAT THIS IS DATA CENTER 2 LOCATED ON THE FIRST FLOOR OF THE BUILDING

Component Locations in the Telecommunications Space

Locations for components in the TS can be determined either by using the grid coordinates for the space or assigning unique numbers to the various cabinet and wall segments in the space.

Grid Labeling

Component locations in a TS are determined using a X-Y coordinate system that is usually based on the

	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT
01																				
02																				
03																				
04																				
05																				
06																				
07																				

floor tile system in the data center space. Using alphabetic designations on one axis of the room and numerical designations on the other axis of the room create a series of alphanumeric designations that can be established for each floor tile in a data center space.

These floor tile designations are the basis for determining the location of data center devices.

Grid Label Recommendation

Printer Type	Laser/Inkjet
Label P/N	C850X1100YJJ

Cabinet/Rack Labeling

The floor tile designations are used to identify each cabinet or rack in the data center. The cabinet/rack location is based on which floor tile the right front corner of the cabinet/rack rests upon. Cabinets and racks should have location labels applied to the top and bottom of both the front and rear of the device. These labels should be visible whether or not doors are closed or opened on the cabinets.



A typical cabinet/rack label would have the following scheme:

AB04

THIS IDENTIFIER WOULD DEFINE THAT THE CABINET/RACK IS LOCATED WITH ITS RIGHT FRONT CORNER AT THE INTERSECTION OF ROW AB AND COLUMN 04.

Cable/Rack Label Recommendation

Printer Type	Laser/Inkjet	LS8E	Desktop Thermal
Label Area	2.00 x 1.00	2.00 x 1.00	2.00 x 1.00
Label P/N	C200X100YJJ	C200X100YPC	C200X100YPT C200X100APT C200X100AMT

Panel Labeling

Once the cabinet/rack identifiers are established then the various panels in the cabinet/rack should be identified. The designation for the panel positions in a cabinet/rack can be either an alphabetic designation or a two-digit number that represent the rack unit number (RU) where the top-left mounting screw lands in the cabinet/rack. Using the RU method provides the data center manager with greater flexibility since it allows for panels and equipment to be added or removed later and not disrupt the designation of panel identifiers.



A typical panel label would have the following scheme:

AB04-24

This identifier would define that the top left mounting screw of the panel is located at the 24th rack unit position in the cabinet/rack located grid AB04 in the data center.

Panel Label Recommendation

Printer Type	Laser/Inkjet	LS8E	Desktop Thermal
Label P/N	C100X050YJJ	C100X050YPC	C100X050APT C100X050A0T

Port Labeling

Now that cabinets/racks and panels in each rack are identified the next task is to establish identifiers for each port on a panel. Port identifiers are very important in that they will define the connectivity of cabling within the data center infrastructure. Many patch panels come from the factory with numbers already screen-printed above the ports. If this is the case then there is no need to re-label those patch panels. If the patch panels are not pre-printed with port numbers then labels will need to be created to identify the port numbers. The numbering sequence should proceed from left to right and top to bottom for all ports on a patch panel. The number of digits used for all numbers on a patch panel should be consistent with the total number of ports on that patch panel. For example a 48-port patch panel should be labeled 01 through 48 and a 144-port patch panel should be labeled 001 through 144.



A typical port label would have the following scheme:

AB04-24:12

This identifier can be decoded to define that this is port 12 located on panel 24 in cabinet/rack AB04. This is somewhat redundant information given that the cabinet/rack and panel are clearly identified and are not usually required information on the port label since the cabinet/rack and panel are apparent to the viewer who is standing at the location of the port. Therefore a typical port label would have the following scheme:

12

This identifier defines that this is port 12.

Port Label Recommendations

Printer Type	Laser/Inkjet				
Cable Type	Copper	Copper	Copper	Copper	Fiber
Label Style	Adhesive	Adhesive	Non-Adhesive	Non-Adhesive	Adhesive
Number of Ports	4	6	4	6	n/a
Label P/N	C261X030FJJ	C379X030FJJ	C261X035Y1J	C390X030Y1J	C350X100YJJ

Printer Type	LS8E				
Cable Type	Copper	Copper	Copper	Copper	Fiber
Label Style	Adhesive	Adhesive	Non-Adhesive	Non-Adhesive	Adhesive
Number of Ports	4	6	4	6	n/a
Label P/N	C252X030FJC	C379X030FJC	C261X035Y1C	C390X030Y1C	T100X000YPC-BK

Printer Type	Desktop Thermal		
Cable Type	Copper	Copper	Fiber
Label Style	Adhesive	Adhesive	Adhesive
Number of Ports	4	6	n/a
Label P/N	C252X030YPT C252X030APT	C379X030YPT C379X030APT	C350X100YJT

Cable Labeling and Patch Cord Labeling

Next the cabling on the back and front of the cabinet/rack must be identified. Labeling of cables on the back of the panel is considered ***cable labeling*** and the labeling of cables connected to the front of the panel is considered ***patch cord/equipment cord labeling***.

Cable Labels

Cables labels are identified with information that defines the connection between the near end panel connection and the far end panel connection. A near end connection identifier would consist of the cabinet/rack location, panel location, and port location. The far end connection identifier would consist of the cabinet/rack location, panel location, and port location.



A typical cable label would have information in the following scheme:

AB04-24:01/AB07-36:13

This identifier would be decoded to define the cable connects between cabinet AB04 panel 24 port 01 going to cabinet AB07 panel 36 port 13. The far end of the cable would have a label that would have the same but with the information reversed.

Recommended Cable Labels

Printer Type	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet
Cable Type	Copper	Copper	Fiber	Fiber	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	2mm/3mm	Duplex 3mm	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Flag	Flag	Self-Laminating
Label P/N	S100X150YAJ	S100X225YAJ	F102X220FJJ	F102X220FJJ	S100X225YAJ

Printer Type	LS8	LS8	LS8	LS8	LS8
Cable Type	Copper	Copper	Fiber	Fiber	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	2mm/3mm	Duplex 3mm	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating for Label-Core	Self-Laminating for Label-Core	Self-Laminating
Label P/N	S100X150VAC R100X150V1C	S100X225VAC R100X150V1C	S100X160VAC	S100X220VAC	S100X225VAC

Printer Type	Desktop Thermal	Desktop Thermal	Desktop Thermal
Cable Type	Copper	Copper	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X150VAT R100X150V1T	S100X225VAT R100X225V1T	S100X225VAT R100X225V1T

Patch Cord/Equipment Cord Labels

Patch cord/equipment cord labels are identified with information that defines the connection between the near end patch panel front connections and the far end patch panel front connections or equipment connections. A near end connection identifier would consist of the cabinet/rack location, panel location, and port location. The far end connection identifier would consist of the cabinet/rack location, panel location, and port location.



A typical patch cord label would have information in the following scheme:

AB04-24:12\AB04-36:24

This identifier would be decoded to define the patch cord connection between cabinet AB04 panel 24 port 12 going to the same cabinet panel 36 port 24. The far end of the cable would have a label that would have the same but with the information reversed.

A typical equipment cord label would information in the following scheme:

AB04-24:01\AB04-Tinley2:A

This identifier would be decoded to define the equipment cord connection between cabinet AB04 panel 24 port 01 going to the same cabinet port A on equipment named Tinley2. Rack unit location could be substituted for equipment name if necessary.

Recommended Patch/Equipment Cord Labels

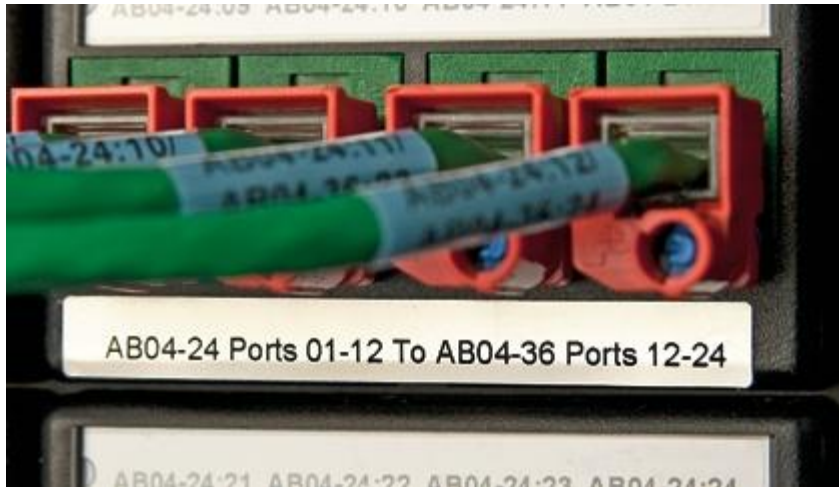
Printer Type	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet	Laser/Inkjet
Cable Type	Copper	Copper	Fiber	Fiber	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	2mm/3mm	Duplex 3mm	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Flag	Flag	Self-Laminating
Label P/N	S100X150YAJ	S100X225YAJ	F102X220FJJ	F102X220FJJ	S100X225YAJ

Printer Type	LS8	LS8	LS8	LS8	LS8
Cable Type	Copper	Copper	Fiber	Fiber	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	2mm/3mm	Duplex 3mm	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating for Label-Core	Self-Laminating for Label-Core	Self-Laminating
Label P/N	S100X150VAC R100X150V1C	S100X225VAC R100X225V1C	S100X160VAC	S100X220VAC	S100X225VAC

Printer Type	Desktop Thermal	Desktop Thermal	Desktop Thermal
Cable Type	Copper	Copper	Fiber
Cable Diameter	Cat5/5e/6	10G UTP/STP	Dia (0.24" to 0.48")
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X150VAT R100X150V1T	S100X225VAT R100X225V1T	S100X225VAT R100X225V1T

Patch Panel Connectivity

Patch Panel connectivity defines the connections between the near-end ports and the far-end ports. This labeling can define the connection of a range of ports on a panel or just define the connection for two individual ports.



A typical patch panel connectivity label would have the following scheme:

AB04-24:ports 01-12/AB04-36:ports 12-24

This identifier would describe that ports 01 through 12 on panel 24 of cabinet AB04 connect to ports 12 through 24 on panel 36 of cabinet AB04.

Recommended Patch Panel Connectivity Labels

Printer Type	Laser/Inkjet		
Media	Copper	Copper	Fiber
Ports	4 or less	more than 4	n/a
Label P/N	C252X030FJJ	C379X030FJJ	C350X100YJJ

Printer Type	LS8		
Media	Copper	Copper	Fiber
Ports	4 or less	more than 4	n/a
Label P/N	C252X030FJC	C379X030FJC	T100X000VJC-BK

Printer Type	Desktop Thermal		
Media	Copper	Copper	Fiber
Ports	4 or less	more than 4	n/a
Label P/N	C252X030YPT	C379X030YPT	C350X100YJT

Labeling For Other Systems

In addition to the data connections there are many other systems in a data center that require labeling.

Grounding and Bonding

LABELING OF THE GROUNDING AND BONDING SYSTEM INVOLVES THE IDENTIFICATION OF THE MAIN GROUNDING BUSBAR, GROUNDING BUSBARS, CONDUCTORS CONNECTING BUSBARS, CONDUCTORS CONNECTING DEVICES TO BUSBARS, AND EQUALIZING CONDUCTORS.

The typical scheme for the main grounding busbar would be:

1-B301-TMGB

This identifier can be decoded to define that this is the main telecommunications grounding busbar located on floor 1 in space B301.

The typical scheme for a grounding busbar would be:

2-R201-TGB

This identifier can be decoded to define that this is the telecommunications grounding busbar on floor 2 in space R201.

Recommended Telecommunications Grounding Busbar Labels

Printer Type	Laser/Inkjet	LS8	Desktop Thermal
Label P/N	C400X200YJJ	C200X100YPC	C400X200YPT

The typical scheme for the busbar connections would be:

1-B301-TMGB/2-R201-TGB

This identifier can be decoded to define that this is the conductor that connects the main telecommunications grounding busbar located on floor 1 in space B301 to the telecommunications grounding busbar on floor 2 in space R201.

Recommended Busbar Connections Labels

Printer Type	Laser/Inkjet				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075YAJ	S100X125YAJ	S100X225YAJ	S100X400YAJ	S100X650YAJ

Printer Type	LS8				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075VAC	S100X125VAC	S100X225VAC	S100X400VAC	S100X650VAC

Printer Type	Desktop Thermal				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075VAT	S100X125VAT	S100X225VAT	S100X400VAT	S100X650VAT

Power Cables

Labeling of the power system involves the labeling of the cables feeding power outlet units (POU) with information defining the source of power to the POU. This information would include the distribution panel and the circuit that feeds the POU.

A typical scheme for the power labeling would be:

AB03A-PP21-15

This identifier can be decoded to define that this is the power cable that connects POU A located in rack/cabinet AB03 to circuit breaker 15 in power panel 21.

Recommended Power Cable Labels

Printer Type	Laser/Inkjet				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075YAJ	S100X125YAJ	S100X225YAJ	S100X400YAJ	S100X650YAJ



Printer Type	LS8				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075VAC	S100X125VAC	S100X225VAC	S100X400VAC	S100X650VAC



Printer Type	Desktop Thermal				
Cable Diameter	18-14 AWG	12-10 AWG	8-4 AWG	2-1 AWG	1/0-250 MCM
Marker Type	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating	Self-Laminating
Label P/N	S100X075VAT	S100X125VAT	S100X225VAT	S100X400VAT	S100X650VAT

Safety, Fire and Security

Maintaining a safe workplace is essential to the proper operation of the data center. There are many potentially dangerous systems present in a data center such as fire suppressant systems, cooling systems, and power systems.

The following pre-printed labels can be installed in the data center.

Area	Part Number	Example
<p>ELECTRICAL HAZARDS</p>	<p>PPS0305W2100 PPS0710D73 PCV-120CY PCV-220CY PCV-480BY</p>	
<p>Fire Safety</p>	<p>PPS1209G010 PPS1209G011 PPS0710G001</p>	

<p>Piping</p>	<p>GPMSH-PY GPMSH-NY</p>	
<p>Security</p>	<p>PSL-DCJB PSL-DCPL FLCCLIW-X PSL-SCBD PSL-LCAB</p>	



CSI SECTION 271116

COMMUNICATIONS CABINETS, RACKS, FRAMES AND ENCLOSURES

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a standard specification applicable to commercial building structured cabling applications.

The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines.

The information contained in this document is based on our experience to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be used with their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements consult the factory. This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supercedes and voids all previous literature, etc.

It is highly recommended and the issuers responsibility to have any RFQ documents, including those based on this general format, reviewed by the issuing company's professional advisors before it is released to the public. In no way may this document be used in a manner that is detrimental to the interests of Panduit and/or its subsidiaries.

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SECTION 271116

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 a minimum of (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:
- Cabinets
 - Racks and Rack Cable Management
 - Frames
 - 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. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

1.3 Regulatory References

- A. The following industry standards are the basis for the structured cabling system described in this document.
1. TIA/EIA
 - TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard
 - TIA/EIA-569-A Commercial Building Standard for Telecom Pathways and Spaces
 - TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 - TIA/EIA-607 Commercial Building Grounding/Bonding Requirements

2. NFPA
 - NFPA-70 National Electric Code (NEC)-1999
3. ISO/IEC
 - ISO/IEC 11801 Generic Cabling for Customer Premises

B. The most recent versions of all documents apply to this project. If there is a conflict between applicable documents, the order above shall dictate the order of precedence in resolving the issue unless an enforceable local or national code is in effect.

1.4 Quality Assurance

A. PANDUIT® **CERTIFICATION PLUS**SM System Warranty

1. A **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 15 years.

B. PANDUIT® **PCI** Contractor Agreement

1. A factory registered *PANDUIT* PCI contractor shall complete network installation. The contractor shall have completed standards based product and installation training. A copy of the PCI Contractor Registration shall be submitted in the proposal.

C. Product Guarantee

1. All *PANDUIT PAN-NET*™ non-consumable products have a 20-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. Applications may include, but are not limited to:

10/100/1000 Mbps 1/10 Gb Ethernet (IEEE 802.3)
 4/16 Mbps Token Ring (IEEE 802.5)
 155, 622, 1.25 Gbps ATM
 SONET
 FDDI/CDDI
 IBM System 3x-AS/400
 Appletalk
 ISDN

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. Panduit categorized product must be used in conjunction with an equivalent or higher Category UL or ETL verified cable.
3. Panduit Products must be installed per Panduit instruction sheets.

Note: All Networks shall be installed per applicable standards and manufacturer's guidelines.

If any *PANDUIT PAN-NET*™ product fails to perform as stated above, *PANDUIT* will provide new components at no charge.

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.

1.5 Approved Products

- A. Approved rack manufacturer: Panduit
- B. Approved rack cable management system manufacturer: Panduit
- C. Approved vertical cable manager manufacturer: Panduit
- D. Approved horizontal cable manager manufacturer: Panduit
- E. Approved wall mounted fiber optic enclosure manufacturer: Panduit
- F. Approved rack mounted fiber optic enclosure manufacturer: Panduit
- G. Approved stackable cable rack spacer manufacturer: Panduit
- H. Approved threaded rod cover manufacturer: Panduit
- I. Approved cable support system manufacturer: Panduit
- J. Approved zone cabling box manufacturer: Panduit

Part 2 - Products

2.1 Equivalent Products

- A. Panduit shall manufacture all products, including but not limited to cabinets, racks, frames and enclosures. There will be no substitutions allowed.

2.2 Cabinets

The Switching and Patching Cabinet shall be used to provide a neat and efficient means for routing and protecting cables and patch cords in cabinets for network switching and patching applications. The cabinet shall provide vertical cable managers, have provisions for routing cables from under floor and overhead, and shall accept 19" horizontal cable managers, and cable management accessories used throughout the cabling system. The cabinet shall protect network investment by enclosing network cabling and equipment, maintaining system performance, and controlling cable bend radius.

Switch Cabinet

Cable Management shall be provided using a cabinet that supports heavy equipment for cross connect or interconnect applications. The cabinet shall be comprised of modular cable management finger sections, completely bonded through an integral grounding system, and have a minimum of 6" of clearance between the switch inlet or exhaust and the cabinet side panels. The cabinet shall be constructed of steel material and support 19" components. The rack shall be UL listed for 2500-pound load rating to accommodate large networking equipment. The cabinet shall provide integral cable management including vertical channels, provisions for the mounting of optional slack spools, knock out holes in the top and an open frame bottom for under floor cable routing. The cabinet shall accept removable, hinged doors and latching side panels. The cabinet shall be able to accept a dual hinging door to provide

complete access to the cables and equipment. Casters shall be an available option, and shall be field installable and removable without tipping the cabinet. Leveling legs shall extend through the cabinet frame for accessibility and easy adjustment without tipping the cabinet.

Part Number	Description
	800mm x 1070mm x 45RU Hot Aisle / Cold Aisle
N8512B	<p>Net-Access™ N-Type Cabinet frame with top panel. Tapped equipment rails (12-24). Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2)</p> <p>Two sets of #12-24 threaded equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 42.0"D (2134mm x 800mm x 1067mm)</p>
N8519B	<p>Net-Access™ N-Type Cabinet frame with top panel. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Two sets of #12-24 threaded equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 42.0"D (2134mm x 800mm x 1067mm)</p>
N8512BC	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2)</p> <p>Two sets of cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 42.0"D (2134mm x 800mm x 1067mm)</p>
N8519BC	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Two sets of cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 42.0"D (2134mm x 800mm x 1067mm)</p>
N8519BS	<p>Net-Access™ N-Type Cabinet frame with top panel. Two sets of #12-24 threaded equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 42.0"D (2134mm x 800mm x 1067mm)</p>
N8519BQ	<p>Net-Access™ N-Type Cabinet frame with top panel. Two sets of cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 42.0"D (2134.0mm x 800mm x 1067mm)</p>

N8519BL	<p>Net-Access™ N-Type Cabinet frame with top panel. Split perforated front and rear doors open in the middle to minimize door swing footprint. Front cage nut equipment mounting rails. Rear extended cage nut equipment rails provide overall rail span of 29.0" (736mm). 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 42.0"D (2134mm x 800mm x 1067mm)</p>
N8512BE	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 42.0"D (2134mm x 800mm x 1067mm)</p>
N8519BG	<p>Net-Access™ N-Type Cabinet frame with top panel. Two sets of #12-24 threaded equipment mounting rails. Dimensions: 84.0"H x 31.5"W x 42.0"D (2134mm x 800mm x 1067mm)</p>
	Containment
N8512BU	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Vertical blanking panels. Two sets of cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 42.0"D (2134mm x 800mm x 1067mm)</p>
N8519BU	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Vertical blanking panels. Two sets of cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 42.0"D (2134mm x 800mm x 1067mm)</p>
	800mm x 1200mm x 45 RU Hot Aisle / Cold Aisle
N8529B	<p>Net-Access™ N-Type Cabinet frame with top panel. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Two sets of #12-24 threaded equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 48.0"D (2134mm x 800mm x 1219mm)</p>

N8529BC	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails (12-24). Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Two sets of #12-24 cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 48.0"D (2134mm x 800mm x 1219mm)</p>
N8522BC	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 48.0"D (2134mm x 800mm x 1219mm)</p>
N8522BE	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage Nut Rails. Single hinge perforated front door Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 48.0"D (2134mm x 800mm x 1219mm)</p>
Containment	
N8521BU	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panel. (1) Vertical blanking panels. Two sets of cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 48.0"D (2134mm x 800mm x 1219mm)</p>
N8529BU	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Vertical blanking panels. Two sets of cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 48.0"D (2134mm x 800mm x 1219mm)</p>
N8522BU	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Vertical blanking panels. Two sets of cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Dimensions: 84.0"H x 31.5"W x 48.0"D (2134mm x 800mm x 1219mm)</p>

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N8529BY	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails (12-24). Dual hinge perforated front door opens to the left or right. Solid Rear Split Door Vertical blanking panels. Two sets of #12-24 cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Vertical exhaust ready. Dimensions: 84.0"H x 31.5"W x 48.0"D (2134mm x 800mm x 1219mm)</p>
N8521BY	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Solid Rear Split Door Solid side panel. (1) Vertical blanking panels. Two sets of cage nut equipment mounting rails. 45 RU cable management on front and rear of front posts. Vertical exhaust duct ready. Dimensions: 84.0"H x 31.5"W x 48.0"D (2134mm x 800mm x 1219mm)</p>
	800mm x 1070mm x 42 RU Hot Aisle/Cold Aisle
N8212BC	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of cage nut equipment mounting rails. 42 RU cable management on front and rear of front posts. Dimensions: 78.0"H x 31.5"W x 42.0"D (2001mm x 800mm x 1067mm)</p>
N8219BC	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Two sets of cage nut equipment mounting rails. 42 RU cable management on front and rear of front posts. Dimensions: 78.0"H x 31.5"W x 42.0"D (2001mm x 800mm x 1067mm)</p>
N8212BL	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Split perforated front door Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of cage nut equipment mounting rails. 42 RU cable management on front and rear of front posts. Dimensions: 78.0"H x 31.5"W x 42.0"D (2001mm x 800mm x 1067mm)</p>

N8212BW	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of cage nut equipment mounting rails. 42 RU cable management on front and rear of front posts. With Casters. Dimensions: 78.0"H x 31.5"W x 42.0"D (2001mm x 800mm x 1067mm)</p>
N8212BE	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of cage nut equipment mounting rails. 42 RU cable management on front and rear of front posts. Dimensions: 78.0"H x 31.5"W x 42.0"D (2001mm x 800mm x 1067mm)</p>
	Containment
N8219BU	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Vertical blanking panels. Two sets of cage nut equipment mounting rails. 42 RU cable management on front and rear of front posts. Dimensions: 78.0"H x 31.5"W x 42.0"D (2001mm x 800mm x 1067mm)</p>
N8212BU	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Vertical blanking panels. Two sets of cage nut equipment mounting rails. 42 RU cable management on front and rear of front posts. Dimensions: 78.0"H x 31.5"W x 42.0"D (2001mm x 800mm x 1067mm)</p>
	800mm x 1070mm x 48 RU Hot Aisle / Cold Aisle
N8812B	<p>Net-Access™ N-Type Cabinet frame with top panel. Tapped equipment rails (12-24). Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of #12-24 threaded equipment mounting rails. 48 RU cable management on front and rear of front posts. Dimensions: 88.5"H x 31.5"W x 42.0"D (2205mm x 800mm x 1067mm)</p>

N8812BC	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of cage nut equipment mounting rails. 48 RU cable management on front and rear of front posts. Dimensions: 88.5"H x 31.5"W x 42.0"D (2205mm x 800mm x 1067mm)</p>
N8819B	<p>Net-Access™ N-Type Cabinet frame with top panel. Tapped equipment rails (12-24). Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Two sets of #12-24 threaded equipment mounting rails. 48 RU cable management on front and rear of front posts. Dimensions: 88.5"H x 31.5"W x 42.0"D (2205mm x 800mm x 1067mm)</p>
N8819BC	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Two sets of cage nut equipment mounting rails. 48 RU cable management on front and rear of front posts. Dimensions: 88.5"H x 31.5"W x 42.0"D (2205mm x 800mm x 1067mm)</p>
N8812BE	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of cage nut equipment mounting rails. 48 RU cable management on front and rear of front posts. Dimensions: 88.5"H x 31.5"W x 42.0"D (2205mm x 800mm x 1067mm)</p>
	800mm x 1200mm x 48 RU
N8822B	<p>Net-Access™ N-Type Cabinet frame with top panel. Tapped equipment rails (12-24). Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of #12-24 threaded equipment mounting rails. 48 RU cable management on front and rear of front posts. Dimensions: 88.5"H x 31.5"W x 48.0"D (2205mm x 800mm x 1219mm)</p>
N8822BC	<p>Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of cage nut equipment mounting rails. 48 RU cable management on front and rear of front posts. Dimensions: 88.5"H x 31.5"W x 48.0"D (2205mm x 800mm x 1219mm)</p>

N8829B	Net-Access™ N-Type Cabinet frame with top panel. Tapped equipment rails (12-24). Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Two sets of #12-24 threaded equipment mounting rails. 48 RU cable management on front and rear of front posts. Dimensions: 88.5"H x 31.5"W x 48.0"D (2205mm x 800mm x 1219mm)
N8829BC	Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Dual hinge perforated front door opens to the left or right. Split perforated rear doors open in the middle to minimize door swing footprint. Two sets of cage nut equipment mounting rails. 48 RU cable management on front and rear of front posts. Dimensions: 88.5"H x 31.5"W x 48.0"D (2205mm x 800mm x 1219mm)
N8822BW	Net-Access™ N-Type Cabinet frame with top panel. Cage nut rails. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of cage nut equipment mounting rails. 48 RU cable management on front and rear of front posts. With casters. Dimensions: 88.5"H x 31.5"W x 48.0"D (2205mm x 800mm x 1219mm)
N8822BE	Net-Access™ N-Type Cabinet frame with top panel. Cage Nut Rails . Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels. (2) Two sets of cage nut equipment mounting rails. 48 RU cable management on front and rear of front posts. Dimensions: 88.5"H x 31.5"W x 48.0"D (2205mm x 800mm x 1219mm)
	ACCESSORIES
SN15F	S and N Type Cabinet Finger Kit
SN25F	S and N Type Cabinet Finger Kit
NCSTR4	Caster Kit of N Type Cabinets
NPVUDB	POU Bracket for Switch Cabinets
NVBP	Vertical Blanking Panels with pass thru holes for N Type Cabinets
N21SPS	42 ru side panel for 1070mm deep N style cabinet
N51SPS	45 ru side panel for 1070mm deep N style cabinet
N81SPS	48 ru side panel for 1070mm deep N style cabinet
N22SPS	42 ru side panel for 1200mm deep N style cabinet
N52SPS	45 ru side panel for 1200mm deep N style cabinet
N82SPS	48 ru side panel for 1200mm deep N style cabinet
N21SPH	42 ru split hinged side panel for 1070mm deep N style cabinet - EOR
N51SPH	45 ru split hinged side panel for 1070mm deep N style cabinet - EOR
N81SPH	48 ru split hinged side panel for 1070mm deep N style cabinet - EOR

N22SPH	42 ru split hinged side panel for 1200mm deep N style cabinet - EOR
N52SPH	45 ru split hinged side panel for 1200mm deep N style cabinet - EOR
N82SPH	48 ru split hinged side panel for 1200mm deep N style cabinet - EOR
	7018 Cabinet Kits
N1000EXT	Extension kit to expand N type cabinets to 1000mm
N2SD100	One set of split doors for 1000mm wide N type 42 ru cabinets
N5SD100	One set of split doors for 1000mm wide N type 45 ru cabinets
N8SD100	One set of split doors for 1000mm wide N type 48 ru cabinets

NET access Server Cabinets

The Server Cabinet shall be used to provide a neat and efficient means for routing and protecting cables, patch cords and power cables in cabinets for server applications. The cabinet shall provide provisions for mounting patch panels and Power Outlet Units (POUs) vertically without blocking the area behind the servers, vertical blanking panels on the outside of the cabinet frame to prevent cold aisle air from bypassing the servers to the hot aisle, vertical cable managers, have provisions for routing cables from under floor and overhead, and shall accept 19" horizontal cable managers, and cable management accessories used throughout the cabling system. The cabinet shall protect network investment by enclosing cabling and equipment, maintaining system performance, and controlling cable bend radius.

Cable Management shall be provided using a cabinet that supports heavy equipment for server applications. The cabinet shall be comprised of modular cable management finger sections, completely bonded through an integral grounding system, and have vertical space between the cabinet frame posts and side panels for vertical mounting of patch panels or Power Outlet Units (POUs) without blocking the area behind the servers. The cabinet shall be constructed of steel material and support 19" components. The rack shall be UL listed for 2500-pound load rating to accommodate large networking equipment. The cabinet shall provide integral cable management including vertical channels, provisions for the mounting of optional slack spools, knock out holes in the top and an open frame bottom for under floor cable routing. The cabinet shall accept removable, hinged doors and latching side panels. Casters shall be an available option, and shall be field installable and removable without tipping the cabinet. Leveling legs shall extend through the cabinet frame for accessibility and easy adjustment without tipping the cabinet.

Part Number	Description
600mm Wide x 1070mm Deep	
S6212B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 79.8"H x 23.6"W x 42.0"D (2026mm x 600mm x 1067mm)
S6212BP	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Zero RU QuickNet™ Style Vertical Patching Rails. Dimensions: 79.8"H x 23.6"W x 42.0"D (2026mm x 600mm x 1067mm)

S6512B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 85.0"H x 23.6"W x 42.0"D (2160mm x 600mm x 1067mm)
S6512BP	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Zero RU QuickNet™ Style Vertical Patching Rails. Dimensions: 85.0"H x 23.6"W x 42.0"D (2160mm x 600mm x 1067mm)
S6812B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 90.3"H x 23.6"W x 42.0"D (2292mm x 600mm x 1067mm)
S6812BP	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Zero RU QuickNet™ Style Vertical Patching Rails. Dimensions: 90.3"H x 23.6"W x 42.0"D (2292mm x 600mm x 1067mm)
600mm Wide x 1200mm Deep	
S6222B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 79.8"H x 23.6"W x 48.0"D (2026mm x 600mm x 1219mm)
S6222BP	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Zero RU QuickNet™ Style Vertical Patching Rails. Dimensions: 79.8"H x 23.6"W x 48.0"D (2026mm x 600mm x 1219mm)
S6522B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 85.0"H x 23.6"W x 48.0"D (2160mm x 600mm x 1219mm)

S6522BP	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Zero RU QuickNet™ Style Vertical patching rails. Dimensions: 85.0"H x 23.6"W x 48.0"D (2160mm x 600mm x 1219mm)</p>
S6822B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 90.3"H x 23.6"W x 48.0"D (2292mm x 600mm x 1219mm)</p>
S6822BP	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Zero RU QuickNet™ Style Vertical Patching Rails. Dimensions: 90.3"H x 23.6"W x 48.0"D (2292mm x 600mm x 1219mm)</p>
700mm Wide x 1070mm Deep	
S7212B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 79.8"H x 27.6"W x 42.0"D (2026mm x 700mm x 1067mm)</p>
S7219B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 79.8"H x 27.6"W x 42.0"D (2026mm x 700mm x 1067mm)</p>
S7512B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 85.0"H x 27.6"W x 42.0"D (2160mm x 700mm x 1067mm)</p>
S7519B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 85.0"H x 27.6"W x 42.0"D (2160mm x 700mm x 1067mm)</p>
S7812B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 90.3"H x 27.6"W x 42.0"D (2292mm x 700mm x 1067mm)</p>

S7819B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 90.3"H x 27.6"W x 42.0"D (2292mm x 700mm x 1067mm)</p>
700mm Wide x 1200mm Deep	
S7222B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 79.8"H x 27.6"W x 48.0"D (2026mm x 700mm x 1219mm)</p>
S7229B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 79.8"H x 27.6"W x 48.0"D (2026mm x 700mm x 1219mm)</p>
S7522B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 85.0"H x 27.6"W x 48.0"D (2160mm x 700mm x 1219mm)</p>
S7529B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 85.0"H x 27.6"W x 48.0"D (2160mm x 700mm x 1219mm)</p>
S7822B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 90.3"H x 27.6"W x 48.0"D (2292mm x 700mm x 1219mm)</p>
S7829B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 90.3"H x 27.6"W x 48.0"D (2292mm x 700mm x 1219mm)</p>
800mm Wide x 1070mm Deep	
S8212B	<p>Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU Brackets (1 set), cage nut rails (2 sets). Dimensions: 79.8"H x 31.5"W x 42.0"D (2026mm x 800mm x 1067mm)</p>

S8219B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 79.8"H x 31.5"W x 42.0"D (2026mm x 800mm x 1067mm)
S8512B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 85.0"H x 31.5"W x 42.0"D (2160mm x 800mm x 1067mm)
S8519B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 85.0"H x 31.5"W x 42.0"D (2160mm x 800mm x 1067mm)
S8812B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 90.3"H x 31.5"W x 42.0"D (2292mm x 800mm x 1067mm)
S8819B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 90.3"H x 31.5"W x 42.0"D (2292mm x 800mm x 1067mm)
S8512BF	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Cable Management Fingers (1 set). Dimensions: 85.0"H x 31.5"W x 42.0"D (2160mm x 800mm x 1067mm)
S8519BF	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Casters, POU brackets (1 set), cage nut rails (2 sets). Cable Management Fingers (1 set). Dimensions: 85.0"H x 31.5"W x 42.0"D (2160mm x 800mm x 1067mm)
S8519BS	Cabinet frame with top panel. Casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 85.0"H x 31.5"W x 42.0"D (2160mm x 800mm x 1067mm)
800mm Wide x 1200mm Deep	

S8222B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 79.8"H x 31.5"W x 48.0"D (2026mm x 800mm x 1219mm)
S8229B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 79.8"H x 31.5"W x 48.0"D (2026mm x 800mm x 1219mm)
S8522B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 85.0"H x 31.5"W x 48.0"D (2160mm x 800mm x 1219mm)
S8529B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 85.0"H x 31.5"W x 48.0"D (2160mm x 800mm x 1219mm)
S8822B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Solid side panels (2), casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 90.3"H x 31.5"W x 48.0"D (2292mm x 800mm x 1219mm)
S8829B	Cabinet frame with top panel. Single hinge perforated front door. Split perforated rear doors open in the middle to minimize door swing footprint. Casters, POU brackets (1 set), cage nut rails (2 sets). Dimensions: 90.3"H x 31.5"W x 48.0"D (2292mm x 800mm x 1219mm)
	Accessories
S21SPS	42 ru side panel for 1070mm deep S style cabinet
S51SPS	45 ru side panel for 1070mm deep S style cabinet
S81SPS	48 ru side panel for 1070mm deep S style cabinet
S22SPS	42 ru side panel for 1200mm deep S style cabinet
S52SPS	45 ru side panel for 1200mm deep S style cabinet
S82SPS	48 ru side panel for 1200mm deep S style cabinet
S2BRK6	S Type Cable Management Bracket 6" full length
S2BRK12	S Type Cable Management Bracket 12" full length
S2DR	S Type D-Ring Kit for full length POU Bracket
S2LR	S Type L-Ring Kit for full length POU Bracket
SCSTR4	S Type Caster Kit
S2EOR1BA1070B1	S Type End of Row Seal Kit of 1070mm Server Cabinets

S2EOR1CA1200B!	S Type End of Row Seal Kit of 1200mm Server Cabinets
SN15F	S and N Type Cabinet Finger Kit
SN25F	S and N Type Cabinet Finger Kit
SPDUBRK	S Type POU Bracket Kit
SN8VPPB	Zero RU Vertical Patch Bracket for S type and N type 800mm wide cabinets
S7VPPB	Zero RU Vertical Patch Bracket for S type 700mm wide cabinets

Net Access Vertical Exhaust Duct and Cold Aisle Containment System

Vertical exhaust system shall channel heat from server exhaust directly to the data center return plenum. The system shall increase CRAH unit cooling efficiency and lower operating expenses. The vertical exhaust system shall leverage existing server fans to direct the flow of hot exhaust air, reducing energy costs and noise levels. The system shall be passive, containing no moving parts resulting in a more energy efficient solution than comparable forced-air options. The vertical exhaust system shall address high heat loads per cabinet to enable dense server applications and eliminate data center hot spots. The vertical exhaust system shall be modular, capable of being added without disrupting existing in-cabinet equipment and cabling to enable a migration path.

The Net-Contain system creates a structure including end of row doors and ceiling panels that enclose the cold aisle between rows of Panduit cabinets to segregate cold and hot air improving the overall thermal efficiency of the cooling system.

Part Number	Description
	Net Contain Vertical Exhaust Ducts
C2VED**I1626^^	Height 406mm (16") up to 660mm (26")
C2VED**I2638^^	Height 660mm (26") up to 965mm (38")
C2VED**I3866^^	Height 965mm (38") up to 1676mm (66")
	** 08 = 800mm, 07=700mm, 06=600mm, ^^ = B1 Black, W1 White
	Net Contain Cold Aisle Containment Sliding Doors
C2CACT5F**SD^^	Sliding Door for 42 and 45 ru Cabinets
	** 04 = 4 ft (1200mm), 06= 6 ft (1800mm) ^^ = B1 Black, W1 White
	Net Contain Integral Low Profile Ceiling Structure
C2CAC08F**IR	CAC Integral Roof for 800mm Wide Cabinets
C2CAC07F**IR	CAC Integral Roof for 700mm Wide Cabinets
C2CAC06F**IR	CAC Integral Roof for 600mm Wide Cabinets
	** 04 = 4 ft (1200mm), 06= 6 ft (1800mm) ^^ = B1 Black, W1 White
	Net Contain Integral Roof Panels
C2CAC**F08WP**	Wall Panels
	** 08 = 800mm, 07=700mm, 06=600mm, ^^ = B1 Black, W1 White
	Net Contain Integral Roof Panels
C2CAC**ABWPA**	In-Row Cooling Adapter
	** 06 = 600mm, 04 = 400mm, 03 = 300mm, ^^ = B1 Black, W1 White

Net Access In-Cabinet Ducting

Part Number	Description
	Inlet Ducts
CDE1	1 RU Air Inlet Duct for Cisco 4948, 4928 and 4924 Switches
CDE2	2 RU Air Inlet Duct for Cisco Nexus N2K-C2148T, N2K-C224TP, N2K-C2232PP, WS-C4948E-F, FS, FE
CNLTD21B2	2 Ru Air Inlet Duct for Cisco 4900M Switch
CNLTD52A2	Inlet Duct for Cisco 6504E Switch
CNLTD142A3	Inlet duct for Cisco 7900 Switch
CNLTD72A3	Inlet Duct for Cisco MDS 9506 Switch
DIBBC2314S21W	Inlet Duct for Cisco 9513 Switch
DIRLC2214M21W	Inlet Duct for Cisco 6509 Switch
	Exhaust Ducts
DERLCC6509A	Exhaust Duct for Cisco 6509 Switch
DERLCC9513A	Exhaust Duct for Cisco 9513 Switch
DERLCC7009A	Exhaust Duct for Cisco 7009 Switch
DERLCC6513A	Exhaust Duct for Cisco 6513 Switch

Standard Pre-Configured

Panduit Pre-Configured Physical Infrastructures for Cisco^ UCS, Nexus, and Catalyst Platforms Optimized for Power, Cooling, and Performance

As a leading physical infrastructure partner for Cisco, Panduit works with Cisco engineering and product teams to develop optimal physical layer solutions for their networking products. As such, these Panduit Pre-Configured Physical Infrastructures were designed specifically for the Cisco^ UCS, Nexus, and Catalyst platforms to balance scalability, power and thermal characteristics. This approach ensures that the physical infrastructure deployments are optimized for power, cooling, and performance, lowering infrastructure risks and costs while increasing agility and sustainability.

Panduit Pre-Configured Physical Infrastructure for Cisco^ Unified Computing Systems (UCS)

Part Number	Description	Std. Pkg. Qty
CQ5108CS1B	Pre-Configured Physical Infrastructure for UCS Base with 32" wide Net-Access™ Cabinet and all necessary cable management, switch shelf, grounding jumpers and patch panels pre-assembled together.	1
CQ5108S752B	Pre-Configured Physical Infrastructure for UCS Base with 28" wide Net-SERV™ Cabinet and all necessary cable management, switch shelf, grounding jumpers and patch panels pre-assembled together.	1

CQ5108S652B	Pre-Configured Physical Infrastructure for UCS Base with 24" wide Net-SERV™ Cabinet and all necessary cable management, switch shelf, grounding jumpers and patch panels pre-assembled together.	1
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Panduit Pre-Configured Physical Infrastructure for the Cisco^ Nexus 7010 Switch

Part Number	Description	Std. Pkg. Qty.
CQ7010CN1B	"Base" Pre-Configured Physical Infrastructure for Cisco Nexus 7010 with Net-Access™ Cabinet, and all necessary cable management, grounding jumpers and eight patch panels pre-assembled together.	1
CQ7010CN1F4	"Medium Fiber" Pre-Configured Physical Infrastructure for Cisco Nexus 7010 with Net-Access™ Cabinet, and all necessary cable management, grounding jumpers, patch panels (8), and LC-LC patch cords (bulk packaged to accommodate 4 additional fiber line cards) pre-assembled together.	1
CQ7010CN1C4	"Medium Copper" Pre-Configured Physical Infrastructure for Cisco Nexus 7010 with Net-Access™ Cabinet, and all necessary cable management, grounding jumpers, patch panels (8), and copper CAT6 patch cords (bulk packaged to accommodate 4 additional copper line cards) pre-assembled together.	1
CQ7010CN1C6	"Heavy Copper" Pre-Configured Physical Infrastructure for Cisco Nexus 7010 with Net-Access™ Cabinet, and all necessary cable management, grounding jumpers, patch panels (8), and copper CAT6 patch cords (bulk packaged to accommodate 6 additional copper line cards) pre-assembled together.	1

Panduit Pre-Configured Physical Infrastructure for the Cisco^ Catalyst 6509 Switch

Part Number	Description	Std. Pkg. Qty.
CQ6509CN1B	"Base" Pre-Configured Physical Infrastructure for Cisco Catalyst 6509 with Net-Access™ Cabinet, and all necessary cable management, grounding jumpers and patch panels pre-assembled together.	1
CQ6509CN1F4	"Medium Fiber" Pre-Configured Physical Infrastructure for Cisco Catalyst 6509 with Net-Access™ Cabinet, and all necessary cable management, grounding jumpers, patch panels, and LC-LC patch cords (bulk packaged to accommodate 4 additional fiber line cards) pre-assembled together.	1
CQ6509CN1C4	"Medium Copper" Pre-Configured Physical Infrastructure for Cisco Catalyst 6509 with Net-Access™ Cabinet, and all necessary cable management, grounding jumpers, patch panels, and copper CAT6 patch cords (bulk packaged to accommodate 4 additional copper line cards) pre-assembled together.	1
CQ6509CN1C6	"Heavy Copper" Pre-Configured Physical Infrastructure for Cisco Catalyst 6509 with Net-Access™ Cabinet, and all necessary cable management, grounding jumpers, patch panels, and copper CAT6 patch cords (bulk packaged to accommodate 6 additional copper line cards) pre-assembled together.	1

Panduit Pre-Configured Physical Infrastructure for the Cisco^ Nexus 7009 Switch

Part Number	Description	Std. Pkg. Qty.
CQ7009CN01	"Base" Pre-Configured Physical Infrastructure for Cisco® Nexus 7009 with Net-Access™ Cabinet, and intake ducting, as well as all necessary cable management, grounding jumpers and patch panels.	1

CQ7009CN02	“Medium Fiber” Pre-Configured Physical Infrastructure for Cisco® Nexus 7009 with Net-Access™ Cabinet and intake ducting, as well as all necessary cable management, grounding jumpers, patch panels, and MTP-LC Hydra cable assemblies (bulk packaged to accommodate four fiber I/O Modules).	1
CQ7009CN03	“Medium Copper” Pre-Configured Physical Infrastructure for Cisco® Nexus 7009 with Net-Access™ Cabinet and intake ducting, as well as all necessary cable management, grounding jumpers, patch panels, and copper Category 6A patch cords (bulk packaged to accommodate four copper I/O Modules).	1
CQ7009CN04	“Heavy Copper” Pre-Configured Physical Infrastructure for Cisco® Nexus 7009 with Net-Access™ Cabinet and intake ducting, as well as all necessary cable management, grounding jumpers, patch panels, and copper Category 6A patch cords (bulk packaged to accommodate six copper I/O Modules).	1

Racks

The 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. The system shall be a complete cable management system comprised of vertical cable managers, horizontal cable manager, and cable management accessories used throughout the cabling system. The system shall protect network investment by maintaining system performance, controlling cable bend radius and providing cable strain relief.

Cable Management shall be provided using the Panduit 2 Post, 4 Post, or *NETFRAME™* 2 post rack system. 2 Post racks shall be used for Patch Panels or mounting of equipment of up to 1000 Lbs and be constructed of aluminum. Panduit NetFrame 2-post rack system shall be used for applications where equipment loads of up to 1500 Lbs and be constructed of steel. Panduit 4 Post Racks shall be used mainly for secure equipment mounting of up to 2500 Lbs weight and be available in tapped and cage nut versions. The racks shall have essential accessories such as shelves, top and bottom troughs. The racks shall have integral mounting systems for the PatchRunner and NetRunner vertical managers. Eight foot tall racks with 52 RU shall be available. These racks support heavy equipment for cross connect or interconnect applications in a data center or telecommunications room. The Rack system shall meet all CEA requirements as defined in CEA-310-E.

4 Post Rack

Part Number	Description	Rack Spaces	Dimensions H x W x D (in)
R4P	4 post EIA rack threaded rails	45	84 x 23.3 x 30.2
R4PCN	4 post EIA rack cage nut rails	45	84 x 23.3 x 30.2
R4P23	4 post EIA rack threaded rails	45	84 x 23.3 x 23.2
R4P23CN	4 post EIA rack cage nut rails	45	84 x 23.3 x 23.2
R4P36	4 post EIA rack threaded rails	45	84 x 23.3 x 36.2
R4P36CN	4 post EIA rack cage nut rails	45	84 x 23.3 x 36.2
R4P42	4 post EIA rack threaded rails	45	84 x 23.3 x 41.7
R4P42CN	4 post EIA rack cage nut rails	45	84 x 23.3 x 41.7

R4P	4 post EIA rack threaded rails	52	96 x 23.3 x 30.2
R4PCN	4 post EIA rack cage nut rails	52	96 x 23.3 x 30.2
R4P23	4 post EIA rack threaded rails	52	96 x 23.3 x 23.2
R4P23CN	4 post EIA rack cage nut rails	52	96 x 23.3 x 23.2
R4P36	4 post EIA rack threaded rails	52	96 x 23.3 x 36.2
R4P36CN	4 post EIA rack cage nut rails	52	96 x 23.3 x 36.2
R4P42	4 post EIA rack threaded rails	52	96 x 23.3 x 41.7
R4P42CN	4 post EIA rack cage nut rails	52	96 x 23.3 x 41.7

4 Post Accessories

R4PAE1	Panduit 4 Post Rack Thermal Duct for use with Cisco* 6509, 6509E, 6513, 9513 Director and Juniper 8208 switches.
R4PAE2	Panduit 4 Post Rack Thermal Duct for use with Cisco* 7018 switch
R4PAE3	Panduit 4 Post Rack Thermal Duct for use with Cisco* 7009 switch
R4PWF	Top trough with waterfall creates pathway above rack. Dimensions: 1.9"H x 26.1"W x 8.5"D (50mm x 662mm x 216mm)
RSHLF23	4 post rack mount shelf, 275 lbs. load rating. Dimensions: 1.7"H x 19.0"W x 23.0"D (44mm x 483mm x 584mm).
RSHLF	4 post rack mount shelf, 275 lbs. load rating. Dimensions: 1.7"H x 19.0"W x 30.0"D (44mm x 483mm x 762mm).
RSHLF36	4 post rack mount shelf, 275 lbs. load rating. Dimensions: 1.7"H x 19.0"W x 36.0"D (44mm x 483mm x 914mm).
RCSTR	4 post rack casters.

R4PFP	Adjustable vertical filler panel for Panduit 4 Post Racks blocks by-pass air and directs cold airflow through equipment when used.
R4PFR	Right vertical finger section for cable management.
R4PFL	Left vertical finger section for cable management.
R4PFM	Finger managers for 7 and 8 foot Panduit 4 Post Racks.
CVPPB	Bracket to vertically mount 1 RU EIA 19" copper and fiber patch panels to the side of the Net-Access™ Cabinet posts or 4 post racks.
CNSPE	Net-Access™ Network Cabinet and 4 post rack end channel slack spools. Package includes one left and one right slack spool and mounting brackets.

CVPDUB	Bracket for vertical POU mounting to the side of the Net-Access™ Cabinet posts or 4 post racks (kit of two).
R4PRT	#12-24 Threaded rails (one pair). 45 RU.
R4PRCN	Cage nut rails (one pair). 45 RU.
RFAKIT	Rack anchor kit for concrete floor (set of four).
CNWS1224-C	#12-24 cage nut and screws.
CNWSM5-C	M5 screw with cage nut.
CNWSM6-C	M6 screw with cage nut.
RGCBNJ660P22	#6 AWG (16mm ²) jumper; 60" (1.52m) length; 45° bent lug on grounding strip side; provided with .16 oz. (5cc) of antioxidant, two each #12-24 x 1/2", M6 x 12mm, #10-32 x 1/2" and M5 x 12mm thread-forming screws, and a copper compression HTAP* for connecting to the MCBN.

2 Post Racks

6" Channel – Numbered Up

R2P6S	19" EIA rack, 6" channel, steel. Dimensions: 84.0"H x 20.3"W x 6"D (2134mm x 514mm x 152mm). Note: This rack is compatible with Patchrunner and High Capacity Patchrunners only.	45
R2P6S96	19" EIA rack, 6" channel, steel. Dimensions: 84.0"H x 20.3"W x 6"D (2134mm x 514mm x 152mm). Note: This rack is compatible with 8' tall Patchrunner and High Capacity Patchrunners only.	52

3" Channel Racks – Numbered Up

R2P96	19" EIA rack, aluminum. Dimensions: 96.0"H x 20.3"W x 3.0"D (2134mm x 514mm x 76mm).	52
R2P	19" EIA rack, aluminum. Dimensions: 84.0"H x 20.3"W x 3.0"D (2134mm x 514mm x 76mm).	45
R2P48	19" EIA rack, aluminum. Dimensions: 48.0"H x 20.3"W x 3.0"D (1219mm x 514mm x 76mm).	24
R2PW	23" EIA rack, aluminum. Dimensions: 84.0"H x 24.3"W x 3.0"D (2134mm x	45

	616mm x 76mm).	
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2 Post Rack Accessories

R2PAE1: 2 Post thermal duct for use with Cisco 6509 and 6509E Switches
R2PAE2: 2 Post thermal duct for use with Cisco 7009 Switch
RFAKIT: Rack anchor kit for concrete floor
S1224C: #12-24 X .5" Mounting Screws
R2PPDUB: Power Outlet POU Bracket for 2 and 4 post racks
R2PPEVWF: Waterfall trough for 2 post rack and Patchrunner High Capacity Vertical Cable Managers
R2PPRVWF: Waterfall trough for 2 post rack and Patchrunner Vertical Cable Managers

2 Post 3" Channel Racks Numbered Up with Dual-Sided Vertical Cable Managers

RWMPV45E	#12-24 threaded equipment mounting rails with front and rear manager. Dimensions: 84.0"H x 25.5"W x 15"D(2134mm x 648mm x 381mm)	45
RWMPVHC45E	#12-24 threaded equipment mounting rails with front and rear manager. Dimensions: 84.0"H x 27.4"W x 15"D	45
RNRV6	#12-24 threaded equipment mounting rails with front and rear manager. Dimensions: 84.0"H x 27.1"W x 15"D(2134mm x 689mm x 381mm)	45
RNRV10	#12-24 threaded equipment mounting rails with front and rear manager. Dimensions: 84.0"H x 30.4"W x 15"D (2134mm x 773mm x 381mm)	45

2 Post 3" Channel Racks Numbered Up with Single Sided Vertical Cable Managers

RWMPVF45E	#12-24 threaded equipment mounting rails with a front only manager. Dimensions: 84.0"H x 25.5"W x 15"D (2134mm x 648mm x 381mm)	45
RWMPVHCF45E	#12-24 threaded equipment mounting rails with a front only manager. Dimensions: 84.0"H x 27.4"W x 15"D (2134mm x 695mm x 381mm)	45

2.3 Vertical Managers

Vertical cable managers shall include components that aid in routing, managing and organizing cable to and from patch panels and/or equipment. Managers shall protect network equipment by controlling cable bend radius and providing cable strain relief. Managers shall be a universal design mounting to EIA 19" or 23" racks and constructed of a base with cable management fingers.

The fingers shall include retaining tabs to keep cables in place during cover removal. The covers shall be hinged to open in either direction allowing for quick moves, adds, and changes.

PatchRunner High Capacity

The vertical cable manager shall be available in 7 and 8 foot tall, 23 inches deep for dual sided versions and consist of a metal backbone with cable management fingers that align with EIA rack spacing. The backbone shall be an open design that will accept 19" EIA accessories such as strain relief bars, patch panels, blanking panels and POU mounted vertically in a zero RU format. The fingers shall be molded out of plastic and provide integral bend radius control throughout the entire

length. Fingers sections shall be removable. Individual fingers can be broken out. The manager shall accept a metal, hinged door that can open to the right or left. The vertical panel shall be able to manage all the cable on the rack without the aid of horizontal cable managers.

Part Number	Type	Rack Spaces	Type	Max. Side Extension (in.)
PEV12	Dual sided	45	High Capacity	12.0
PEVF12	Single sided	45	High Capacity	12.0
PED12B1	Hinged Door	-	-	12.0
PEV10	Dual sided	45	Standard	10.0
PEVF10	Single sided	45	Standard	10.0
PED10B1	Hinged Door	-	-	10.0
PEV8	Dual sided	45	Standard	8.0
PEVF8	Single sided	45	Standard	8.0
PED8B1	Hinged Door	-	-	8.0
PEV6	Dual sided	45	Standard	6.0
PEVF6	Single sided	45	Standard	6.0
PED6B1	Hinged Door	-	-	6.0

PED DOOR BRACKETS

PEDK6	Bracket kit for 6" wide PR	Dual Hinged Door PED6.
PEDK8	Bracket kit for 8" wide PR	Dual Hinged Door PED8.
PEDK10	Bracket kit for 10" wide PR	Dual Hinged Door PED10.
PEDK12	Bracket kit for 12" wide PR	Dual Hinged Door PED12.

PEV ACCESSORIES

PEVBRC6	Horizontal cross brace bend radius control clips for PatchRunner™ High Capacity Vertical Cable Managers PEV6 and PEVF6.
PEVBRC8	Horizontal cross brace bend radius control clips for PatchRunner™ High Capacity Vertical Cable Managers PEV8 and PEVF8.
PEVBRC10	Horizontal cross brace bend radius control clips for PatchRunner™ High Capacity Vertical Cable Managers PEV10 and PEVF10.

PEVBRC12	Horizontal cross brace bend radius control clips for PatchRunner™ High Capacity Vertical Cable Managers PEV12 and PEVF12.
PEVEP	End Panel. Dimensions: 83.7"H x 23.2"W x .5"D (2125mm x 590mm x 12mm).
SRB19D5BL	Strain relief bar extends 5" off the rack; supports, manages, and provides proper bend radius protection.
SRB19D7BL	Strain relief multi-depth bar extends 7" off the rack; supports, manages, and provides proper bend radius protection. Ideal for use with Category 6A copper cabling installations.
WR5E-X	Snap-on finger cable retainers.

PatchRunner

The vertical managers' fingers shall include retaining tabs to keep cables in place during cover removal. The covers shall be hinged to open in either direction allowing for quick moves, adds, and changes. Cable retainers that clip onto the individual fingers can be used to hold cable toward the back of the manger.

The vertical manager shall be used with angled patch panels to maximize the space in the data center by routing cables directly into the vertical manager with using horizontal managers.

Part Number	Type	Rack Spaces	Type	Max. Side Extension (in.)
PRV15	Front and Rear	45	High Capacity	15.0
PRVF15	Front only	45	High Capacity	15.0
PRD15	Hinged Door	-	-	15.0
PRV12	Front and Rear	45	High Capacity	12.0
PRVF12	Front only	45	High Capacity	12.0
PRD12	Hinged Door	-	-	12.0
PRV10	Front and Rear	45	Standard	10.0
PRVF10	Front only	45	Standard	10.0
PRD10	Hinged Door	-	-	10.0
PRV8	Front and Rear	45	Standard	8.0
PRVF8	Front only	45	Standard	8.0
PRD8	Hinged Door	-	-	8.0
PRV6	Front and Rear	45	Standard	6.0
PRVF6	Front only	45	Standard	6.0
PRD6	Hinged Door	-	-	6.0

NetRunner High Capacity

The NetRunner High Capacity vertical managers shall be of fully molded construction and the fingers shall include integral cable retainers to keep cables in place during door opening and removal. The doors shall be metal and allow opening of up to 100 degrees for quick moves adds and changes. Cable retainers that clip onto the individual fingers can be used to hold cable toward the back of the manager.

Part Number	Type	Rack Spaces	Type	Max. Side Extension (in.)
NRV6	Front and Rear	45	High Capacity	6.55
NRV10	Front and Rear	45	High Capacity	10
NRV12	Front and Rear	45	High Capacity	12
NRVF6	Front	45	High Capacity	6.55
NRVF10	Front	45	High Capacity	10
NRVF12	Front	45	High Capacity	12
NRD6B1	NRV 6" door	-	-	6.55
NRD10B1	NRV 10" door	-	-	10
NRD12B1	NRV 12" door	-	-	12

NetRunner

The vertical managers shall be fully molded. The fingers shall have integral cable retainers to keep cables in place during cover removal. The covers shall be hinged to open in either direction allowing for quick moves, adds, and changes. Cable retainers that clip onto the individual fingers can be used to hold cable toward the back of the manager.

WMPV22E	Front and Rear	20	Standard	4.25
WMPV45E	Front and Rear	45	Standard	4.25
WMPVHC45E	Front and Rear	45	Medium Capacity	6.55
WMPVF22E	Front	20	Standard	4.25
WMPVF45E	Front	45	Standard	4.25
WMPVHCF45E	Front	45	Medium Capacity	6.55

Vertical cable management solution of flexible Vertical D-rings shall be used on standard communication racks. The Vertical D-rings used for open access shall be manufactured from a Polycarbonate material and shall be black in color. The vertical cable management D-rings shall be a one-piece design. The front arm of the product shall be able to rotate ninety degrees to allow entire cable bundles to be inserted. The vertical cable management solution of flexible D-rings shall be installed with two screws less than 0.25" in diameter.

Part Number	Outside Dimensions (L x W)	Capacity (.187" UTP)	Capacity (.25" ScTP)	Capacity (3mm Fiber)
CMVDR1	5.7" x 2"	96	48	252
CMVDR1S	3.3" x 2"	52	32	132
CMVDR2	5.7" x 3"	192	96	504
CMVDR2S	3.3" x 3"	96	48	252
CMVDRC	5.6" x 8"	400	200	1000

2.4 Horizontal Managers

Horizontal cable managers shall include components that aid in routing, managing and organizing cable to and from patch panels and/or equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" racks and constructed with cable management fingers. The fingers shall include retaining tabs to keep cables in place during cover removal. The covers shall be easily removed or hinged to allow for quick moves, adds, and changes. The cable managers shall be provided with wire retainers to retain the

cables during cover removal and #12-24 English and M6 metric mounting screws.

Part Number	Type	Rack Spaces	Max. Front Extension (in.)
NM1	Front & Rear	1	7.6
NMF1	Front only	1	7.6
NM2	Front & Rear	2	7.6
NMF2	Front only	2	7.6
NM3	Front & Rear	3	7.6
NMF3	Front only	3	7.6
NM4	Front & Rear	4	7.6
NMF4	Front only	4	7.6
NCMH2	Front & Rear	2	3.1
NCMHF2	Front only	2	3.1
NCMHF1	Front Only	1	3.1
NCMH1-RFC	Front Cover	1	3.1
NCMH2-RFC	Front Cover	2	3.1
WMPH2E	Front & Rear Duct	2	3.1
WMP1E	Front & Rear Duct	2	3.1
WMPHF2E	Front Duct	2	3.1
WMPF1E	Front Duct	2	3.1
WMPSE	Front and Rear	1	3.1
WMPLSE	Front and Rear	1	3.1
WMPFSE	Front Duct	1	2.1
WMPLFSE	Front Duct	1	2.1

Net-Manager Accessories

NMB	Front to rear pass through blanking panel for NetManager™ High Capacity Horizontal Cable Managers, NM1 and NMF1.
NM2B	Front to rear pass through blanking panel for NetManager™ High Capacity Horizontal Cable Managers, NM2 and NMF2.
NM3B	Front to rear pass through blanking panel for NetManager™ High Capacity Horizontal Cable Managers, NM3 and NMF3.
NM4B	Front to rear pass through blanking panel for NetManager™ High Capacity Horizontal Cable Managers, NM4 and NMF4.

Patchrunner High Capacity Horizontal Managers

			Max. Front Extension (in.)
PEHF2	Front Only	2	7.6
PEHF3	Front Only	3	7.6
PEHF4	Front Only	4	7.6

D-Rings

Part Number	Ring Orientation	Type	Rack Spaces
CMPH2	Horizontal	Front and Rear	2
CMPH2C	N/A – cover	Front and Rear	2
CMPHF2	Horizontal	Front	2
CMPHH2	Horizontal	Front High Capacity	2
CMPH1	Horizontal	Front and Rear	1
CMPH1C	N/A – cover	Front and Rear	1
CMPHF1	Horizontal	Front	1
CMPHHF1	Horizontal	Front	1

2.5 Enclosures

PANDUIT Rack Mount and Wall Mounted fiber optic enclosures shall be shall be capable of doubling the capacity by increasing fiber cable density within the allotted space when using LC connections. Enclosures shall provide patch cable protection. Enclosures shall protect fiber optic connections for patching or splicing requirements.

Rack Mount Enclosures

Opticom Rack Mount Fiber Trays

Opticom rack mount fiber trays shall be constructed of steel material and mount to standard 19" rack rails and be RoHS compliant. Can be used as a back box for Mini-Com patch panels. The removable top cover provides access to connections, fibers and slack storage in rear of tray. Multiple trunk cable entry locations provided on rear and sides of enclosure. Includes fiber optic cable routing kit (grommets, cable ties, spools, strain relief bracket and ID/caution labels).

Ordering Information

Part Number	Dimensions	Capacity	Type
FMT1	1.75"H x 17.16"W x 11.16"D (44.4mm x 433.3mm x 283.5mm)	Four FAP or FMP adapter panels	Flat
FMT2	3.48"H x 17.16"W x 11.16"D (88.3mm x 433.3mm x 283.5mm)	Eight FAP or FMP adapter panels	
FMT1A	1.75"H x 17.16"W x 11.16"D (44.4mm x 433.3mm x 283.5mm)	Four FAP or FMP adapter panels	Angled
FMT2A	3.48"H x 17.16"W x 11.16"D (88.3mm x 433.3mm x 283.5mm)	Eight FAP or FMP adapter panels	

Opticom Rack Mount Fiber Enclosures

Opticom rack mount fiber enclosures shall be constructed of steel material and mount to standard 19" or 23" EIA rack or cabinet and shall be RoHS compliant. Holds Opticom fiber adapter panels and Opticom fiber optic splice modules. Front and rear access on all models via durable molded-hinge doors. Integral bend radius control and cable management for fiber patch cords. Multiple trunk cable entry locations provided on rear and sides of enclosure. Includes fiber optic cable routing kit (grommets, cable ties, spools, strain relief bracket and ID/caution labels).

Ordering Information

Part Number	Dimensions	Capacity
FRME1U	1.74"H x 17.16"W x 11.08"D (44.2mm x 435.9mm x 299.7mm)	Three FAP or FMP adapter panels
FRME2U	3.45"H x 17.16"W x 11.80"D (87.6mm x 433.3mm x 292.1mm)	Six FAP or FMP adapter panels
FRME3	5.00"H x 17.16"W x 11.80"D (127.0mm x 433.3mm x 292.1mm)	Nine FAP or FMP adapter panels
FRME4	6.62"H x 17.16"W x 11.80"D (168.1mm x 433.3mm x 292.1mm)	Twelve FAP or FMP adapter panels

Opticom QuickNet Rack Mount Fiber Cassette Enclosures

Fiber cassette enclosure shall be designed to house, organize, manage and protect OPTICOM ® QUICKNET Pre-terminated Fiber Optic Cassettes and associated MTP* trunk cables, connectors, and patch cords. Enclosure shall accommodate all pre-terminated MTP* cassettes and include integral cable management and bend radius control for transition to vertical cable managers. Fiber optic enclosure shall be constructed of steel material. Molded front covers shall be removable for cabling and connector installation. Enclosure shall have multiple knockouts for a variety of trunk cable entry points.

Ordering Information

Part Number	Dimensions	Capacity
FCE1U	1.73"H x 17.60"W x 16.03"D (43.9mm x 447.0mm x 414.0mm)	Four QuickNet Cassettes, FAP adapter panels or FOSM splice modules
FCE1UA	1.73"H x 17.60"W x 16.03"D (43.9mm x 447.0mm x 414.0mm)	Open access version, of the FCE1U
FCE2U	3.48"H x 17.60"W x 16.30"D (88.4mm x 447.0mm x 414.0mm)	Eight QuickNet Cassettes, FAP adapter panels or FOSM splice modules
FCE4U	6.98"H x 17.60"W x 16.30"D (177.0mm x 447.0mm x 414.0mm)	Twelve QuickNet Cassettes, FAP adapter panels or FOSM splice modules

Opticom Fiber Adapter Patch Panels

Opticom fiber adapter patch panels shall be constructed of steel material and mount to standard 19" rack rails and be RoHS compliant. Use with Opticom fiber mount tray to protect fibers and terminations.

Ordering Information

Part Number	Dimensions	Capacity	Type
CFAPPBL1	19"W x 1.72"H x 0.44"D (482.6mm x 43.7mm x 11.2mm)	Four FAP or FMP adapter panels	Flat
CFAPPBL2	19"W x 3.47"H x 0.44"D (482.6mm x 88.1mm x 11.2mm)	Eight FAP or FMP adapter panels	
CFAPPBL1A	19"W x 1.72"H x 0.44"D (482.6mm x 43.7mm x 11.2mm)	Four FAP or FMP adapter panels	Angled
CFAPPBL2A	19"W x 3.47"H x 0.44"D (482.6mm x 88.1mm x 11.2mm)	Eight FAP or FMP adapter panels	

Wall Mount Enclosures

Wall mount enclosures shall be constructed of steel material. Enclosures shall provide cable bend radius protection. Enclosures offer optional discrete locking capability between installer and user segments.

Technical Information

- Improved strain relief clip:** Easier to install and align fiber with grommet
- Spooling area:** Manages and organizes fiber slack
- Rubber grommet:** Offers dust/debris protection and helps secure cable to enclosure
- Improved latch:** Provides improved closure
- Optional keyed lock:** Provides added security
- Compatibility:** Works with all MINI-COM®, OPTI-JACK® Offers flexibility for a variety of applications ST, SC, Coax and Fiber Cassette modules
- Flush mounted latch:** Minimizes box depth from wall
- Optional splicing tray and holder:** Allows splicing within patching enclosures

Ordering Information

Part Number	Dimensions	Capacity
FWME2	12.00"W x 10.18"H x 2.32"D (304.8mm x 258.6mm x 59.1mm)	Two QuickNet Cassettes, FAP or FMP adapter panel
FWME4	16.11"W x 12.25"H x 3.52"D (409.2mm x 311.0mm x 89.4mm)	Four QuickNet Cassettes, FAP or FMP adapter panel
FWME8	16.11"W x 20.25"H x 3.52"D (409.2mm x 514.2mm x 127.00mm)	Eight QuickNet Cassettes, FAP or FMP adapter panel

Locking devices available with the following part numbers:

- FELS:** Fiber enclosure lock for service side
- FELU:** Fiber enclosure lock for user side

Opticom Zero RU Cable Management Solutions

Opticom zero RU solutions mount directly to rack or enclosure to provide locate, connection, and quick deployment of Quicknet or Opticom Fiber Adapter Panels or QuickNet or SFQ MTP Cassettes.

Ordering Information

Part Number	Description
FEABRUA	Zero RU adhesive or magnetic mount 90° angle fiber enclosure adapter panel bracket.
FEABRU	Zero RU screw mount fiber enclosure adapter panel bracket
FQCBRUA	QuickNet SFQ Cassette Zero RU Bracket. Holds up to two fiber QuickNet SFQ cassettes or up to two copper QuickNet pre-terminated cable assembly. Mounts to any EIA-310-D complaint rack rail
FQCRCM	Fiber QuickNet Rear Cable Manager

2.6 Zone Cabling

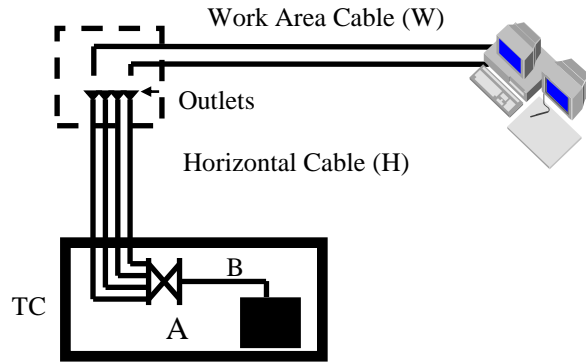
Consolidation Point and Multi-User Telecommunication Outlet Assembly (MUTOA) configurations shall be implemented in open office applications where the office area is split into zones and the cabling system utilizes short runs from an intermediate connection to facilitate frequent moves, adds and changes (MACs) as specified per TIA/EIA-568-B. The MUTOA and consolidation point equipment will be chosen to match the horizontal cabling medium and performance category. The same manufacturer shall provide the modular connectors and patch cords.

MUTOA - Maximum length of horizontal and work area cables

Horizontal Area Cable (H)	Max Combined Length Of Patch Cords, Work Area & Equip. Cable (C)	Max Work Area Cable Length (W)
90 m (295 ft)	10 m (33 ft)	5 m (16 ft)
85 m (279 ft)	14 m (46 ft)	9 m (30 ft)
80 m (262 ft)	18 m (59 ft)	13 m (44 ft)
75 m (246 ft)	22 m (72 ft)	17 m (57 ft)
70 m (230 ft)	27 m (89 ft)	22 m (71 ft)

Formulas: $C = (102 - H)/1.2$ $W = C - 5, <22m$

MUTOAs represent optional cabling practices for Open office environments. The Horizontal Cables shall be terminated in a common location. Patch cords are then routed directly from the MUTOA to the work area equipment. Shall be used in applications in which frequent moves are anticipated. Each MUTOA shall serve no more than 12 work areas. The MUTOA shall be fully accessible and permanently mounted. The MUTOA shall not be located in ceiling areas.

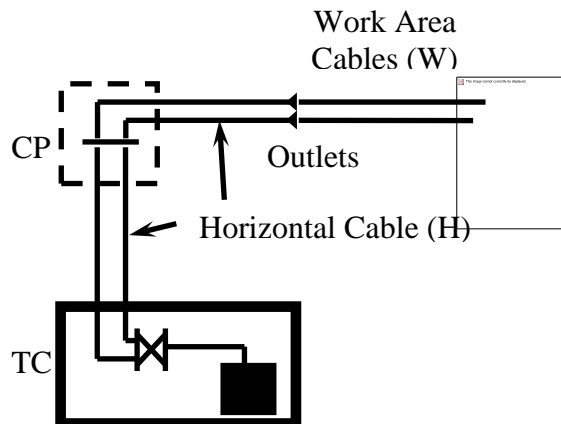


MUTOA shall use *MINI-COM*® Fiber/Multi-Media Surface Mount Boxes. The Surface Mount Boxes shall be six and 12-port surface mount boxes with all connections exiting one side of the box, parallel to the wall. The six and 12 port boxes shall contain a “captive” fiber spool that maintains a minimum 25.4mm (1”) bend radius. The six and 12 port boxes shall store up to 24 meters of buffered optical fiber. The boxes shall be capable of mounting with screws, adhesive, and/or magnets. The boxes shall include breakouts for use with *PAN-WAY*™ surface raceway on three sides and cable tie slots at each raceway entry point to provide strain relief on incoming cables. The six and 12 port boxes shall include tamper resistant screws that securely fasten the cover to the base and are concealed by screw covers and labels. Each box shall accept individual connector modules that can be individually inserted and removed as required.

Part Number	Number of Modules	Maximum Height
CBXF6**-A	6	25 mm
CBXF12**-A	12	46 mm

** Designates color option

A Consolidation Point (CP) serves as a connection between horizontal cabling and the work area cabling especially in modular furniture pathways. Consolidation Points are not a user interface and preferred for applications where moves are anticipated. No more than one CP is allowed in each horizontal cable run. The recommended location of the CP is greater than 15 meters from the Telecommunications Closet (TC) to reduce Near-end Cross Talk (NEXT). Each CP shall be easily accessible, permanently mounted and serve no more than 12 work areas. Products shall include, but not be limited to:



PANZONE™ Cabling Boxes

Consolidation Points shall use ZONE CABLING BOXES to separate the barriers of plenum and

non-plenum environments and the workspace. In-floor boxes shall be available in multiple sizes and mount into the allocated space for standard 24" x 24" raised floor panels, minimum 6" depth. In-ceiling boxes shall be available to accommodate 2' x 6', 2' x 4' and 2' x 2' ceiling grids. All zone boxes shall support standard 19" patch panels and are plenum rated. Cable entry and exit openings should be no less than 11"W x 3.5"H x 3"D (279.4 x 88.9 x 76.2mm). Each opening shall accommodate 96 four-pair UTP cables. The boxes shall be made of 14-gauge aluminum.

Part Number	Mounting Location	Max Number of Rack Units
PZRFE4U	Raised floor	4
PZRFE8U	Raised floor	8
PZRFE12U	Raised Floor	12

PANZONE™ Active In-ceiling Zone Cabling Box shall be UL listed and approved for use in environmental air handling spaces. In-ceiling box shall be compatible with 2'x2', 2'x4', 2'x6' ceiling grids and shall hold active equipment up to 3 RU and passive hardware up to 6 RU. The box shall include a cooling fan for air exchanges and 2-keyed locks for security.

Part Number	Mounting Location	Max Number of Rack Units
PZICEA	Drop ceiling	8
PZICE	Drop ceiling	8

PANZONE™ Overhead Distribution Racks shall be made of steel and have a universal mounting bracket set to be capable of mounting to the overhead ladder rack or basket rack. The overhead distribution rack shall provide RU space for patching above the rack or cabinet in a data center or telecommunications room.

Part Number	Mounting Location	Max Number of Rack Units
PZLRB2U	Above rack or cabinet	2
PZLRB4U	Above rack or cabinet	4
PZLRB6U	Above rack or cabinet	6

Part 3 - Execution

3.1 Horizontal Distribution Cable Installation

Shall be installed in accordance with manufacturer's recommendations and best industry practices.

A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

Cable raceways shall not be filled greater than the TIA/EIA-569-A maximum fill for the particular raceway type or 40%.

Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

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.

The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

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.

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.

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.

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.

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.

Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606.

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.

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.

Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.

3.2 Horizontal Cross Connect Installation

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.

Pair untwist at the termination shall not exceed 3.18 mm (0.125 inch).

Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

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.

The cable jacket shall be maintained as close as possible to the termination point.

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

Racks shall be securely attached to the concrete floor using minimum 3/8" hardware or as required by local codes.

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.

All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 2.4 of this document.

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.

Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of white fire retardant paint.

Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.

END OF SECTION



CSI SECTION 271119

TERMINATION BLOCKS AND PATCH PANELS

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a standard specification applicable to commercial building structured cabling applications.

The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines.

The information contained in this document is based on our experience to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be used with their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements consult the factory. This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supercedes and voids all previous literature, etc.

It is highly recommended and the issuers responsibility to have any RFQ documents, including those based on this general format, reviewed by the issuing company's professional advisors before it is released to the public. In no way may this document be used in a manner that is detrimental to the interests of Panduit and/or its subsidiaries.

SECTION 271119 – TERMINATION BLOCKS AND PATCH PANELS

PART 1 - GENERAL

1. RELATED DOCUMENTS
 - a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 & 1 Specification Sections, apply to this Section.
2. SUMMARY
 - a. Section Includes:
 - 1) Telecommunications termination elements.
 - b. Related Sections:
 - 1) Section 270500 “Common Work Results for Communications”
 - 2) Section 271323 "Communications Optical Fiber Backbone Cabling"
 - 3) Section 271315 “Communications Copper Horizontal Cabling”
 - 4) Section 271116 “Communications Cabinets, Racks, Frames and Enclosures”
3. SUBMITTALS
 - a. Coordinate with Division 0 & 1.
 - b. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - c. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
 - 1) Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2) Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
 - 3) Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.
4. QUALITY ASSURANCE
 - a. Electrical Components, Devices, and Accessories: Listed and labeled, meeting the National Electrical code or National Building Code and tested by a qualified testing agency, and marked for intended location and application
 - b. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-B, the National Electrical Code and the National Building Code.
 - c. Grounding: Comply with ANSI-J-STD-607-A and the National Electrical Code.
 - d. Warranty
 - 1) See Section 270500 “Common Work Results for Communications”.
 - e.
5. PROJECT CONDITIONS
 - a. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, and work above ceilings in IT spaces is complete.
6. COORDINATION
 - a. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate

service entrance arrangement with local exchange carrier.

- 1) Meet jointly with other equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2) Record agreements reached in meetings and distribute them to other participants.
 - 3) Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 - 4) Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- b. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:

1. PANDUIT

2.2 Category 6A modular patch panels

A. 24 and 48 port patch panels that accept Category 6A modular jacks with IDC connector terminations on rear

1. The patch shall have electrical performance guaranteed to meet or exceed TIA/EIA 568-C.2 Category 6A and ISO/IEC 11801 Class EA component and channel specifications.
2. The panel shall be available in flat and angled 24-port 1RU and 48-port 1RU and 2RU configurations.
3. Each modular jack in the panel shall come with universal A/B labeling and IDC termination that ensures 22 to 26 AWG cable conductors are fully terminated by utilizing a termination cap design and terminates to the modular jack through a smooth forward motion without impact on critical internal components for maximum reliability.
4. Each modular jack shall be 100% performance tested, capable of being re-terminated up to 20 times and identified with the performance level and with a individual serial number for traceability.
5. The panel shall have a black powder finish over high-strength steel.
6. The panel shall have a labeling option to comply with TIA/EIA-606-A.
7. The panel shall be equipped with a removable rear mounted cable management bar
8. The panel shall be UL listed and UL-C certified.
9. The panel shall support network line speeds in excess of 1 and 10 gigabit per second and be backward compatible with Category 6, 5e, 5 and 3 cords and cables.
10. The Category 6A modular jack panels shall meet or exceed the Category 6/Class E standards requirements in ISO/IEC 11801, TIA/EIA-568C and shall be UL Listed.
11. The panels shall be 19-inch rack mountable.

B. 24 and 48 port patch panels:

1. The Category 6A modular jack panels shall meet or exceed Category 6A standards requirements in ANSI/ TIA 568-C.2 and Class E_A in Amendment 1 to ISO/IEC11801:2002 shall be UL Listed.
2. The modular jack panel shall utilize universal A/B wiring.
3. The jack panels shall be 19-inch rack mountable.

Insertion Loss	5 %	2 %
<i>Electrical Parameter</i>	<i>Guaranteed Channel Margins to ISO/IEC 11801:2002 “Class E” (1 – 250MHz)</i>	<i>Guaranteed Channel Margins to Draft ISO/IEC 11801 Edition 2.1 “Class EA” (1 – 500 MHz)</i>
NEXT	6 dB	1 dB
PSNEXT	7.5 dB	2.5 dB
ACR-F	6 dB	4 dB
PSACR-F	8 dB	6 dB
Return Loss	3 dB	2 dB
PSANEXT	N/A	2 dB
PSAACR-F	N/A	5 dB

2.3 High-Capacity, High-Density Combination Fiber-Optic Panel and Modular Shelves

A. Modular Shelves

1. Low Profile Combination Modular Shelf

- a. The shelf shall be used for a combination of splicing and termination of fiber-optic building cable or outside plant (OSP) cables.
- b. The modular shelf shall be available in both 1U- and 2U-height fully enclosed shelves, with integrated front cable management trough included.
- c. They shall be a slide-out, tilt-down tray for easy access. Slide-out, tilt-down functionality shall be maintained regardless of the number of enclosures stacked one on top of another within a given rack or cabinet.
- d. They shall provide complete interoperability with MTP based plug and play pre-terminated fiber systems.
- e. The modular shelf shall have interchangeable modules, which are ordered separately.
- f. The modules shall be available in LC for 50 and 62.5 micron multimode and singlemode solutions
- g. The 1U shelf shall accept up to 4 modules and the 2U shelf shall accepts 8 fiber modules, which shall be pre-populated with fiber-optic adapters.
- h. The fiber modules shall be either fiberless or equipped with pre-terminated pigtailed ready for splicing.
- i. Multimedia outlet bezel shall be able to be used interchangeably with the module to facilitate multimedia applications.
- j. Enclosures must be modular to support mixed multimedia applications
- i. Each modular shelf shall be equipped with the following:
 - 1) Hinged front doors for easy access
 - 2) Front cable management trough
 - 3) Top cover panel
 - 4) Standard water-tight cable entry conduit connectors for OSP cable
 - 5) Blank labels for identifying fiber splices and terminations
- j. Additional shelf accessories shall include Water-tight connector kit for

- smaller diameter cables.
- i. Specifications:

Modular Fiber Enclosures

<u>Application</u>	<u>Connection Type</u>	Capacity	Capacity
		1U	2U
Termination Only	LC	96	192
Termination + Fusion Splicing	LC	96	192
Termination + Mechanical Splicing	LC	48	

B. Modules for Modular Shelves

1. The modular shelf systems, described above, shall have interchangeable modules available in LC for multimode and singlemode solutions.
2. Adapters deployed within modules shall be color coded per TIA/EIA 568C.3 .
 - a. All modules shall be prepopulated with fiber-optic adapters, and shall be offered with or without pre-assembled and factory-terminated pigtails.
3. LC adapters must contain zirconia-ceramic alignment sleeves for both LOMF and single mode applications.
3. Underminated Modules shall include the following features and options:
 - b. Laser Optimized Multimode modules with twelve duplex LC adapters
 - c. Multimode modules with twelve duplex LC adapters
 - d. Singlemode modules with twelve duplex LC adapters
 - e. All modules can be used on all shelves
4. Pre-Terminated Modules shall include the following features and options:
 - a. Laser Optimized Multimode modules with twelve duplex LC adapters; include 2-meters long pre-terminated pigtails.
 - b. Multimode modules with twelve duplex LC adapters include 2-meters long pre-terminated pigtails.
 - c. Singlemode modules with twelve duplex LC adapters include 2-meters long pre-terminated pigtails.
 - d. All modules can be used on all shelves.
5. Modular panel shall include:
 - a. Blank panel with the same footprint as the fiber module, and can be used in all modular shelves.
 - b. Multimedia Outlet Bezel panel with the same footprint as the fiber module, which accepts up to four M-Series jacks for multimedia applications. Blanking panels for individual ports shall be available.

2.4 Fiber optic connectors

A. LC Fiber Optic Connectors

1. The connector shall have an insertion release mechanism similar to the RJ-45 intuitive push/pull-style housing.
2. The connector shall be pull-proof to prevent momentary disconnect from axial loads
3. The connector possess a unitary, anti-s snag, rear-pivot latch which facilitates routing of patch cords
4. The connector shall be field-mountable with minimal polish
5. The connector shall have the capability to change polarity in the field.
6. The connector shall be Bellcore, TIA/EIA and IEC compliant
7. The connector shall meet the following specifications:

Fiber Type	Multimode	Singlemode
Nominal Fiber OD	125 μm	125 μm

Cable OD	0.9 mm	0.9 mm
Insertion Loss λ, ϕ	0.10, 0.10 dB	0.10, 0.15 dB
Return Loss Maximum	-20.0 dB	-40 dB
Cable Retention	2 lbs.	2 lbs.
Mating Durability for 500 Reconnects Insertion Loss Change	<0.2 dB	<0.2 dB
Temperature Stability (-40°C to +75°C) Insertion Loss Change	<0.3 dB	<0.3 dB
Tip Material	Ceramic	Ceramic

Table Footnotes: * Assumes these values represent average and standard deviation.

2.5 Required additional equipment and material necessary for installation.

- A. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional SCS installation shall be provided in a level of quality consistent with other specified items.

2.6 110 wiring block – wall mounted (copper backbone)

- A. The wiring block shall support Category 3, Category 5, Category 5e and Category 6 (110 type terminations) applications and facilitate cross connection and interconnection using cross connect wire (voice only).
- B. The wiring blocks shall be fire retardant, molded plastic consisting of horizontal index strips for terminating 25 pairs (24 pairs for Category 6) of conductors each. The index strips shall be marked with five colors on the high teeth, separating the tip and ring of each pair, to establish pair location.
- C. A series of fanning strips shall be located on each side of the block for dressing the cable pairs terminated on the adjacent index strips.
- D. The wiring block shall accommodate 22- through 26-AWG conductors and shall be able to mount directly on backboards..
- E. Clear label holders with the appropriate inserts shall be provided with the wiring blocks. The insert labels shall contain vertical lines spaced on the basis of circuit size (3-, 4-, or 5-pair) and shall not interfere with running, tracing or removing jumper wire/patch cords.
- F. The wiring blocks shall be available in 100 and 300 pair sizes.
- G. The wiring block shall be reliable for over 500 repeated insertions without incurring permanent deformation when tested per IEC 11801.
- H.
- H. The 110 wiring blocks shall meet the TIA/EIA– T-568-C specifications:

PART 3 - EXECUTION

3.1 Unshielded Twisted-Pair Installation

- A. Place unshielded twisted-pair (UTP) cable so as to maintain the minimum cable bend radius limits specified by the manufacturer or the following, whichever is larger:
 - 1. Horizontal 4-Pair Unshielded Twisted-Pair Cables:
 - a. Termination Points: eight times the cable diameter.
 - b. Other Locations: four times the cable diameter.
 - 2. Multi-pair Unshielded Twisted-Pair Cables: Maintain a minimum bend radius of ten times the cable diameter.
- B. To avoid stretching four-pair horizontal cable conductors during installation, do not exceed a 25-pound force pulling tension (tensile loading).
- C. Place copper cables transitioning between the cable trays and cabinets or racks in a neat and orderly manner per NEC 318.11(b) requirements. Velcro tie-wrap transitioning bundles.
- D. Directly terminate twisted-pair cable on wiring blocks, patch panels, and TOs in standard T568B color termination scheme.
- E. Use wiring block and/or connector manufacturer's recommended tools with the proper-sized anvils for all copper punch down, wire wrap, and crimp terminations. Stuffer caps are not permitted.
- F. Unshielded twisted-pair connecting hardware and material including wiring blocks, patch panels, connectors, TOs, cross-connect jumper wire or cables, patch cords, and other components used to connect unshielded 100-ohm twisted-pair cable shall meet or exceed the requirements of EIA/TIA 568-C.2, Specifications for Unshielded Twisted-Pair Connecting Hardware, for the category of use specified in the Contract Documents.
- G. Cable Jackets: To reduce untwisting of pairs, maintain the twisted pair cable jacket as close as possible to the point of termination.
 - 1. Multi-pair Cable: Strip back only as much cable jacket as is minimally required to terminate on connecting hardware.
 - 2. Horizontal Cable: Strip back no more than 1 inch of cable sheathing.
- H. Pair Twist: Observe the TIA/EIA -568-C recommended practice of preserving wire pair twists as closely as possible to the point of mechanical termination. The amount of untwisting in a pair as a result of termination to connecting hardware shall be no greater than 1/2 inch for all copper cables. This practice maintains the maximum number of twists in the wire, to minimize signal impairment and reduce potential problems with high-speed transmission.

3.2 Fiber-optic Installation

- A. Place fiber-optic cable so as to maintain the minimum cable bend radius limits specified by the manufacturer or the following, whichever is larger:
 - 1. Horizontal Fiber-Optic Cables:
 - a. Termination Points: Ten times the cable diameter.
 - b. Other Locations: Ten times the cable diameter.
 - 2. Backbone Fiber-Optic Cables: Maintain a minimum bend radius of ten times the cable diameter.
- B. Place fiber-optic cables transitioning between the cable trays and cabinets or racks in a neat and orderly manner per NEC 318.11(b) requirements and pathway requirements of EIA/TIA 569-A. Velcro tie-wrap transitioning bundles.

- C. Follow guidance of current draft of proposed TIA/ EIA 568-C.3 regarding polarity management of fiber elements in the permanent link. Directly terminate fiber-optic on patch panels, in standard color code order.
- D. Use connector manufacturer's recommended tools.
- E. Fiber-optic connecting hardware and material including patch panels, connectors, TOs, cross-connect cables, patch cords, and other components used to connect fiber-optic cable shall exceed the requirements of TIA/EIA 568-C.3. Specifications for Fiber-optic Connecting Hardware for the type of use specified in the Contract Documents.
- F. Cable Jackets: Maintain the cable jacket as close as possible to the point of termination.
 - 1. Strip back only as much cable jacket as is minimally required to terminate on connecting hardware.

3.3 IDENTIFICATION

- A. See Section 270553 "Identification for Communications Systems".

END OF SECTION 271119



CSI SECTION 271123

CABLE MANAGEMENT

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a standard specification applicable to commercial building structured cabling applications.

The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines.

The information contained in this document is based on our experience to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be used with their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements consult the factory. This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supersedes and voids all previous literature, etc.

It is highly recommended and the issuers responsibility to have any RFQ documents, including those based on this general format, reviewed by the issuing company's professional advisors before it is released to the public. In no way may this document be used in a manner that is detrimental to the interests of Panduit and/or its subsidiaries.

SECTION 271123 - COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 & 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Telecommunications mounting elements, ladder rack and cable management.

- B. Related Sections:

- 1. Section 270500 "Common Work Results for Communications"
 - 2. Section 271323 "Communications Optical Fiber Backbone Cabling"
 - 3. Section 271315 "Communications Copper Horizontal Cabling"
 - 4. Section 260526 "Grounding and Bonding for Communications Systems"
 - 5. Section 260536 "Pathways for Communications Systems"

1.3 SUBMITTALS

- A. Coordinate with Division 0 & 1.

- B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- C. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

- 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled by a qualified testing agency, and marked for intended location and application.

- B. Product Warranty

- 1. Refer to Section 270500 "Common Work Results for Communications"

- C. Comply with the National Electrical Code and the National Building Code..
- D. Grounding: Comply with ANSI-J-STD-607-A and the National Electrical Code.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.6 COORDINATION

- A. Refer to Divisions 0 and 1.
- B. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute them to other participants.
 - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 - 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

PART 2 - PRODUCTS

- 2.1 Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
 - a. PANDUIT
- 2.2 PATHWAYS within the Data Center, Network Center, IDFs and Net Pops.
 - A. Refer to Division 26, Section 260536 "Cable Trays For Electrical Systems"
 - B. General Requirements: Comply with TIA/EIA-569-B, the National Building Code and the National Electrical Code.

C. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.

1. Comply with the National Electrical Code and UL 2043 for fire-resistant and lowsmoke-producing characteristics.
2. Support brackets with cable tie slots for fastening cable ties to brackets.
3. Lacing bars, spools, J-hooks, and D-rings.
4. Straps and other devices.

D. Ladder Rack: (Cable Runway):

1. Ladder Rack Materials: Ladder rack shall be of tubular steel construction:
 - a. Ladder Cable Trays: Nominally 18 inches wide, with a rung spacing of 9 inches.
 - b. Color: Black Enamel
 - c. Straight sections of ladder rack shall be provided in 10 ft. standard lengths.
 - d. Stringers (Side rails to be 1-1/2" deep x 3/8" wide)

E. Optical Fiber Routing System (Fiber Runner):

1. The optical fiber routing system shall be used to route, segregate and protect fiber optic communication cabling.
 - a. UL Listed (UL2024A)
 - b. Size: 6" x 4" and 4" x 4" (Per Drawings)
 - c. 2" minimum bend radius through-out pathway.
 - d. Impact Resistant and flame retardant material. (UL94-V0 Flammability).
 - e. Color: Yellow
 - f. Will include all mounting hardware, waterfalls, directional fittings and other accessories required for installation

F. Vertical Wire Manager Cage with a door (Per Drawings)

1. Physical characteristics
 - a. Color: Black
 - b. Wide: 6", 8", 10" (Per Drawings)
 - c. Deep: 13"
 - d. High: 7'

G. Vertical Wire Manager Cage without door (Per Drawings)

1. Physical characteristics
 - a. Color: Black
 - b. Wide: 6", 8", 10" (Per Drawings)
 - c. Deep: 13"
 - d. High: 7'

H. Horizontal Cable Management for Equipment Frames:

1. Physical Characteristics:
 - a. Color: Black
 - b. Wide: 19"
 - c. Deep: 6.76
 - d. Rack Units High: 2
2. Metal, with integral wire retaining fingers.
3. Baked-polyester powder coat finish.
4. Vertical cable management panels shall have front and rear channels, with covers.

5. Provide horizontal crossover cable manager at the top of each rack, with a minimum height of two rack units each.

I. Wall or Backboard Mounted Cable Management

1. Hinged Cover Wiring Duct

A wide slotted wiring duct or solid wall wiring duct shall be used to route, protect and contain horizontal or cross-connect cabling around or near communications equipment that is wall-mounted. A snap-on hinged cover shall be used to prevent cover loss and provide easy access to the channel for moves, adds or changes. A selection of bend radius control accessories shall be available for routing cabling around inside corners and to feed in or out of the channel.

2. Slotted Hinged Wiring Duct Base

Part Number	Description	Color	Dimensions W x H (in.)
H1.5X2BL6	Type H Slotted Wall Base-6 foot	Black	1.75 x 1.92
H1.5X3BL6	Type H Slotted Wall Base-6 foot	Black	1.75 x 3.00
H2X2BL6	Type H Slotted Wall Base-6 foot	Black	2.17 x 1.92
H2X3BL6	Type H Slotted Wall Base-6 foot	Black	2.17 x 3.00
H2X4BL6	Type H Slotted Wall Base-6 foot	Black	2.17 x 4.00
H3X3BL6	Type H Slotted Wall Base-6 foot	Black	3.25 x 3.00
H3X4BL6	Type H Slotted Wall Base-6 foot	Black	3.25 x 4.00
H4X4BL6	Type H Slotted Wall Base-6 foot	Black	4.25 x 4.00

3. Solid Hinged Wiring Duct Base

Part Number	Description	Color	Dimensions W x H (in.)
HS2X2BL6NM	Type H Solid Wall Base-6 foot	Black	2.17 x 1.92
HS4X4BL6NM	Type H Solid Wall Base-6 foot	Black	4.25 x 4.00

5. Cover for Hinged Wiring Duct

Part Number	Description	Color	Dimensions W x H (in.)
HC1.5BL6	Type H 1.5" Hinged Cover-6 foot	Black	—
HC2BL6	Type H 2" Hinged Cover-6 foot	Black	—
HC3BL6	Type H 2" Hinged Cover-6 foot	Black	—
HC4BL6	Type H 2" Hinged Cover-6 foot	Black	—

Other colors: Replace BL in part number with LG for Light Gray or WH for White.

NM= provided without mounting holes.

6. Hinged Wiring Duct Accessories

Part Number	Description	Color	For Duct Height
CSC1LG6	Cut-to-size 6 foot corner strip with a 1" bend radius	Light Gray	All sizes (Cut to size)
CSC1BL6		Black	
TRC2HDBL	Bend Radius Control Trumpet for 2" height Type H Duct	Black	2"
WR2H-C	Wire Retainer for 2" duct width	Black	-
WR3-C	Wire Retainer for 3" duct width	Black	-
WR4-C	Wire Retainer for 4" duct width	Black	-

J. J-MOD™ Cable Support System

Open top cable supports shall be utilized as a pathway for communication cabling. The J Hook cable supports shall be manufactured from a non-conductive material suitable for use in air-handling spaces. The cable support must maintain complete horizontal and vertical 1" bend radius control and must manage up to 50, 0.24" O. D. cables. The system must allow for the ability to add future cable routing capacity. The cable support must provide the ability to retain the cable bundle with *TAK-TY*® Hook & Loop Cable Ties.

Part Number	Description	Material*
JMJH2W-X20	J Hook for wall mount applications	Nylon
JMJH2-X20	J Hook for use with brackets	Nylon
JMCB-X	Chaining Bracket	Galvanized Steel
JMCMB25-1-X	Ceiling Mount Bracket – 1 level	Galvanized Steel
JMCMB25-3-X**	Ceiling Mount Bracket – 3 level	Galvanized Steel
JMDWB-1-X	Drop Wire Bracket – 1 level	Galvanized Steel
JMDWB-3-X**	Drop Wire Bracket – 3 level	Galvanized Steel
JMTRB38-1-X	Threaded Rod Bracket – 1level	Galvanized Steel
JMTRB38-3-X**	Threaded Rod Bracket – 3level	Galvanized Steel
JMSBCB87-1-X	Screw-on Beam Clamp Bracket – 1 level	Galvanized Steel
JMSBCB87-3-X**	Screw-on Beam Clamp Bracket – 3 level	Galvanized Steel

** Not for use with chaining brackets

* Suitable for use in air handling spaces per UL 2043.

Listed in accordance with CAN/ULC S102.2 when mounted as single units or in pairs.

Minimum spacing of 4 ft. (1220mm) required between mount points.

(Flame Spread Rating = 0, Smoke Developed Classification = 30)

Maximum Cable Capacity

Part Number	Category 6A (0.300")	Category 6 (0.240")	Category 5e (0.225")
JMJH2W or JMjH2	30	46	55

J-PRO™ Cable Support System

Open top cable supports shall be utilized as a pathway for communication cabling. The J Hook cable supports shall be manufactured from a non-conductive material suitable for use in air-handling spaces. The pre-rieveted J Hook assemblies must maintain complete horizontal and vertical 1" bend radius control. The cable support must provide the ability to retain the cable bundle with *TAK-TY*® Hook & Loop Cable Ties.

Part Number	Part Description	Bundle Capacity (In)	Material*	Max. Cable Capacity	
				Cat 6 (0.240")	Cat 5e (0.225")
JP75CM-L20	J Hook with ceiling mount bracket that has one 3/16" (M5), 1/4" (M6) and 3/8" (M10) mounting hole.	0.75	Nylon 6.6 J Hook with metal attachments	8	10
JP75CP-L20	J Hook with c-purlin clip for use with vertical flanges up to 1/4" thick.	0.75	Nylon 6.6 J Hook with metal attachments	8	10
JP75DW-L20	J Hook with clip for use with #12 wire, threaded rod up to 3/8" in diameter, or 1/8" – 3/8" thick flanges.	0.75	Nylon 6.6 J Hook with metal attachments	8	10
JP75HBC25R-L20	J Hook with hammer-on beam clamp for use with flanges 1/8" – 1/4" thick. Rotates 360 degrees.	0.75	Nylon 6.6 J Hook with metal attachments	8	10
JP75HBC50R-L20	J Hook with hammer-on beam clamp for use with flanges 5/16" – 1/2" thick. Rotates 360 degrees.	0.75	Nylon 6.6 J Hook with metal attachments	8	10
JP75HBC75R-L20	J Hook with hammer-on beam clamp for use with flanges 9/16" – 3/4" thick. Rotates 360 degrees.	0.75	Nylon 6.6 J Hook with metal attachments	8	10
JP75SBC50-L20	J Hook with screw-on beam clamp for use with flanges up to 1/2" thick.	0.75	Nylon 6.6 J Hook with metal attachments	8	10
JP75SBC50R-L20	J Hook with screw-on beam clamp for use with flanges up to 1/2" thick. Rotates 360 degrees.	0.75	Nylon 6.6 J Hook with metal attachments	8	10
JP75SBC87-L20	J Hook with screw-on beam clamp for use with flanges up to 3/4" thick.	0.75	Nylon 6.6 J Hook with metal attachments	8	10
JP75SBC87R-L20	J Hook with screw-on beam clamp for use with flanges up to 3/4" thick. Rotates 360 degrees.	0.75	Nylon 6.6 J Hook with metal attachments	8	10

JP75UF100-L20	J Hook with under floor pedestal support clamp for use with pedestal support up to 7/8" sq. or 1 1/8"- 1 3/8" in diameter.	0.75	Nylon 6.6 J Hook with metal attachments	8	10
JP75W-L20	J Hook for wall mount applications. One 1/4" (M6) mounting hole for user supplied screw.	0.75	Nylon 6.6	8	10
JP75WP2-L20	J Hook for powder actuated installation on walls. One 5/32" (M4) mounting hole and one 1/4" (M6) mounting hole for user supplied fasteners.	0.75	Nylon 6.6 J Hook with metal attachments	8	10
JP75ZP-L20	J Hook with z-purlin clip for use with angled flanges up to 1/4" thick.	0.75	Nylon 6.6 J Hook with metal attachments	8	10
JP131CM-L20	J Hook with ceiling mount bracket that has one 3/16" (M5), 1/4" (M6) and 3/8" (M10) mounting hole.	1.31	Nylon 6.6 J Hook with metal attachments	25	29
JP131CP-L20	J Hook with c-purlin clip for use with vertical flanges up to 1/4" thick.	1.31	Nylon 6.6 J Hook with metal attachments	25	29
JP131DW-L20	J Hook with clip for use with #12 wire, threaded rod up to 3/8" in diameter, or 1/8" – 3/8" thick flanges.	1.31	Nylon 6.6 J Hook with metal attachments	25	29
JP131HBC25R-L20	J Hook with hammer-on beam clamp for use with flanges 1/8" – 1/4" thick. Rotates 360 degrees.	1.31	Nylon 6.6 J Hook with metal attachments	25	29
JP131HBC50R-L20	J Hook with hammer-on beam clamp for use with flanges 5/16" – 1/2" thick. Rotates 360 degrees.	1.31	Nylon 6.6 J Hook with metal attachments	25	29
JP131HBC75R-L20	J Hook with hammer-on beam clamp for use with flanges 9/16" – 3/4" thick. Rotates 360 degrees.	1.31	Nylon 6.6 J Hook with metal attachments	25	29
JP131SBC50-L20	J Hook with screw-on beam clamp for use with flanges up to 1/2" thick.	1.31	Nylon 6.6 J Hook with metal attachments	25	29
JP131SBC50R-L20	J Hook with screw-on beam clamp for use with flanges up to 1/2" thick. Rotates 360 degrees.	1.31	Nylon 6.6 J Hook with metal attachments	25	29
JP131SBC87-L20	J Hook with screw-on beam clamp for use with flanges up to 3/4" thick.	1.31	Nylon 6.6 J Hook with metal attachments	25	29
JP131SBC87R-L20	J Hook with screw-on beam clamp for use with flanges up to 3/4" thick. Rotates 360 degrees.	1.31	Nylon 6.6 J Hook with metal attachments	25	29
JP131UF100-L20	J Hook with under floor pedestal support clamp for use with pedestal support up to 7/8" sq. or 1 1/8"- 1 3/8" in diameter.	1.31	Nylon 6.6 J Hook with metal attachments	25	29
JP131W-L20	J Hook for wall mount applications. One 1/4" (M6) mounting hole for user supplied screw.	1.31	Nylon 6.6	25	29

JP131WP2-L20	J Hook for powder actuated installation on walls. One 5/32" (M4) mounting hole and one 1/4" (M6) mounting hole for user supplied fasteners.	1.31	Nylon 6.6 J Hook with metal attachments	25	29
JP131ZP-L20	J Hook with z-purlin clip for use with angled flanges up to 1/4" thick.	1.31	Nylon 6.6 J Hook with metal attachments	25	29
JP2CM-L20	J Hook with ceiling mount bracket that has one 3/16" (M5), 1/4" (M6), and 3/8" (M10) mounting hole.	2	Nylon 6.6 J Hook with metal attachments	46	55
JP2CP-L20	J Hook with c-purlin clip for use with vertical flanges up to 1/4" thick.	2	Nylon 6.6 J Hook with metal attachments	46	55
JP2DW-L20	J Hook with clip for use with #12 wire, threaded rod up to 3/8" in diameter, or 1/8" - 3/8" thick flanges.	2	Nylon 6.6 J Hook with metal attachments	46	55
JP2HBC25R-L20	J Hook with hammer-on beam clamp for use with flanges 1/8" - 1/4" thick. Rotates 360 degrees.	2	Nylon 6.6 J Hook with metal attachments	46	55
JP2HBC50R-L20	J Hook with hammer-on beam clamp for use with flanges 5/16" - 1/2" thick. Rotates 360 degrees.	2	Nylon 6.6 J Hook with metal attachments	46	55
JP2HBC75R-L20	J Hook with hammer-on beam clamp for use with flanges 9/16" - 3/4" thick. Rotates 360 degrees.	2	Nylon 6.6 J Hook with metal attachments	46	55
JP2SBC50-L20	J Hook with screw-on beam clamp for use with flanges up to 1/2" thick.	2	Nylon 6.6 J Hook with metal attachments	46	55
JP2SBC50R-L20	J Hook with screw-on beam clamp for use with flanges up to 1/2" thick. Rotates 360 degrees.	2	Nylon 6.6 J Hook with metal attachments	46	55
JP2SBC87-L20	J Hook with screw-on beam clamp for use with flanges up to 3/4" thick.	2	Nylon 6.6 J Hook with metal attachments	46	55
JP2SBC87R-L20	J Hook with screw-on beam clamp for use with flanges up to 3/4" thick. Rotates 360 degrees.	2	Nylon 6.6 J Hook with metal attachments	46	55
JP2UF100-L20	J Hook with under floor pedestal support clamp for use with pedestal support up to 7/8" sq. or 1 1/8" - 1 3/8" in diameter.	2	Nylon 6.6 J Hook with metal attachments	46	55
JP2W-L20	J Hook for wall mount applications. One 1/4" (M6) mounting hole for user supplied screw.	2	Nylon 6.6	46	55
JP2WP2-L20	J Hook for powder actuated installation on walls. One 5/32" (M4) mounting hole and one 1/4" (M6) mounting hole for user supplied fasteners.	2	Nylon 6.6 J Hook with metal attachments	46	55
JP2ZP-L20	J Hook with z-purlin clip for use with angled flanges up to 1/4" thick.	2	Nylon 6.6 J Hook with metal attachments	46	55
JP4CM-X20	J Hook with ceiling mount bracket that has one 3/16" (M5), 1/4" (M6) and 3/8" (M10) mounting hole.	4	Nylon 6.6 J Hook with metal attachments	180	200

JP4CP-X20	J Hook with c-purlin clip for use with vertical flanges up to 1/4" thick.	4	Nylon 6.6 J Hook with metal attachments	180	200
JP4HBC25R-X20	J Hook with hammer-on beam clamp for use with flanges 1/8" - 1/4" thick. Rotates 360 degrees.	4	Nylon 6.6 J Hook with metal attachments	180	200
JP4HBC50R-X20	J Hook with hammer-on beam clamp for use with flanges 5/16" - 1/2" thick. Rotates 360 degrees.	4	Nylon 6.6 J Hook with metal attachments	180	200
JP4HBC75R-X20	J Hook with hammer-on beam clamp for use with flanges 5/16" - 1/2" thick. Rotates 360 degrees.	4	Nylon 6.6 J Hook with metal attachments	180	200
JP4SBC50-X20	J Hook with screw-on beam clamp for use with flanges up to 1/2" thick.	4	Nylon 6.6 J Hook with metal attachments	180	200
JP4SBC50R-X20	J Hook with screw-on beam clamp for use with flanges up to 1/2" thick. Rotates 360 degrees.	4	Nylon 6.6 J Hook with metal attachments	180	200
JP4SBC87-X20	J Hook with screw-on beam clamp with flanges up to 3/4" thick.	4	Nylon 6.6 J Hook with metal attachments	180	200
JP4SBC87R-X20	J Hook with screw-on beam clamp with flanges up to 3/4" thick. Rotates 360 degrees.	4	Nylon 6.6 J Hook with metal attachments	180	200
JP4UF100-X20	J Hook with under floor pedestal support clamp for use with pedestal support up to 7/8" sq. or 1 1/8"- 1 3/8" in diameter.	4	Nylon 6.6 J Hook with metal attachments	180	200
JP4W-X20	J Hook for wall mount applications. One 1/4" (M6) mounting hole for user supplied screw.	4	Nylon 6.6	180	200
JP4WP2-X20	J Hook for powder actuated installation on walls. One 5/32" (M4) mounting hole and one 1/4" (M6) mounting hole for user supplied fasteners.	4	Nylon 6.6 J Hook with metal attachments	180	200
JP4ZP-X20	J Hook with z-purlin clip for use with angled flanges up to 1/4" thick.	4	Nylon 6.6 J Hook with metal attachments	180	200

* Suitable for use in air handling spaces in accordance with Sec. 300.22 (c) and (d) of the National Electrical Code when mounted as single units or in pairs. JP4 family of parts suitable for use in single unit configurations only. Listed in accordance with CAN/ULC S102.2 when mounted as single units or in pairs. Maximum spacing of 4' (1220mm) required between mount points. (Flame Spread Rating = 0, Smoke Developed Classification = 20)

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Cut standard straight sections of materials to length in the field.
- B. De-bur and file all rough cable tray and ladder rack edges at any cut sections.
- C. Cable runway locations shown on the drawings are approximate unless dimensioned.

- D. Install cable runway as shown on the drawings.
- E. All cable runways shall be accessible.
- F. Maintain minimum 6-inch clearance between cable runway and piping. Locate cable runway at least 12 inches away from electrical or heat sources such as parallel runs of flues, steam or hot water pipes, and heating appliances.
- G. Run exposed and concealed cable runway parallel or perpendicular to walls, structural members, or intersections of vertical planes to maintain headroom and provide a neat appearance.
- H. Passageways shall not be obstructed.
- I. Install appropriate cable runway bends, dropouts, and other accessories to protect minimum cable bend radius and provide adequate support at all locations where cable direction changes occur.

3.2 INSTALLATION

- A. Installation shall be in compliance with the National Build Code and the National Electrical Code.
- B. Install aerial pathways complying with recommendations in TIA/EIA-569-B, "Entrance Facilities" Article.
- C. Comply with all drawings and BICSI TDMM for layout and installation of communications equipment rooms.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

END OF SECTION 271123



CSI SECTION 271513

COMMUNICATIONS COPPER HORIZONTAL CABLING

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a standard specification applicable to commercial building structured cabling applications.

The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines.

The information contained in this document is based on our experience to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be used with their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements consult the factory. This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supercedes and voids all previous literature, etc.

It is highly recommended and the issuers responsibility to have any RFQ documents, including those based on this general format, reviewed by the issuing company's professional advisors before it is released to the public. In no way may this document be used in a manner that is detrimental to the interests of Panduit and/or its subsidiaries.

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Section 271513
COMMUNICATIONS COPPER HORIZONTAL CABLING REQUIREMENTS

Part 4 - General

4.1 Work Included

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

4.2 Scope of Work

- A. This document describes the products and execution requirements relating to furnishing and installing Telecommunications Cabling for the horizontal cabling comprised of Copper Cabling and support systems are covered under this document.

Install a structured cabling system that will be able to support interconnections to active telecommunications equipment for voice and data applications in a multi vendor, multi product environment. The structured cabling system should adhere to ANSI/TIA 568 C; 569-A; 606-A; J-STD-607-A and TIA 942 standards with respect to pathways, distribution, administration, and grounding of the system. The structured cabling system to be installed should also follow the guidelines spelled out in this RFP in accordance to local codes and regulations.

For Reference of the drops, each Standard drop will consist of three terminations that can be interoperable to accommodate either voice or data applications. Each meeting room drop will consist of four drops each consisting of two terminations can be interoperable to accommodate either voice or data applications. There will also be convenience phone drops that will consist of a single termination that will be installed in the proper faceplate for each location's phone.

Install, terminate, test, and guarantee each drop according to customer all applicable standards and customer preferences.

Horizontal cables will be rated Cat 6 enhanced in performance rated to connector outlets at the work area. The Horizontal cables will home run back to a floor serving telecommunications room and will terminate on individual Cat 6 enhanced rated jacks to populate a modular 48 port angled patch panel. All cables will be patched at cutover as an interconnection into the floor serving active equipment using RJ45 modular equipment cables rated to Cat 6 enhanced.

The floor serving active data equipment will be interconnected to the facility serving data equipment via a fiber backbone terminated in 19" rack mounted 48 port enclosures which will utilize SC or LC connections. This will serve to connect the Main Telecommunications Room to an additional Telecommunications Room serving the locations that exceed the distance limitations (90 meters) of the Main Telecommunications Room for the horizontal Data and Voice drops.

Contractor will also be required to make matching additions to the cable tray to complete the system according to ANSI/TIA/EIA 569

- B. This section includes minimum requirements for the following:
- UTP Cable from TR to Work Area
 - UTP//Coax /WA Patch Cords
 - Category 6A, 6, and 5e (if called for) UTP Connector Modules

- C. 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.
- D. 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, formal clarification shall be obtained from in the form of Question Clarification Request. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

4.3 Regulatory References

- A. The following industry standards are the basis for the structured cabling system described in this document.
 - 1. ANSI/TIA/EIA
 - TIA/EIA-568-C.1 Commercial Building Telecommunications Cabling Standard
 - TIA/EIA-568-C.0 General Requirements
 - TIA/EIA-568-C.2 Balanced Twisted Pair Cabling Components Standard
 - TIA/EIA-568-C.2.10 Specifications for Augmented Category 6 Cabling
 - TIA/EIA-568-C.3 Optical Fiber Cabling Components Standard
 - TIA/EIA - 942 Telecommunications Infrastructure for Data Centers
 - TIA/EIA-569-A Commercial Building Standard for Telecom Pathways and Spaces
 - TIA/EIA-606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 - J-STD-607-A Commercial Building Grounding/Bonding Requirements
 - 2. NFPA
 - NFPA 70 National Electric Code (NEC)
 - 3. ISO/IEC
 - ISO 11801 Generic Cabling for Customer Premises
- B. If there is a conflict between applicable documents, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.
- C. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

4.4 Quality Assurance

- A. Cabling System Warranty
 - 1. A Cable Products Warranty shall provide a complete warranty to guarantee a high performance cabling systems that meet application requirements. The guarantee shall include all cable installed in the structured cabling system. The Cable shall be warranted for a period of at least 25 years.

B. *PANDUIT System Warranty*

1. A **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 copper connectivity components. The system shall be warranted for a period of at least 25 years.

C. Product Guarantee

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.

In order to qualify for the guarantee, the structured cabling system must be installed per the following:

1. Meet all TIA commercial building wiring standards
2. Panduit will provide a single source solution for the end-to-end installation
3. Panduit Products must be installed per Panduit instruction sheets by a BICSI certified Installer with minimum agreement of Panduit Certified Installer by Panduit Corp.

Installer: Company specializing in installing products specified in this section with minimum three years documented experience, and with service facilities within 120 miles of project. The Electrical/Telecommunications contractor must be Panduit Corp. approved for copper cabling and fiber solutions – a qualified BICSI trained installer who also is certified to install Warrantee-able solution by Panduit Corp. A copy of certification documents for each must be submitted with the quote in order for such quote to be valid.

The Electrical/Telecommunications contractor is responsible for workmanship and installation practices in accordance with the Panduit cabling solutions Certified Program. Manufacturer (Panduit) will extend a 25-year Static, Dynamic and Applications Warranty to the end user once the Electrical/Telecommunications contractor fulfills all requirements under the Panduit Cabling Solutions Certified Program. At least 30 percent of the installation and termination crew must be certified by Panduit with a Technicians Level of Training. Also, Panduit must certify 10 percent of the installation and termination crew for Optical Fiber Training.

Note: All Networks shall be installed per applicable standards and manufacturer's guidelines.

If any *PANDUIT PAN-NET™* product fails to perform as stated above, *PANDUIT* will provide new components at no charge.

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.

4.5 Approved Products

- A. Approved UTP 4-pair Cable: Panduit
 - PUx6A04xx-UG
 - PUx6504xx-UY
 - PUx6004xx-UY
- B. Approved UTP connector product manufacturer: Panduit
- C. Approved Patch Panel manufacturer: Panduit
- D. Approved UTP Patch Cord manufacture: Panduit

Part 5 - Products

5.1 Equivalent Products

- A. Panduit shall manufacture all products, including but not limited to cable management, faceplates, copper modules, patch panels, racks, 110 blocks, patch cords, labels, grounding

- lugs and fiber connectivity products for the purpose of this document.
- B. Panduit Corp. shall manufacture all data/telecommunication and fiber optic cable.

5.2 Substitutions – (no exceptions)

- A. *This is a performance-based single source solution. Therefore, substitutions are highly discouraged. Substitutions must follow the same rigid standards for quality and termination style as those described in section 2.3 and 2.5.*
- B. *Any Contractor wishing to offer structured cabling products other than those specified herein shall submit a request for product substitution in writing no less than one week in advance of bid. Written requests for substitution shall be accompanied by all drawings, specification sheets and engineering documents, as well as third party laboratory performance test results proving equivalency in performance and manufacturing style.*
- C. *This written documentation shall be accompanied by samples of the substitution product offered for evaluation. Equal product acceptance must be received in writing.*
- D. *Contractor shall be responsible and assume all costs for removal and replacement of any substituted product installed without prior written approval. Such costs shall include, but not be limited to labor, materials as well as any penalties, fees or costs incurred for late completion.*

5.3 Work Area Subsystem

- A. The Work Area shall consist of the connectivity equipment used to connect the horizontal cabling subsystem and the equipment in the work area. Both copper and fiber media shall be supported. The connectivity equipment shall include the following options:
- Patch (equipment) cords and modular connectors
 - Outlets and surface mount boxes
 - Surface raceway and outlet poles
 - Consolidation point / MUTO
- B. Patch Cords and Modular Connectors
1. The modular connectors and patch cords will be chosen to match the horizontal cabling medium and rating. The same manufacturer shall provide the modular connectors and patch cords. The total patch cord length at the work area is not to exceed 3 meters (10 ft). Exception: When implementing an open office cabling system as specified under TIA TSB-75 (see section 3.4).
 2. Copper Connectivity
The **PANDUIT MINI-COM® Network Cabling System** shall be used for the Work Area subsystem, including all modular connectors. The network cabling system shall be comprised of modular connectors in support of high-speed networks and applications designed for implementation on copper cabling. All outlets shall utilize fully interchangeable and individual connector modules that mount side-by-side to facilitate quick and easy moves, adds and changes.

MINI-COM® TX-6™ TG Modules shall be Category 6 modules featuring GIGA-TX™ Technology. The eight position modules shall be used in all work areas and shall exceed the connector requirements of the TIA/EIA Category 6 standard. Termination shall be accomplished by use of a forward motion termination cap and shall not require the use of a punch down tool. The termination cap shall provide strain relief on the cable jacket, ensure cable twists are maintained to within 1/8" (3.18 mm) and include a wiring scheme label. The wiring scheme label shall be available with both T568A and T568B wiring schemes. All terminations for this project shall use the T568B (B) wiring scheme. The modules shall terminate 4 pair 23-AWG 100-ohm solid unshielded twisted pair cable. The modules shall be universal in design, including complying with the intermateability standard IEC 60603-7 for backward compatibility. Category 6 modules shall have UL and CSA approval. The modules shall have ETL verified Category 6 performance and ISO Class E performance (as defined in ISO/IEC 11801) in both the basic and channel links. They shall be universal in design, accepting 2, 3, or 4 pair modular plugs without damage to the outer jack contacts. The modules shall be able to be re-terminated a minimum of 10 times and be available in 11 standard colors for color-coding purposes. The jack shall snap into all MINI-COM outlets and patch panels. The module shall include a black base to signify Category 6 400 MHz performance.

TX-6™ Category 6 Patch Cords shall be factory terminated with modular plugs featuring a one-piece, tangle-free latch design and black strain-relief boots to support easy moves, adds and changes. They shall be constructed with Category 6 23-AWG stranded UTP cable. Each patch cord shall be 100% performance tested at the factory in a channel test to the TIA/EIA Category 6 standard. The patch cords shall come in standard lengths of 3, 5, 7, 9, 14, and 20 feet and 6 standard colors of Off White, Black, Blue, Green, Red and Yellow

- Additional Copper Cabling Connectors

Additional *MINI-COM*® Modules for copper shall include the following:

- 50 and 75 Ohm BNC coax coupler modules, male-male
- F-Type coax coupler module, male-male threaded
- RCA connector modules with black, red, yellow, and white inserts
 - Solder, pass through and punchdown termination types
- S-Video connectors' modules - coupler and punchdown termination types
- Blank module to reserve space for future additions

The connectors shall snap into all *MINI-COM* outlets and patch panels.

**C. Copper Cable:
PUx6A04xx-UG**

- Exceeds requirements of ANSI/TIA-568-C.2 Category 6A, IEEE 802.3an-2006, and ISO 11801 Class EA channel standards
- Meets requirements of IEEE 802.af and IEEE 802.3at for PoE applications
- Exceeds requirements of ANSI/TIA-568-C.2 Category 6A and IEC 61156-5 Category 6A component standards
- Patent-pending cable design suppresses alien crosstalk with enhanced internal electrical performance
- Round cable design with reduced cable diameter enables improved cable bundling and optimizes fill capacity
- Cable diameter: 0.310 in. (7.9mm) nominal
- Installation temperature range: 32°F to 140°F (0°C to 60°C)
- Operating temperature range: -4°F to 167°F (-20°C to 75°C)
- Descending length cable markings enable easy identification of remaining cable which reduces installation time and cable scrap

PUx6504xx-UY

- Superior performance exceeds all TIA/EIA-568-C.2-1 Category 6 and ISO 11801 Edition 2.0 for Class E cable requirements
- ETL tested for Category 6 component performance
- Conductors are twisted in pairs with four pairs contained in a flame retardant PVC jacket separated by a spline
- Performance tested to 650 MHz
- Plenum (CMP) and non-plenum/riser (CMR) flame rated
- Maximum installation tension of 25 lbs (110 N)
- Installation temperature range: 32°F to 140°F (0°C to 60°C)
- Operating temperature range: 14°F to 140°F (-10°C to 60°C)
- Cable diameter: Riser – 0.260"; Plenum – 0.250"
- Easy payout, reel-in-a-box and descending length markings on cable speed installation
- Supports the following applications: Ethernet 10BASE-T, 100BASE-T (Fast Ethernet) and 1000BASE-T (Gigabit Ethernet); 1.2Gb/s ATM; Token Ring 4/16; digital video; and broadband/baseband analog video

PUx6004BU-UY

- Exceeds requirements of ANSI/TIA-568-C.2 Category 6 and ISO 11801 2nd Edition Class E channel standards
- Exceeds requirements of ANSI/TIA-568-C.2 and IEC 61156-5 Category 6 component standards
- Meets requirements of IEEE 802.af and IEEE 802.3at for PoE applications
- Third party tested to comply with ANSI/TIA/EIA-568-C.2
- Cable diameter: 0.236 in. (5.9mm) nominal
- Installation temperature range: 32°F to 122°F (0°C to 50°C)
- Operating temperature range: 14°F to 140°F (-10°C to 60°C)
- Descending length cable markings enable easy identification of remaining cable which reduces installation time and cable scrap
- Cable supplied in an easy payout reel-in-a-box

D. MUTOA's and Consolidation Points

Consolidation Point and MUTO assembly configurations shall be implemented in open office applications where the office area is split into zones and the cabling system utilizes short runs from an intermediate connection to facilitate frequent moves, adds and changes (MAC's) as specified per TIA/EIA TSB-75. The MUTO and consolidation point equipment will be chosen to match the horizontal cabling medium and performance category. The same manufacturer shall provide the modular connectors and patch cords.

Maximum length of horizontal and work area cables

Horizontal Area Cable (H)	Max Combined Length of Patch Cords, Work Area & Equip. Cable (C)	Max Work Area Cable Length (W)
------------------------------	--	--------------------------------------

90 m (295 ft)	10 m (33 ft)	5 m (16 ft)
85 m (279 ft)	14 m (46 ft)	9 m (30 ft)
80 m (262 ft)	18 m (59 ft)	13 m (44 ft)
75 m (246 ft)	22 m (72 ft)	17 m (57 ft)
70 m (230 ft)	27 m (89 ft)	22 m (71 ft)

Formulas: $C = (102 - H)/1.2$ $W = C - 5, <22m$

1. Multi User Telecommunication Outlets Assembly (MUTOA's)

MUTO assemblies shall use *MINI-COM*® Fiber/Multi-Media Surface Mount Boxes. The Surface Mount Boxes shall be **6 and 12** port surface mount boxes with all connections exiting one side of the box, parallel to the wall. The 6 and 12 port boxes shall contain a "captive" fiber spool that maintains a minimum 25.4 mm (1") bend radius. The 6 and 12 port boxes shall store up to 24 meters of buffered optical fiber. The boxes shall be capable of mounting with screws, adhesive, and/or magnets. The boxes shall include breakouts for use with *PAN-WAY*TM surface raceway on three sides and cable tie slots at each raceway entry point to provide strain relief on incoming cables. The 6 and 12 port boxes shall include tamper resistant screws that securely fasten the cover to the base and are concealed by screw covers and labels.

Each box shall accept individual connector modules that can be individually inserted and removed as required. All installed MUTOAs shall be marked with the maximum allowable length for the equipment cables.

2. Consolidation Points

Consolidation Points shall use ZONE CABLING BOXES to separate the barriers of plenum and non-plenum environments and the workspace. In-floor boxes shall be available in multiple sizes and mount into the allocated space for standard 24" x 24" raised floor panels, minimum 6" depth. In-ceiling boxes shall be available to accommodate 2' x 6' and 2' x 4' ceiling grids. All zone boxes shall support standard 19" patch panels and are plenum rated. Cable entry and exit openings should be no less than 11"W x 3.5"H x 3"D (279.4 x 88.9 x 76.2 mm). Each opening shall accommodate 96 4-pair UTP cables. The boxes shall be made of 14-gauge aluminum.

MINI-COM® Modular Patch Panels shall be of a metal design with snap in four position and six position molded faceplate frames. The patch panels shall be modular accepting all *MINI-COM* modules. The faceplate frames shall be releasable from the front to provide access to the modules and terminated cable. Modules shall be mounted to the patch panel using *MINI-COM* mounting features for added strength. Patch panels shall be available with and without labels

5.4 Horizontal Distribution Cabling

The horizontal distribution cabling system is the portion of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the horizontal cross-connect in the TR.

- Horizontal cabling in an office should terminate in a TR located on the same floor as the work area being served
- Horizontal cabling is installed in a star topology (home run)
- Bridged taps and splices are not permitted as part of the copper horizontal cabling

5.5 Telecommunication Room

The telecommunications room (TR) includes those products that connect the networking equipment to the horizontal and backbone cabling subsystems. These products include termination hardware (connectors and patch cords), racks, cable management products and cable routing products.

1) Cable Termination Hardware

Each horizontal or backbone cabling run will be terminated using appropriate connectors or connecting blocks depending upon the cable type. Matching patch cords will be used to perform cross-connect activities or to connect into the networking/voice hardware.

2) Category 6 Enhanced Unshielded Twisted Pair (UTP)

Four-pair Category 6 UTP cabling shall be terminated onto a four-pair Category 6 module. All modules shall be terminated using the T568B wiring scheme. The eight-position module shall exceed the connector requirements of the TIA/EIA Category 6 standard. The jack termination to 4-pair, 100 ohm solid unshielded twisted pair cable shall be accomplished by use of a forward motion termination cap and shall not require the use of a punchdown or insertion tool.

TX-6™ Patch Cords shall be used between modular patch panels configured as a cross-connect or between the patch panel and networking hardware when the patch is used as an interconnect. The patch cords shall be factory terminated with modular plugs featuring a one-piece, tangle-free latch design and black strain-relief boots to support easy moves, adds and changes. They shall be constructed with Category 6 24-AWG stranded UTP cable. Each patch cord shall be 100% performance tested at the factory in a channel test to the Category 6 standard.

DP6™ Patch Panels - Four-pair Category 6 UTP cabling shall be terminated onto four-pair punchdown style connecting hardware mounted to the rear of integral patch panels and routed to Category 6 modules on the front face of the patch panel. Patch panels shall be universal for T568A and T568B wiring configurations. The patch panels shall have a removable 6-port design that allows a 6-port module to be removed without disrupting the other ports. Integral cable tie mounts shall be included in the panel for cable management on the back of the panel. Port and panels shall be easy to identify with write-on areas and optional label holder for color-coded labels. Rack mountable patch panels shall mount to standard EIA 19" and 23" racks.

TX-6™ PATCH Cords shall be used between modular patch panels configured as a cross-connect or between the patch panel and networking hardware when the patch is used as an interconnect. The patch cords shall be factory terminated with modular plugs featuring a one-piece, tangle-free latch design and black strain-relief boots to support easy moves, adds and changes. They shall be constructed with Category 6 24-AWG stranded UTP cable. Each patch cord shall be 100% performance tested at the factory in a channel test to the TIA/EIA Category 6 standard. The patch cords shall come in standard lengths of 3, 5, 7, 9, 14, and 20 feet

3) Power over Ethernet (PoE)

The power midspan shall comply with IEEE 802.3af to provide power to compliant devices. The power midspan shall provide eight shielded RJ45 ports to accommodate incoming data and outgoing data combined with 48 VDC power output on pairs (1,2) and (3,6). A status LED for each port shall designate when the port is actively supplying power. An additional front mounted LED shall indicate overall power midspan status. Labeling sections above both port banks shall accommodate TIA-606-A compliant labeling. An RJ45 port on the rear provides network connectivity and access to management settings. The power midspan shielding shall maintain immunity to electromagnetic and radio frequency interference. Power midspan hubs shall be Panduit DPOE8S2XG.

PoE panels shall comply with IEEE 802.3af and to provide power to compliant devices, while supporting 1 GbE data throughput for higher bandwidth connections. The panels shall provide 24 RJ45 ports to accommodate incoming data connectivity. A status LED above each port shall designate when the port is actively supplying power. An additional front panel LED shall indicate overall panel status. Labeling sections above each of six ports shall accommodate TIA-606-A compliant labeling. Rear 110 punchdown connections shall accommodate TIA 568A and TIA 568B wiremap and 48 VDC power output on pairs (1, 2) and (3, 6) and data on all pairs. Two RJ45 ports in the rear shall allow for network connectivity and management. PoE panels shall be Panduit DPOE24U1XG.

The power system shall occupy 1 RU of space. The power system shall accommodate modular rectifiers capable of supplying from 500W to 3,750W through combinations of 10A and 25A rectifier modules. All rectifier modules shall support 48 VDC output voltages. The power supply chassis shall accommodate up to three interchangeable rectifier modules. The rectifiers shall be hot pluggable and shall load share to meet versatile power needs. The chassis and panel combination shall operate at 93% efficiency. The power supply chassis shall be Panduit DPOEPWRCU. The rectifier modules shall be Panduit DPOEPWRR500 (500 watt) or DPOEPWRR1250 (1250 watt)

4) Grounding and Bonding

The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways,

and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/J-STD-607-A Telecommunications Bonding and Grounding Standard.

The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

5) Fire stop

A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the firestop system(s).

Part 6 - Execution

6.1 Work Area Outlets

Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 36" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely configured and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-C document, manufacturer's recommendations and best industry practices.

Pair untwist at the termination shall not exceed 3.18mm (0.125 inch).

Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.

The cable jacket shall be maintained to within 25mm (one inch) of the termination point.

Data jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).

Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

6.2 Horizontal Distribution Cable Installation

Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.

A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

Cable raceways shall not be filled greater than the TIA/EIA-569-A maximum fill for the particular raceway type

Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

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.

The cable's minimum bend radius and maximum pulling tension shall not be exceeded.

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.

Horizontal distribution cables shall be bundled in groups of no more than 25 cables. Cable bundle quantities in excess of 25 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

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.

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.

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.

Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. 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.

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.

Pulling tension on 4-pair UTP cables shall not exceed 25-lbf for a four-pair UTP cable.

6.3 Vertical Outlet Pole and Surface Raceway

- A. Vertical outlet poles and Surface Raceway refers to a surface raceway system used for branch circuit wiring and/or data network, voice, video and other low-voltage cabling. Surface raceway shall be used in solid wall applications or for applications where moves, additions and changes are very typical to the workflow.
- B. The raceway system shall consist of raceway, appropriate fittings and accessories to complete installation per electrical drawings. Non-metallic surface raceway is to be utilized in dry interior locations only as covered in Article 352, part B of the NEC, as adopted by the NFPA and as approved by the ANSI.
- C. Equivalent Products - Panduit shall manufacture all raceway products, including but not limited to those listed below. The raceway shall conform to the manufacturing and compatibility requirements listed in appendix E and there will be no substitutions allowed.

6.4 Horizontal Cross connect Installation

Cables shall be dressed and terminated in accordance with the recommendations made in the

TIA/EIA-568-C standard, manufacturer's recommendations and best industry practices.

Pair untwist at the termination shall not exceed 3.18 mm (0.125 inch).

Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

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.

The cable jacket shall be maintained as close as possible to the termination point.

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.

6.5 Copper Termination Hardware

Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA-568-C standard, manufacturer's recommendations and best industry practice.

Pair untwist at the termination shall not exceed 3.18mm (0.125 inch). Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

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.

The cable jacket shall be maintained to within 25 mm (one inch) of the termination point.

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.

6.6 Racks

Racks shall be securely attached to the concrete floor using minimum 3/8" hardware or as required by local codes.

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.

All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 2.4 of this document.

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.

Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of white fire retardant paint.

Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.

6.7 Fire stop System

All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance. The firestop solution must be DHEC approved.

6.8 Grounding System

The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the J-STD-607-A standard, and shall be installed in accordance with best industry practice.

A licensed electrical contractor shall perform installation and termination of the main bonding conductor to the building service entrance ground.

6.9 Identification and Labeling

1. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
2. All label printing will be machine generated by Panduit PanMark software and Panduit desktop and hand-held printers using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

6.10 Testing and Acceptance

A. General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C-1 Section 11. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the PANDUIT® **CERTIFICATION PLUS**SM System Warranty guidelines and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

B. Copper Channel Testing

All twisted-pair copper cable links shall be tested for compliance to the requirements in ANSI/TIA/EIA/568-C.2 for the appropriate Category of cabling installed.

Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm

6.11 System Documentation

- A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer/End User for approval. Documentation shall include the items detailed in the sub-sections below.
- B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.
- C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the

Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

- D. **Test Results** documentation shall be provided in electronic format within three weeks after the completion of the project. The media shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
- E. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-C. The appropriate level III tester shall be used to verify Category 6 cabling systems.
- F. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. Alternately, the telecommunications contractor may furnish this information in electronic form. The media shall contain the electronic equivalent of the test results as defined by the specification along with the software necessary to view and evaluate the test reports.
- G. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.
- H. The **As-Built** drawings are to include cable routes and outlet locations. Their sequential number as defined elsewhere in this document shall identify outlet locations. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD rel. 14) formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.
- I. The Contractors shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD rel. 14) form

END OF SECTION



CSI SECTION 271323

COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a standard specification applicable to commercial building structured cabling applications.

The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines.

The information contained in this document is based on our experience to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be used with their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements consult the factory. This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supercedes and voids all previous literature, etc.

It is highly recommended and the issuers responsibility to have any RFQ documents, including those based on this general format, reviewed by the issuing company's professional advisors before it is released to the public. In no way may this document be used in a manner that is detrimental to the interests of Panduit and/or its subsidiaries

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Section 271323

COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING REQUIREMENTS

General

Work Included

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

Scope of Work

This document describes the products and execution requirements relating to furnishing and installing Telecommunications Cabling for the backbone cabling comprised of Optical Fiber Cabling, and support systems are covered under this document.

Install a structured cabling system that will be able to support interconnections to active telecommunications equipment for voice and data applications in a multi vendor, multi product environment. The structured cabling system should adhere to ANSI/TIA/EIA 568 B; 569-A; 606-A; J-STD-607-A and EIA/TIA 942 standards with respect to pathways, distribution, administration, and grounding of the system. The structured cabling system to be installed should also follow the guidelines spelled out in this RFP in accordance to local codes and regulations.

The floor serving active data equipment will be interconnected to the facility serving data equipment via a fiber backbone terminated in 19" rack mounted 48 port enclosures which will utilize SC or LC connections. This will serve to connect the Main Telecommunications Room to an additional Telecommunications Room serving the locations that exceed the distance limitations (90 meters) of the Main Telecommunications Room for the horizontal Data and Voice drops.

Contractor will also be required to make matching additions to the cable tray to complete the system according to ANSI/TIA/EIA 569

This section includes minimum requirements for the following:

- Optical Fiber from Entrance Facility to Equipment Room
- Optical Fiber from Equipment Room to Telecommunications Room
- Optical Fiber from Telecommunications Room to Telecommunications Room
- Fiber WA Patch Cords
- Optical Fiber Connector Modules

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.

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, formal clarification shall be obtained from in the form of Question Clarification Request. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

Regulatory References

The following industry standards are the basis for the structured cabling system described in this document.

ANSI/TIA/EIA

- | | |
|-------------------|---|
| • TIA/EIA-568-B | Commercial Building Telecommunications Cabling Standard |
| • TIA/EIA-568-B.1 | General Requirements |
| • TIA/EIA-568-B.2 | Balanced Twisted Pair Cabling Components Standard |
| • TIA/EIA-568-C.3 | Optical Fiber Cabling Components Standard |
| • TIA/EIA - 942 | Telecommunications Infrastructure for Data Centers |
| • TIA/EIA-569-A | Commercial Building Standard for Telecom Pathways and Spaces |
| • TIA/EIA-606-A | Administration Standard for the Telecommunications Infrastructure of Commercial Buildings |

- J-STD-607-A Commercial Building Grounding/Bonding Requirements
- NFPA
- NFPA 70 National Electric Code (NEC)
- ISO/IEC
- ISO 11801 Generic Cabling for Customer Premises

If there is a conflict between applicable documents, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.

This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

Quality Assurance

Cabling System Warranty

A Cable Products Warranty shall provide a complete warranty to guarantee a high performance cabling systems that meet application requirements. The guarantee shall include all cable installed in the structured cabling system. The Cable shall be warranted for a period of at least 25 years.

PANDUIT *System Warranty*

A **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 copper connectivity components. The system shall be warranted for a period of at least 25 years.

Product Guarantee

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.

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. Panduit will provide a single source solution for the end-to-end installation
3. Panduit Products must be installed per Panduit instruction sheets by a BICSI certified Installer with minimum agreement of Panduit Certified Installer by Panduit Corp.

Installer: Company specializing in installing products specified in this section with minimum three years documented experience, and with service facilities within 120 miles of project. The Electrical/Telecommunications contractor must be Panduit Corp. approved for cabling and fiber solutions – a qualified BICSI trained installer who also is certified to install Warrantee-able solution by Panduit Corp.. A copy of certification documents for each must be submitted with the quote in order for such quote to be valid.

The Electrical/Telecommunications contractor is responsible for workmanship and installation practices in accordance with the Panduit cabling solutions Certified Program. Manufacturer (Panduit) will extend a 25-year Static, Dynamic and Applications Warranty to the end user once the Electrical/Telecommunications contractor fulfills all requirements under the Panduit Cabling Solutions Certified Program. At least 30 percent of the installation and termination crew must be certified by Panduit with a Technicians Level of Training. Also, Panduit must certify 10 percent of the installation and termination crew for Optical Fiber Training.

Note: All Networks shall be installed per applicable standards and manufacturer's guidelines.

If any *PANDUIT PAN-NET*™ product fails to perform as stated above, *PANDUIT* will provide new components at no charge.

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.

Approved Products

Approved Optical Fiber Cable manufacturer: **Panduit**
Approved Fiber Optic cabinet product manufacturer: Panduit
Approved Fiber Optic connectors/splices/couplers: Panduit
Approved Rack and Cabinet manufacturer: Panduit
Approved Patch Cord manufacture: Panduit

Products

Equivalent Products

Panduit shall manufacture all products, including but not limited to cable management, faceplates, copper modules, patch panels, racks, 110 blocks, patch cords, labels, grounding lugs and fiber connectivity products for the purpose of this document.

Panduit Corp. shall manufacture all data/telecommunication and fiber optic cable.

Substitutions – (no exceptions)

This is a performance-based single source solution. Therefore, substitutions are highly discouraged. Substitutions must follow the same rigid standards for quality and termination style as those described in section 2.3 and 2.5.

Any Contractor wishing to offer structured cabling products other than those specified herein shall submit a request for product substitution in writing no less than one week in advance of bid.

Written requests for substitution shall be accompanied by all drawings, specification sheets and engineering documents, as well as third party laboratory performance test results proving equivalency in performance and manufacturing style.

This written documentation shall be accompanied by samples of the substitution product offered for evaluation. Equal product acceptance must be received in writing.

Contractor shall be responsible and assume all costs for removal and replacement of any substituted product installed without prior written approval. Such costs shall include, but not be limited to labor, materials as well as any penalties, fees or costs incurred for late completion.

Fiber Optics

Indoor Cable

Indoor Interlocking Armored Cable

PANDUIT® OPTI-CORE® Fiber Optic Indoor Interlocking Armored Cable is an integral part of the PANDUIT end-to-end fiber optic solution, designed to support today's data needs while meeting tomorrow's ever-advancing network requirements. OPTI-CORE® Fiber Optic Indoor Interlocking Armored Cable is used within buildings to provide high-density connectivity and ease of installation. Interlocking aluminum armor eliminates the need for inner duct or conduit to provide a smaller crush resistant pathway for improved design flexibility and lower installed cost. Applications include intrabuilding backbones, building backbones, and horizontal installations for riser (OFNR), plenum (OFNP), and harsh environments. OPTI-CORE® 10GIG™ Fiber Optic Indoor Interlocking Armored Cable features the highest quality OM4 fiber to support 10Gb/s applications while maintaining compatibility with existing 50µm multimode systems. RoHS compliant singlemode and multimode cable is available in fiber counts from 6 to 144 fibers.

Technical Information

Standard Requirements:	RoHS compliant
Fiber Compatibility	62.5/125µm OM1, 50/125µm OM2, 10GIG™ 50/125µm OM3 and OM4 and 9/125µm OS1/OS2
Bend Radius:	Riser: Dynamic: 15 x Cable O.D. Static: 10 x Cable O.D. Plenum: Dynamic: 15 x Cable O.D. Static: 10 x Cable O.D.
Tensile rating (<12 fibers):	Riser: Installation: 150 lbs. (667 N) Long term: 45 lbs. (200 N) Plenum: Installation: 100 lbs. (445 N) Long term: 30 lbs. (133N)
Tensile rating (>12 fibers):	Riser: Installation: 300 lbs. (1334 N) Long term: 90 lbs. (400N) Plenum: Installation: 150 lbs. (667 N) Long term: 45 lbs. (200N)
Storage temperature:	-40° to 185°F (-40° to 85°C)
Installation temperature:	Riser: -4° to 140°F (-20° to 60°C) Plenum: 32° to 140°F (0° to 60°C)

Operation temperature: -40° to 167°F (-40° to 75°C)
 Attenuation: Singlemode: 0.7dB/km @ 1310 and 1550nm
 Multimode: 3.5dB/km @ 850nm; 1.5dB/km @ 1300nm

Aluminum interlocking armor: Provides superior crush resistance and eliminates the need for inner duct or conduit with a smaller pathway for improved design flexibility and lower installed cost

Ordering Information

Part Number	Cable Type	Rating	Color
FSPR6**Y	62.5/125um (OM1) MM	Riser	Orange
FSPR5**Y	50/125um (OM2) MM		
FOPRX**Y	10Gig 50/125um (OM3) MM		Aqua
FOPRZ**Y	10Gig 50/125um (OM4) MM		Aqua
FSPR9**Y	9/125um (OS1/OS2) SM		Yellow
FSP6**Y	62.5/125um (OM1) MM	Plenum	Orange
FSP5**Y	50/125um (OM2) MM		
FOPPX**Y	10Gig 50/125um (OM3) MM		Aqua
FOPRZ**Y	10Gig 50/125um (OM4) MM		Aqua
FSP9**Y	9/125um (OS1/OS2) SM		Yellow

Distribution Cable

PANDUIT® OPTI-CORE® Fiber Optic Distribution Cable is an integral part of the PANDUIT end-to-end fiber optic solution, designed to support today's data needs while meeting tomorrow's ever-advancing network requirements. OPTI-CORE® Fiber Optic Distribution Cable is used within buildings to provide high-density connectivity and ease of installation. Applications include intrabuilding backbones, routing between telecommunications rooms and connectorized cables in riser and plenum environments. OPTI-CORE® 10GIG™ Fiber Optic Distribution Cable features the highest quality OM3 and OM4 to support 10Gb/s applications while maintaining compatibility with existing 50µm multimode systems. Standard RoHS compliant singlemode and multimode distribution cable is available in fiber counts from 6 to 72 fibers. Distribution cable in 6 and 12 fiber stranded designs have 900µm tight-buffered fibers surrounded by an aramid yarn strength member. Larger distribution cable (24 fibers and greater) features a sub-unit design that simplifies fiber identification, provides easy access and routing of the fibers and increases cable durability with a dielectric central strength member.

Technical Information

Standards Requirements: Telcordia GR-20, Issue 2, GR-409 and with relevant EIA/TIA-455 series FOTPs for fiber optic cables

Fiber Compatibility: 62.5/125µm OM1, 50/125µm OM2, 10GIG™ 50/125µm OM3 and OM4 and 9/125µm OS1/OS2

Bend radius: **Riser:** Dynamic: 20 x Cable O.D. Static: 10 x Cable O.D.
Plenum: Dynamic: 20 x Cable O.D. Static: 10 x Cable O.D.

Tensile rating (<12 fibers): **Riser:** Installation: 150 lb. (660 N) Long Term: 37 lb. (165 N)
Plenum: Installation: 100 lb. (440 N) Long Term: 24 lb. (100 N)

Tensile rating (>12 fibers): **Riser:** Installation: 300 lb. (1300 N) Long Term: 74 lb. (330 N)
Plenum: Installation: 150 lb. (660 N) Long Term: 37 lb. (165 N)

Storage temperature: -40° to 150°F (-40° to 65°C)

Installation temperature: **Riser:** -4° to 122°F (-20° to 50°C)
Plenum: 32° to 122°F (0° to 50°C)

Operation temperature: **Riser:** -4° to 122°F (-20° to 50°C)
Plenum: 32° to 122°F (0° to 50°C)

Attenuation: Singlemode: 0.7dB/km @ 1310 & 1550nm
 Multimode: 3.5dB/km @ 850nm; 1.5dB/km @ 1300nm

Buffered fibers: High quality buffering offers ease of stripping while maintaining optical performance

Standard designs available: Riser (OFNR) and plenum (OFNP) rated versions
 Singlemode (OS1/OS2) and multimode (OM1, OM2, OM3 and OM4 fiber

Ordering Information

Part Number	Cable Type	Rating	Construction Type	Color
FSDR6**Y	62.5/125um (OM1) MM	Riser	Subunits of six fibers for 36f count cables and subunits of 12f for 48f or greater	Orange
FSDR5**Y	50/125um (OM2) MM			Aqua
FODRX**Y	10Gig 50/125um (OM3) MM			Aqua
FODRZ**Y	10Gig 50/125um (OM4) MM			Yellow
FSDR9**Y	9/125um (OS1/OS2) SM			Orange
FSDP6**Y	62.5/125um (OM1) MM	Plenum		Aqua
FSDP5**Y	50/125um (OM2) MM			Aqua
FODPX**Y	10Gig 50/125um (OM3) MM			Yellow
FODPZ**Y	10Gig 50/125um (OM4) MM			
FSDP9**Y	9/125um (OS1/OS2) SM			

** Denotes fiber count in 2,4,6,8,12, 24,36, 48, and 72 counts

Outdoor Cable

Indoor/Outdoor Gel-Free Interlocking Armored Cable

PANDUIT® OPTI-CORE® Fiber Optic Indoor/Outdoor Interlocking Armored Cable is an integral part of the PANDUIT end-to-end fiber optic solution, designed to support today's data needs while meeting tomorrow's ever-advancing network requirements. OPTI-CORE® Fiber Optic Indoor/Outdoor Interlocking Armored Cable provides UV resistance, water-blocking, high density and easy installation in transitional aerial and duct applications and entrance facilities. Interlocking aluminum armor eliminates the need for inner duct and conduit to provide a smaller crush resistant pathway for improved design flexibility and lower installed cost. RoHS compliant singlemode and multimode cable is available in fiber counts up to 12 fibers as a "central tube" design and up to 144 fibers as a "stranded tube" design.

Technical Information

Standards Requirements:	Telcordia GR-20, Issue 2, GR-409 and with relevant EIA/TIA-455 series FOTPs for fiber optic cables
Fiber Compatibility:	62.5/125µm OM1, 50/125µm OM2, 10GIG™ 50/125µm OM3, OM4 and 9/125µm OS1/OS2
Bend Radius	Dynamic: 15 x Cable O.D. Static: 10 x Cable O.D.
Tensile rating (<12 fibers):	Installation: 300 lbs. (1334 N) Long term: 90 lbs. (400 N)
Tensile rating (>12 fibers):	Installation: 600 lbs. (2669 N) Long term: 180 lbs. (801 N)
Storage temperature:	-40° to 185°F (-40° to 85°C)
Installation temperature:	Riser: -4° to 140°F (-20° to 60°C) Plenum: 32° to 140°F (0° to 60°C)
Operation temperature:	Riser: -40° to 167°F (-40° to 75°C) Plenum: -40° to 167°F (-40° to 75°C)
Attenuation:	Singlemode: 0.7dB/km @ 1310 and 1550nm Multimode: 3.5dB/km @ 850nm; 1.5dB/km @ 1300nm
Aluminum interlocking armor:	Provides superior crush resistance and eliminates the need for inner duct or conduit with a smaller pathway for improved design flexibility and lower installed cost
Indoor/outdoor design:	Allows installation using typical loose tube cable methods; saves space and time by eliminating splices at the cable vault
UV resistant cable sheathing:	Meets the light absorption requirement defined by GR-20 and withstands harsh outdoor environmental demands
Dry water-blocking technology:	Allows rapid cable preparation and termination for lower installation costs and time (no messy gel required)

Ordering Information

Part Number	Cable Type	Rating	Construction Type	Color		
FSGR6**Y	62.5/125um (OM1) MM	Riser	Central	Black		
FSMR6**Y			Stranded			
FSGR5**Y	50/125um (OM2) MM		Central			
FSMR5**Y			Stranded			
FOGRX**Y	10Gig 50/125um (OM3) MM		Central			
FOMRX**Y			Stranded			
FOGRZ**Y	10Gig 50/125um (OM4) MM		Central			
FOMRZ**Y			Stranded			
FSGR9**Y	9/125um (OS1/OS2) SM		Central			
FSMR9**Y			Stranded			
FSGP6**Y	62.5/125um (OM1) MM		Plenum		Central	Orange
FSMP6**Y					Stranded	
FSGP5**Y	50/125um (OM2) MM	Central				
FSMP5**Y		Stranded				
FOGPX**Y	10Gig 50/125um (OM3) MM	Central		Aqua		
FOMPX**Y		Stranded				
FOGPZ**Y	10Gig 50/125um (OM4) MM	Central				
FOMPZ**Y		Stranded				
FSGP9**Y	9/125um (OS1) SM	Central		Yellow		
FSMP9**Y		Stranded				

** Denotes fiber count in 2, 4, 6, 8,12 in central tube design and 24, 36, 48, 72, 96, and 144 count in stranded tube design

Indoor/Outdoor Gel-Free All-Dielectric Cable

PANDUIT® OPTI-CORE® Fiber Optic Indoor/Outdoor Cable is an integral part of the PANDUIT end-to-end fiber optic solution, designed to support today's data needs while meeting tomorrow's ever-advancing network requirements. This riser rated cable provides water-blocking, high density and easy installation in transitional aerial and duct applications, and entrance facilities. OPTI-CORE® 10GIG™ Fiber Optic Indoor/Outdoor Cable features the highest quality OM4 fiber to support 10Gb/s applications while maintaining compatibility with existing 50um multimode systems. Standard RoHS compliant multimode and singlemode indoor/outdoor cables are available in fiber counts up to 12 fibers as a "central tube" design and up to 144 fibers as a "stranded tube" design.

Technical Information

Standards Requirements:	Telcordia GR-20, Issue 2, GR-409 and with relevant EIA/TIA-455 series FOTPs for fiber optic cables
OFNR and OFN-FT4 flame rated:	Riser rated design meets UL1666 for standard compliant safety
Fiber Compatibility:	62.5/125um OM1, 50/125um OM2, 10GIG™ 50/125um OM3, OM4 and 9/125um OS1/OS2
Bend radius:	Dynamic: 20 x Cable O.D.; Static: 10 x Cable O.D.
Tensile rating (<12 fibers):	Installation: 400 lb. (1800 N); Long Term: 180 lb. (800N)
Tensile rating (>12 fibers):	Installation: 600 lb. (2700 N); Long Term: 80 lb. (800 N)
Storage temperature:	-40° to 167°F (-40° to 75°C)
Installation temperature:	-22° to 140°F (-30° to 60°C)
Operation temperature:	-40° to 158°F (-40° to 70°C)
Attenuation:	Singlemode: .40/.30dB/km @ 1310nm/1550nm Multimode: 3.5/1.5dB/km @ 850nm/1300nm
Dry water-blocking technology:	Allows rapid cable preparation and termination; lower installation costs and time (no messy gel required)
Flexible buffer tube:	Superior kink resistance and increased flexibility facilitates route management in closures; eliminates need for closure transportation tubing

All Dielectric Construction:

No metallic elements to bond or ground for applications where armor is not permitted; provides easy access to cable core

Ordering Information

Part Number	Cable Type	Rating	Construction Type	Color	
FSCR6**Y	62.5/125um (OM1) MM	Riser	Central	Orange	
FSNR6**Y			Stranded		
FSCR5**Y	50/125um (OM2) MM		Central		
FSNR5**Y			Stranded		
FOCRX**Y	10Gig 50/125um (OM3) MM		Central	Aqua	
FONRX**Y			Stranded		
FOCRZ**Y	10Gig 50/125um (OM4) MM		Central		
FONRZ**Y			Stranded		
FSCR9**Y	9/125um (OS1/OS2) SM		Central	Black	
FSNR9**Y			Stranded		
FSCP6**Y	62.5/125um (OM1) MM		Plenum	Central	Orange
FSNP6**Y				Stranded	
FSCP5**Y	50/125um (OM2) MM	Central			
FSNP5**Y		Stranded			
FOCPX**Y	10Gig 50/125um (OM3) MM	Central		Aqua	
FONPX**Y		Stranded			
FOCPZ**Y	10Gig 50/125um (OM4) MM	Central			
FONPZ**Y		Stranded			
FSCP9**Y	9/125um (OS1/OS2) SM	Central		Yellow	
FSNP9**Y		Stranded			

** Denotes fiber count in 2, 4, 6, 8,12 in central tube design and 24, 36, 48, 72, 96 and 144 count in stranded tube design

Outside Plant Armored Cable

PANDUIT® OPTI-CORE® Fiber Optic Outside Plant Cable is an integral part of the PANDUIT end-to-end fiber optic solution, designed to support today's data needs while meeting tomorrow's ever-advancing network requirements. This armored cable offers crush resistance for direct buried applications in addition to aerial and duct applications.

OPTI-CORE® 10GIG™ Fiber Optic Outside Plant Armored Cable features the highest quality OM4 fiber to support 10Gb/s applications while maintaining compatibility with existing 50µm multimode systems. Standard RoHS compliant multimode and singlemode outdoor cables are available in fiber counts up to 144 fibers as a "stranded tube" design.

Technical Information

Standards Requirements:	Telcordia GR-20, Issue 2, and ICEA 640 to withstand harsh outdoor environments.
Fiber Compatibility:	62.5/125µm OM1, 50/125µm OM2, 10GIG™ 50/125µm OM3 and OM4 and 9/125µm OS1/OS2
Outdoor Design:	Offers water blocking for aerial and duct applications for standards compliance and flexibility for outdoor use.
UV resistant cable sheathing:	Protects cable and meets the light absorption requirement defined by Standards
Bend radius:	Dynamic: 20 x Cable O.D.; Static: 10 x Cable O.D.
Tensile rating:	Installation: 600 lb. (2700 N); Long Term: 180 lb. (800N) a
Storage temperature:	-40° to 167°F (-40° to 75°C)
Installation temperature:	-22° to 140°F (-30° to 60°C)
Operation temperature:	-40° to 158°F (-40° to 70°C)
Attenuation:	Singlemode: .75 dB/km @ 1310nm/1550nm

Dry water-blocking technology: Multimode: 3.5/1.5dB/km @ 850nm/1300nm
Allows rapid cable preparation and termination; lower installation costs and time (no messy gel required)

Flexible buffer tube: Superior kink resistance and increased flexibility facilitates route management in closures; eliminates need for closure transportation tubing

Ordering Information

Part Number	Cable Type	Rating	Color
FSWN6**	62.5/125um (OM1) MM	Armored	Black
FSWN5**	50/125um (OM2) MM		
FOWNX**	10Gig 50/125um (OM3) MM		
FOWNZ**	10Gig 50/125um (OM4) MM		
FSWN9**	9/125um (OS1) SM		

** Denotes fiber count in 6, 12, 24, 36, 48, 72, 96 and 144 count.

Outside Plant All-Dielectric Cable

PANDUIT® OPTI-CORE® Fiber Optic Outside Plant All-Dielectric Cable is an integral part of the PANDUIT end-to-end fiber optic solution, designed to support today’s data needs while meeting tomorrow’s ever-advancing network requirements. This all-dielectric cable offers UV resistance water-blocking technology and high density for aerial and duct applications standards compliance and flexibility for outdoor use. OPTI-CORE® 10GIG™ Fiber Optic Outside Cable features the highest quality OM4 fiber to support 10Gb/s applications while maintaining compatibility with existing 50µm multimode systems. Standard RoHS compliant multimode and singlemode outdoor cables are available in fiber counts up to 144 fibers as a “stranded tube” design.

Technical Information

Standards Requirements: Telcordia GR-20, Issue 2, and ICEA 640 to withstand harsh outdoor environments

Fiber Compatibility: 62.5/125µm OM1, 50/125µm OM2, 10GIG™ 50/125µm OM3 and OM4 and 9/125µm OS1/OS2

Outdoor Design: Offers water blocking for aerial and duct applications for standards compliance and flexibility for outdoor use.

UV resistant cable sheathing: Protects cable and meets the light absorption requirement defined by Standards

All Dielectric Construction: No metallic elements to bond or ground for applications where armor is not permitted; provides easy access to cable core

Bend radius: Dynamic: 20 x Cable O.D.; Static: 10 x Cable O.D.

Tensile rating: Installation: 600 lb. (2700 N); Long Term: 180 lb. (800N) a

Storage temperature: -40° to 167°F (-40° to 75°C)

Installation temperature: -22° to 140°F (-30° to 60°C)

Operation temperature: -40° to 158°F (-40° to 70°C)

Attenuation: Singlemode: .75 dB/km @ 1310nm/1550nm
Multimode: 3.5/1.5dB/km @ 850nm/1300nm

Dry water-blocking technology: Allows rapid cable preparation and termination; lower installation costs and time (no messy gel required)

Flexible buffer tube: Superior kink resistance and increased flexibility facilitates route management in closures; eliminates need for closure transportation tubing

Ordering Information

Part Number	Cable Type	Rating	Color
FSTN6**	62.5/125um (OM1) MM	Dielectric	Black
FSTN5**	50/125um (OM2) MM		
FOTNX**	10Gig 50/125um (OM3) MM		
FOTNZ**	10Gig 50/125um (OM4)		
FSTN9**	9/125um (OS1/OS2) SM		

** Denotes fiber count in 6, 12, 24, 36, 48, 72, 96 and 144 count

Telecommunication Room

The telecommunications room (TR) includes those products that connect the networking equipment to the horizontal and backbone cabling subsystems. These products include termination hardware (connectors and patch cords), racks, cable management products and cable routing products.

Fiber Termination Hardware

LC Fiber Optic Connectors

LC Fiber Optic Connectors – Field Polish Termination

LC small form factor (SFF) field polish connectors with rear pivot latch are TIA/EIA-604 FOCIS-10 compatible. LC simplex and duplex connectors are field terminable. The fibers shall terminate in 1.25mm ceramic ferrules with non-optical disconnect functionality and an average insertion loss of .1dB per mated pair for multimode and singlemode fiber

Technical Information

Standard Requirements: TIA/EIA-604 FOCIS-10 compatible; exceeds TIA/EIA-568-B.3 requirements

Fiber compatibility: 62.5/125µm OM1, 50/125µm OM2, 10GIG™ 50/125µm OM3, OM4 and 9/125µm OS1/OS2

Fiber cable type: 900µm tight-buffered cable recommended

Fiber cable size: 1.6mm – 2.0mm jacketed cable

Ferrule type: Zirconia ceramic ferrule

Insertion loss: .1dB average (multimode and singlemode)

Return loss: >20dB (multimode), >40dB (singlemode)

Ordering Information

Part Number	Connector Type	Cable Type	Fiber	Ferrule
FLCSMEI	Simplex	900µm buffered fiber and 1.6mm – 2.0mm jacketed cable	MM	Zirconia Ceramic
FLCDMEI	Duplex	1.6mm – 2.0mm jacketed cable		
FLCDM900EI	Duplex	900µm buffered fiber		
FLCSSBU	Simplex	900µm buffered fiber and 1.6mm – 2.0mm jacketed cable	SM	Zirconia Ceramic
FLCDSBU	Duplex	1.6mm – 2.0mm jacketed cable		
FLCDS900BU	Duplex	900µm buffered fiber		

LC Pre-Polished OptiCam® Fiber Optic Connectors- Pre-Polished Cam Termination

LC small form factor (SFF) pre-polished connectors with rear pivot latch shall be TIA/EIA-604 FOCIS-10 compatible and contain a factory-terminated fiber, eliminating field polishing and adhesive. LC pre-polished

connectors shall have an average insertion loss of 0.3dB per mated pair for multimode fiber. LC pre-polished connectors shall captivate fiber and buffer in one action allowing for up to two re-terminations with no degradation in performance

Technical Information

Standards requirements: TIA/EIA-604 FOCIS-10 compatible; exceeds TIA/EIA-568-B.3 requirements
Fiber compatibility: 62.5/125µm OM1, 50/125µm OM2, 10GIG™ 50/125µm laser optimized OM3 and 9/125µm OS1
Fiber cable type: 900µm tight-buffered cable only
Fiber cable size: 1.6mm – 2.0mm and 3.0mm jacketed cable with optional boots
Ferrule type: Zirconia ceramic with a pre-polished fiber stub
Insertion loss: Ceramic: 0.3dB average (multimode and singlemode)
Return loss: Ceramic: >20dB (multimode), >26dB (10GIG™ multimode), >50dB (singlemode)

Ordering Information

Part Number	Connector Type	Ferrule Material	Fiber	Ferrule Finish
FLCSMCXAQY	Simplex	Zirconia Ceramic	10 GbE OM3/OM4	SPC
FLCDMCXAQY	Duplex			
FLCSMC5BLY	Simplex	Zirconia Ceramic	50/125um OM2	SPC
FLCDMC5BLY	Duplex			
FLCSMC6BLY	Simplex	Zirconia Ceramic	62.5/125um OM1	SPC
FLCDMC6BLY	Duplex			
FLCSSCBUY	Simplex	Zirconia Ceramic	9/125um OS1/OS2	UPC
FLCDSCBUY	Duplex			

LC Pre-Polished Keyed Opticam Fiber Optic Connectors – Pre-Polished Cam Termination

LC small form factor (SFF) field polish connectors that come in eighteen different keying features and colors. LC simplex connectors are field terminable. The fibers shall terminate in 1.25mm ceramic ferrules with non-optical disconnect functionality and an average insertion loss of 0.1dB per mated pair for multimode and singlemode fiber

Technical Information

Standard Requirements: Exceeds TIA/EIA-568-B.3 requirements
Fiber compatibility: 62.5/125µm OM1, 50/125µm OM2, 10GIG™ 50/125µm OM3, OM4 and 9/125µm OS1/OS2
Fiber cable type: 900µm tight-buffered cable recommended
Fiber cable size: 1.6mm – 2.0mm jacketed cable
Ferrule type: Zirconia ceramic ferrule
Insertion loss: 0.3dB average (multimode and singlemode)
Return loss: >26dB (10G multimode) , >20dB (multimode), >50dB (singlemode)

Ordering Information

Part Number	Connector Type	Cable Type
FLCSMCX***	Simplex	10G 50/125um OM3/OM4
FLCSMC5***	Simplex	50/125um OM2
FLCSMC6***	Simplex	62.5/125um OM1
FLCSSC***	Simplex	9/125um OS1/OS2

Replace the X with a 5 = OM2, 6 = OM1

***ABL = Black, BRD =Red, CGR=Green, DYL=Yellow, EOR=Orange, FBL=Blue, GVL=Violet, HAQ=Aqua, JRO=Rose, KIG=Slate, LLB=Brown, PWT=White, QCG=Charcoal, RLV=Lavender, SPE=Peach, TSB=Blue Steel, VMA=Maroon, WMI=Mint

LC Pre-Polished OptiCam® Fiber Optic Connectors- Pre-Polished Cam Termination

LC small form factor (SFF) pre-polished connectors with rear pivot latch shall be TIA/EIA-604 FOCIS-10 compatible and contain a factory-terminated fiber, eliminating field polishing and adhesive. LC pre-polished connectors shall have an average insertion loss of 0.3dB per mated pair for multimode fiber. LC pre-polished connectors shall captivate fiber and buffer in one action allowing for up to two re-terminations with no degradation in performance

Technical Information

Standards requirements: TIA/EIA-604 FOCIS-10 compatible; exceeds TIA/EIA-568-B.3 requirements
Fiber compatibility: 62.5/125µm OM1, 50/125µm OM2, 10GIG™ 50/125µm OM3, OM4 and 9/125µm OS1/OS2
Fiber cable type: 900µm tight-buffered cable only
Fiber cable size: 1.6mm – 2.0mm and 3.0mm jacketed cable with optional boots
Ferrule type: Zirconia ceramic with a pre-polished fiber stub
Insertion loss: Ceramic: 0.3dB average (multimode and singlemode)
Return loss: Ceramic: >20dB (multimode), >26dB (10GIG™ multimode), >50dB (singlemode)

Ordering Information

Part Number	Connector Type	Ferrule Material	Fiber	Ferrule Finish
FLCSMCXAQY	Simplex	Zirconia Ceramic	10 GbE OM3/OM4	SPC
FLCDMCXAQY	Duplex			
FLCSMC5BLY	Simplex	Zirconia Ceramic	50/125um OM2	SPC
FLCDMC5BLY	Duplex			
FLCSMC6BLY	Simplex	Zirconia Ceramic	62.5/125um OM1	SPC
FLCDMC6BLY	Duplex			
FLCSSCBUY	Simplex	Zirconia Ceramic	9/125um OS1/OS2	UPC
FLCDSCBUY	Duplex			

SC Fiber Optic Connectors

SC Fiber Optic Connectors – Field Polish Termination

SC field polish connectors are TIA/EIA-604 FOCIS-3 compliant. SC simplex and duplex connectors are field terminable. The fibers shall terminate in 2.5mm ceramic ferrules with non-optical disconnect functionality and an average insertion loss of .1dB (multimode) and .15dB (singlemode) per mated pair.

Technical Information

Standards requirements: TIA/EIA-604 FOCIS-3 compliant; exceeds TIA/EIA-568-B.3 requirements
Fiber compatibility: 62.5/125µm OM1, 50/125µm OM2, 10GIG™ 50/125µm OM3, OM4 and 9/125µm OS1/OS2
Fiber cable type: 900µm tight-buffered cable recommended
Fiber cable size: 3.0mm or 1.6mm – 2.0mm jacketed cable
Ferrule type: Zirconia ceramic ferrule
Insertion loss: .1dB average (multimode), .15dB (singlemode)
Return loss: >20dB (multimode), >40dB (singlemode)

Ordering Information

Part Number	Connector Type	Cable Type	Fiber	Ferrule
FSCMBL	Simplex	900µm buffered fiber and 3.0 mm jacketed cable	MM	Zirconia Ceramic
FSCMRD	Simplex	900µm buffered fiber and 3.0mm jacketed cable		
FSCM2.0BL	Simplex	900µm buffered fiber and 1.6mm – 2.0mm jacketed cable		
FSCM2.0RD	Simplex	900µm buffered fiber and 1.6mm – 2.0mm jacketed cable		
FSCDM	Duplex	3.0mm jacketed cable		
FSCSBU	Simplex	900µm buffered fiber and 3.0mm jacketed cable	SM	Zirconia Ceramic
FSCS2.0BU	Simplex	900um buffered fiber and 1.6mm – 2.0mm jacketed cable		

SC Opticam Pre-Polished Connectors

SC pre-polished fiber optic connectors shall be TIA/EIA-604 FOCIS-3 compliant and contain a factory-terminated fiber, eliminating field polishing and adhesive. SC pre-polished connectors shall have an average insertion loss of 0.3dB per mated pair for multimode and singlemode fiber. SC pre-polished connectors shall captivate fiber and buffer in one action allowing for up to two re-terminations with no degradation in performance

Technical Information

Standards requirements: TIA/EIA-604 FOCIS-3 compliant; exceeds TIA/EIA-568-B.3 requirements

Fiber compatibility: 62.5/125µm OM1, 50/125µm OM2, 10GIG™ 50/125µm OM3, OM4 and 9/125µm OS1

Fiber cable type: 900µm tight-buffered cable only

Fiber cable size: 1.6mm – 2.0mm and 3.0mm jacketed cable with optional boots

Ferrule type: Zirconia ceramic or composite ferrule with a pre-polished fiber stub

Insertion loss: Ceramic: 0.3dB average (multimode and singlemode)

Composite: 0.3dB average (multimode)

Return loss: Ceramic: >20dB (multimode), >26dB (10GIG™ multimode), >50dB (singlemode) Composite: >20dB (multimode)

Ordering Information

Part Number	Connector Type	Fiber	Ferrule Material	Ferrule Finish
FSCMCXAQ	Simplex	10 GbE 50/125um OM3/OM4	Zirconia Ceramic	SPC
FSCDMCXAQ	Duplex			
FSCMC5BL	Simplex	50/125um OM2	Zirconia Ceramic	SPC
FSCDMC5BL	Duplex			
FSCMPC5BL	Simplex		Composite	
FSCMC6BL	Simplex	62.5/125um OM1	Zirconia Ceramic	SPC

FSCDMC6BL	Duplex			
FSCMPC6BL	Simplex		Composite	
FSCSCBU	Simplex	9/125um OS1/OS2	Zirconia Ceramic	UPC

ST Fiber Optic Connectors

ST Fiber Optic Connectors – Field Polish Termination

ST Fiber Optic Connectors shall be compatible with TIA FOCIS-2. ST connectors shall be field installable in one module space. The fibers shall terminate in 2.5mm ferrules and have typical insertion loss of 0.15dB (multimode) or 0.20dB (singlemode) per connector.

Technical Information

Standards requirements: TIA/EIA-604 FOCIS-3 compliant; exceeds TIA/EIA-568-B.3 requirements

Fiber compatibility: 62.5/125µm and 50/125µm (multimode), 9/125µm (singlemode)

Fiber cable types: 3.0mm jacketed or 900µm buffered

Ferrule type: Zirconia ceramic, pre-radiused

Insertion loss: 0.15dB typical (multimode), 0.20dB typical (singlemode)

Return loss: Greater than 20dB (multimode), 40dB (singlemode)

Ordering Information

Part Number	Connector Type	Cable Type	Fiber	Ferrule Type
FSTMABL	Simplex	900µm buffered fiber and 3.0mm jacketed cable	62.5/125um	Zirconia Ceramic
FSTMARD			50/125um	
FSTMA50BL				
FSTMA50RD				
FSTSABU			9/125um	

ST Opticam Pre-Polished Connectors

ST pre-polished fiber optic connectors shall be TIA/EIA-604 FOCIS-2 compliant and contain a factory-terminated fiber, eliminating field polishing and adhesive. ST pre-polished connectors shall have an average insertion loss of 0.3dB per mated pair for multimode and singlemode fiber. ST pre-polished connectors shall capture fiber and buffer in one action allowing for up to two re-terminations with no degradation in performance.

Technical Information

Standards requirements: TIA/EIA-604 FOCIS-2 compliant; exceeds TIA/EIA-568-B.3 requirements

Fiber compatibility: 62.5/125µm OM1, 50/125µm OM2, 10GIG™ 50/125µm laser optimized OM3 and 9/125µm OS1

Fiber cable type: 900µm tight-buffered cable only

Fiber cable size: 1.6mm – 2.0mm and 3.0mm jacketed cable with optional boots

Ferrule type: Zirconia ceramic or composite ferrule with a pre-polished fiber stub

Insertion loss: Ceramic: 0.3dB average (multimode and singlemode)

Composite: 0.3dB average (multimode)

Return loss: Ceramic: >20dB (multimode), >26dB (10GIG™ multimode), >50dB (singlemode) Composite: >20dB (multimode)

Fiber cable types: 3.0mm jacketed or 900µm buffered, works with 62.5/125µm or 50/125µm multimode

Ferrule type: Ceramic (Zirconia)

Insertion loss: 0.1dB typical for 62.5/125um and 50/125um

Return loss: Greater than 20dB for 62.5/125um and 50/125um

Flush Mount: Unused ports do not protrude from the wall, able to be used with shuttered faceplates

Ordering Information

Part Number	Connector Type	Fiber	Ferrule Material	Ferrule Finish
FSTMCXAQ ^F / _J	Simplex	10 GbE 50/125um (laser optimized) OM3	Zirconia Ceramic	SPC
FSTMC5BL ^K / _e		50/125um OM2	Zirconia Ceramic	SPC
FSTMPC5BL ^v / _e			Composite	
FSTMC6BL ^d / _e		62.5/125um OM1	Zirconia Ceramic	SPC
FSTMPC6BL			Composite	
FSTMC9BL		9/125um OS1	Zirconia Ceramic	UPC

Technical Information

Standards Requirements: FOCIS-6 interface approved at the TIA, required for TIA/EIA-568-B.3

Fiber cable types: 3.0mm jacketed or 900µm buffered, works with 62.5/125µm or 50/125µm multimode

Mechanical Keying: Keyed configurations prevent unintentional insertion into adjacent ports

Ferrule type: Ceramic (Zirconia)

Insertion loss: 0.1dB typical

Return loss: Greater than 20dB

Ordering Information

Part Number	Cable Type	Fiber	Color
FJEPGM5CWBL	900um buffered fiber and 3.0mm jacketed cable	62.5um/125um or 50/125um	Black
FJEPGM5CXRD			Red
FJEPGM5CYOR			Orange
FJEPGM5CZYL			Yellow
FJEPGM5CQWH			White

FJ Duplex Fiber Optic Plug

Small form factor fiber optic modules and connectors include all the same features as the FJ Jack Modules with the added benefit of visual and mechanical security. They shall be compliant with the TIA FOCIS-6 Fiber Jack (FJ) interface specification. RJ-45 style module and connector shall be field terminable in one module space with no adapter. The fibers shall terminate in 2.5mm ferrules with non-optical disconnect and typical insertion loss of 0.1dB per connector

Technical Information

Standards requirements: TIA/EIA-604 FOCIS-3 compliant; exceeds TIA/EIA-568-B.3 requirements
Fiber compatibility: 62.5/125µm and 50/125µm (multimode), 9/125µm (singlemode)
Fiber cable types: 3.0mm or 1.6mm – 2.0mm jacketed
Ferrule type: Zirconia ceramic
Insertion loss: 0.10dB typical (multimode), 0.20dB typical (singlemode)
Return loss: Greater than 20dB (multimode), Greater than 40dB (singlemode)

Ordering Information

Part Number	Cable Type	Fiber	Color
FJEPGM5CEI	900um buffered fiber and 3.0mm jacketed cable	62.5/125um or 50/125um	Electric Ivory
FJEPGM2.0CEI	900um buffered and 1.6mm - 2.0mm jacketed		
FJEPGS9CBUY	900um buffered and 3.0mm jacketed cable	9/125um	Blue
FJEPGS2.0CBUY	900um buffered and 1.6mm - 2.0mm jacketed		

Mini-Com FJ Duplex Jack Modules

Small form factor fiber optic modules and connectors shall be compliant with the TIA FOCIS-6 Fiber Jack (FJ) interface specification. RJ-45 style module and connector shall be field terminable in one module space with no adapter. The fibers shall terminate in 2.5mm ferrules with non-optical disconnect and typical insertion loss of 0.1dB per connector.

Technical Information

Standards Requirements: FOCIS-6 interface approved at the TIA, required for TIA/EIA-568-B.3
Fiber cable types: 3.0mm jacketed or 900µm buffered, works with 62.5/125µm or 50/125µm multimode and 9/125um
Ferrule type: Ceramic (Zirconia)
Insertion loss: 0.1dB typical for 62.5/125um and 50/125um
Less than 0.3 dB typical for 9/125um
Return loss: Greater than 20dB for 62.5/125um and 50/125um
Greater than 40dB for 9/125um
Flush mount: Unused ports do not protrude from the wall, able to be used with shuttered faceplates

Ordering Information

Part Number	Cable Type	Fiber	Color
FJJGM5C**	900um buffered fiber and 3.0mm jacketed cable	62.5/125um or 50/125um	**
FJJGM2.0C**	900um buffered and 1.6mm - 2.0mm jacketed		
FJJGS9CBU	900um buffered and 3.0mm jacketed cable	9/125um	Blue
FJJFS2.0CBU	900um buffered and 1.6mm - 2.0mm jacketed		

For other colors replace ** with colors IE (Electric Ivory), BU (Blue), BL (Black), IW (Off White) or AW (Artic White)

Enclosures

PANDUIT Rack Mount and Wall Mounted fiber optic enclosures shall be capable of doubling the capacity by increasing fiber cable density within the allotted space when using LC connections. Enclosures shall provide patch cable protection. Enclosures shall protect fiber optic connections for patching or splicing requirements.

Cable Management

The 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. The system shall be a complete cable management system comprised of vertical and horizontal cable managers to manage cables on both the front and rear of the rack. The system shall protect network investment by maintaining system performance, controlling cable bend radius and providing cable strain relief.

A. Rack System

Cable Management shall be provided using the applicable rack system that supports heavy equipment and high capacity cable for cross connect or interconnect applications in a telecommunications closet. The Rack system shall be modular and support copper and fiber cables. The rack system solution shall be constructed of steel material and support both assembled to accommodate both 19" and 23" components. The rack system solution shall provide integral cable management including vertical channels, pass through holes and slots for additional cable management accessories. Pass through holes shall be located on the front, back and side of the rack for maximum flexibility. The rack shall accept removable, hinged doors.

B. Vertical Cable Management

Vertical cable managers shall include components that aid in routing, managing and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" or 23" racks and constructed of steel bases with PVC duct attached. The covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.

C. Horizontal Cable Management

Horizontal cable managers shall include components that aid in routing, managing and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" or 23" racks and constructed of steel bases with PVC duct attached. The duct fingers shall include retaining tabs to retain the cables in place during cover removal. The covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.

D. Cabinet Cable Management

IN-Cabinet cable management system shall include components that aid in routing, managing and organizing cable to and from equipment within a cabinet. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a flexible design with adjustable mounting. Panels shall be constructed of steel bases with PVC duct attached. Duct fingers shall have score lines for easy removal.

Grounding and Bonding

The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/J-STD-607-A Telecommunications Bonding and Grounding Standard.

The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All

cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

Fire stop

A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the firestop system(s).

Execution

Optical Fiber Termination Hardware

Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

Each cable shall be individually attached to the respective fiber enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

A maximum of 24 strands of fiber shall be spliced in each tray
All spare strands shall be installed and stored into spare splice trays.

Backbone Cable Installation

Backbone cables shall be installed separately from horizontal distribution cables

A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits

Where cables are installed in an air return plenum, riser rated cable shall be installed in metallic conduit.

Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.

All backbone cables shall be securely fastened to the sidewall of the TR on each floor.

Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.

Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.

Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

Racks

Racks shall be securely attached to the concrete floor using minimum 3/8" hardware or as required by local codes.

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.

All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 2.4 of this document.

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.

Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of white fire retardant paint.

Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.

Fire stop System

All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance. The firestop solution must be DHEC approved.

Grounding System

The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the J-STD-607-A standard, and shall be installed in accordance with best industry practice.

A licensed electrical contractor shall perform installation and termination of the main bonding conductor to the building service entrance ground.

Identification and Labeling

The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

All label printing will be machine generated by Panduit PanMark software and Panduit desktop and hand-held printers using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

Testing and Acceptance

General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-B-1 Section 11. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the PANDUIT® **CERTIFICATION PLUS**SM System Warranty guidelines and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

Fiber Testing

All installed fiber shall be tested in accordance with ANSI/TIA/EIA-568-B.1 section 11.

For horizontal cabling system using multimode optical fiber, attenuation shall be measured in one direction at either 850 nanometer (nm) or 1300 nm using an LED light source and power meter.

Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for single mode) in Both directions.

Test set-up and performance shall be conducted in accordance with ANSI/TIA/EIA-526-14 Standard, Method B.

Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. **ONLY BASIC LINK TEST IS REQUIRED.** The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.

Attenuation testing shall be performed with a two meter (2m) Panduit reference quality cable assembly using a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements. Refer to Panduit document PN445 "Permanent Link Testing of Fiber Optic Cabling Systems"

System Documentation

Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer/End User for approval. Documentation shall include the items detailed in the sub-sections below.

Documentation shall be submitted within ten (10) working days of the completion of each testing phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.

The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

Test Results documentation shall be provided in electronic format within three weeks after the completion of the project. The media shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

568-B. The appropriate level III tester shall be used to verify Category 6 cabling systems.

Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. Alternately, the telecommunications contractor may furnish this information in electronic form. The media shall contain the electronic equivalent of the test results as defined by the specification along with the software necessary to view and evaluate the test reports.

When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

The **As-Built** drawings are to include cable routes and outlet locations. Their sequential number as defined elsewhere in this document shall identify outlet locations. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD rel. 14) formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.

The Contractors shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD rel. 14) form

END OF SECTION



CSI SECTION 271543

COMMUNICATIONS FACEPLATES AND CONNECTORS

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a standard specification applicable to commercial building structured cabling applications.

The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines.

The information contained in this document is based on our experience to date and is believed to be reliable. It is intended as a guide for use by persons having technical skill and is to be used with their own discretion and risk. We do not guarantee favorable results or assume any liability in connection with its use. Dimensions contained herein are for reference purposes only. For specific dimensional requirements consult the factory. This publication is not to be taken as a license to operate under, or a recommendation to infringe any existing patents. This supercedes and voids all previous literature, etc.

It is highly recommended and the issuers responsibility to have any RFQ documents, including those based on this general format, reviewed by the issuing company's professional advisors before it is released to the public. In no way may this document be used in a manner that is detrimental to the interests of Panduit and/or its subsidiaries

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Section 271543
COMMUNICATIONS FACEPLATES AND CONNECTORS REQUIREMENTS

Part 7 - General

7.1 Work Included

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

7.2 Scope of Work

- A. This document describes the products and execution requirements relating to furnishing and installing Telecommunications faceplates and connectors for the horizontal cabling comprised of Copper and Optical Fiber Cabling, and support systems are covered under this document.

Install a structured cabling system that will be able to support interconnections to active telecommunications equipment for voice and data applications in a multi vendor, multi product environment. The structured cabling system should adhere to ANSI/TIA/EIA 568 C; 569-A; 606-A; J-STD-607-A and EIA/TIA 942 standards with respect to pathways, distribution, administration, and grounding of the system. The structured cabling system to be installed should also follow the guidelines spelled out in this RFP in accordance to local codes and regulations.

For Reference of the drops, each Standard drop will consist of three terminations that can be interoperable to accommodate either voice or data applications. Each meeting room drop will consist of four drops each consisting of two terminations can be interoperable to accommodate either voice or data applications. There will also be convenience phone drops that will consist of a single termination that will be installed in the proper faceplate for each location's phone.

Install, terminate, test, and guarantee each drop according to customer all applicable standards and customer preferences.

Horizontal cables will be rated Cat 6 enhanced in performance rated to connector outlets at the work area. The Horizontal cables will home run back to a floor serving telecommunications room and will terminate on individual Cat 6 enhanced rated jacks to populate a modular 48 port angled patch panel. All cables will be patched at cutover as an interconnection into the floor serving active equipment using RJ45 modular equipment cables rated to Cat 6 enhanced.

The floor serving active data equipment will be interconnected to the facility serving data equipment via a fiber backbone terminated in 19" rack mounted 48 port enclosures which will utilize SC or LC connections. This will serve to connect the Main Telecommunications Room to an additional Telecommunications Room serving the locations that exceed the distance limitations (90 meters) of the Main Telecommunications Room for the horizontal Data and Voice drops.

Contractor will also be required to make matching additions to the cable tray to complete the system according to ANSI/TIA/EIA 569

- B. This section includes minimum requirements for the following:
- Category 6 UTP Connector Modules
 - Optical Fiber Connector Modules
 - Faceplates and Modules

- C. 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.
- D. 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, formal clarification shall be obtained from in the form of Question Clarification Request. The successful vendor shall meet or exceed all requirements for the cable system described in this document.

7.3 Regulatory References

- A. The following industry standards are the basis for the structured cabling system described in this document.
 - 1. ANSI/TIA/EIA
 - TIA/EIA-568-C.1 Commercial Building Telecommunications Cabling Standard
 - TIA/EIA-568-C General Requirements
 - TIA/EIA-568-C.2 Balanced Twisted Pair Cabling Components Standard
 - TIA/EIA-568-C.2.10 Specifications for Augmented Category 6 Cabling
 - TIA/EIA-568-C.3 Optical Fiber Cabling Components Standard
 - TIA/EIA - 942 Telecommunications Infrastructure for Data Centers
 - TIA/EIA-569-A Commercial Building Standard for Telecom Pathways and Spaces
 - TIA/EIA-606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 - J-STD-607-A Commercial Building Grounding/Bonding Requirements
 - 2. NFPA
 - NFPA 70 National Electric Code (NEC)
 - 3. ISO/IEC
 - ISO 11801 Generic Cabling for Customer Premises
- B. If there is a conflict between applicable documents, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents. The Contractor has the responsibility to determine and adhere to the most recent release when developing the proposal for installation.
- C. This document does not replace any code, either partially or wholly. The contractor must be aware of local codes that may impact this project.

7.4 Quality Assurance

- A. Cabling System Warranty
 - 1. A Cable Products Warranty shall provide a complete warranty to guarantee a high performance cabling systems that meet application requirements. The guarantee shall include all cable installed in the structured cabling system. The Cable shall be warranted for a period of at least 25 years.
- B. PANDUIT *System Warranty*
 - 1. A **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 copper connectivity components. The system shall be warranted for a period of at least 25 years.
- C. Product Guarantee

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.

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. Panduit will provide a single source solution for the end-to-end installation
3. Panduit Products must be installed per Panduit instruction sheets by a BICSI certified Installer with minimum agreement of Panduit Certified Installer by Panduit Corp.

Installer: Company specializing in installing products specified in this section with minimum three years documented experience, and with service facilities within 120 miles of project. The Electrical/Telecommunications contractor must be Panduit Corp. approved for cabling and fiber solutions – a qualified BICSI trained installer who also is certified to install Warrantee-able solution by Panduit Corp.. A copy of certification documents for each must be submitted with the quote in order for such quote to be valid.

The Electrical/Telecommunications contractor is responsible for workmanship and installation practices in accordance with the Panduit cabling solutions Certified Program. Manufacturer (Panduit) will extend a 25-year Static, Dynamic and Applications Warranty to the end user once the Electrical/Telecommunications contractor fulfills all requirements under the Panduit Cabling Solutions Certified Program. At least 30 percent of the installation and termination crew must be certified by Panduit with a Technicians Level of Training. Also, Panduit must certify 10 percent of the installation and termination crew for Optical Fiber Training.

Note: All Networks shall be installed per applicable standards and manufacturer's guidelines.

If any *PANDUIT PAN-NET™* product fails to perform as stated above, *PANDUIT* will provide new components at no charge.

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.

7.5 Approved Products

- A. Approved UTP connector product manufacturer: Panduit
- B. Approved Fiber Optic cabinet product manufacturer: Panduit
- C. Approved Fiber Optic connectors/splices/couplers: Panduit
- D. Approved Patch Panel manufacturer: Panduit
- E. Approved Faceplate manufacturer: Panduit

Part 8 - Products

8.1 Equivalent Products

- A. Panduit shall manufacture all products, including but not limited to cable management, faceplates, copper modules, patch panels, racks, 110 blocks, patch cords, labels, grounding lugs and fiber connectivity products for the purpose of this document.
- B. Panduit Corp. shall manufacture all data/telecommunication and fiber optic cable.

8.2 Substitutions – (no exceptions)

- A. This is a performance-based single source solution. Therefore, substitutions are highly discouraged. Substitutions must follow the same rigid standards for quality and termination style as those described in section 2.3 and 2.5.
- B. Any Contractor wishing to offer structured cabling products other than those specified herein shall submit a request for product substitution in writing no less than one week in advance of bid. Written requests for substitution shall be accompanied by all drawings, specification sheets and engineering documents, as well as third party laboratory performance test results proving equivalency in performance and manufacturing style.
- C. This written documentation shall be accompanied by samples of the substitution product offered for evaluation. Equal product acceptance must be received in writing.

- D. Contractor shall be responsible and assume all costs for removal and replacement of any substituted product installed without prior written approval. Such costs shall include, but not be limited to labor, materials as well as any penalties, fees or costs incurred for late completion.

8.3 Work Area Subsystem

- A. The Work Area shall consist of the connectivity equipment used to connect the horizontal cabling subsystem and the equipment in the work area. Both copper and fiber media shall be supported. The connectivity equipment shall include the following options:
- Patch (equipment) cords and modular connectors
 - Outlets and surface mount boxes
 - Surface raceway and outlet poles
 - Consolidation point / MUTO
- B. Patch Cords and Modular Connectors
1. The modular connectors and patch cords will be chosen to match the horizontal cabling medium and rating. The same manufacturer shall provide the modular connectors and patch cords. The total patch cord length at the work area is not to exceed 3 meters (10 ft). Exception: When implementing an open office cabling system as specified under TIA/EIA TSB-75 (see section 3.4).
 2. Copper Connectivity
The **PANDUIT MINI-COM® Network Cabling System** shall be used for the Work Area subsystem, including all modular connectors. The network cabling system shall be comprised of modular connectors in support of high-speed networks and applications designed for implementation on copper cabling. All outlets shall utilize fully interchangeable and individual connector modules that mount side-by-side to facilitate quick and easy moves, adds and changes.

MINI-COM® TX-6™ TG Modules shall be Category 6 modules featuring *GIGA-TX™* Technology. The eight position modules shall be used in all work areas and shall exceed the connector requirements of the TIA/EIA Category 6 standard. Termination shall be accomplished by use of a forward motion termination cap and shall not require the use of a punch down tool. The termination cap shall provide strain relief on the cable jacket, ensure cable twists are maintained to within 1/8" (3.18 mm) and include a wiring scheme label. The wiring scheme label shall be available with both T568A and T568B wiring schemes. All terminations for this project shall use the T568B (B) wiring scheme. The modules shall terminate 4 pair 23 100-ohm solid unshielded twisted pair cable. The modules shall be universal in design, including complying with the intermateability standard IEC 60603-7 for backward compatibility. Category 6 modules shall have UL and CSA approval. The modules shall have ETL verified Category 6 performance and ISO Class E performance (as defined in ISO/IEC 11801) in both the basic and channel links. They shall be universal in design, accepting 2, 3, or 4 pair modular plugs without damage to the outer jack contacts. The modules shall be able to be re-terminated a minimum of 10 times and be available in 11 standard colors for color-coding purposes. The jack shall snap into all *MINI-COM* outlets and patch panels. The module shall include a black base to signify Category 6 400 MHz performance.

TX-6™ Category 6 Patch Cords shall be factory terminated with modular plugs featuring a one-piece, tangle-free latch design and black strain-relief boots to support easy moves, adds and changes. They shall be constructed with Category 6 23-AWG stranded UTP cable. Each patch cord shall be 100% performance tested at the factory in a channel test to the TIA/EIA Category 6 standard. The patch cords shall come in standard lengths of 3, 5, 7, 9 14, and 20 feet and 6 standard colors of Off White, Black, Blue, Green, Red and Yellow

- Additional Copper Cabling Connectors

Additional *MINI-COM®* Modules for copper shall include the following:

- USB and HDMI coupler modules female-female
- 50 and 75 Ohm BNC coax coupler modules, male-male
- F-Type coax coupler module, male-male threaded
- RCA connector modules with red, yellow, and white inserts
 - Solder, pass through and punchdown termination types
- S-Video connectors' modules - coupler and punchdown termination types
- Blank module to reserve space for future additions

The connectors shall snap into all *MINI-COM* outlets and patch panels.

Part Number	Description
CMUSBAA**	USB 2.0 female A to female A coupler
CMHDMI**	HDMI 1.3 type A coupler
CMBA**Y	50 Ohm BNC coupler
CMBA75**Y	75 Ohm BNC coupler
CMF**	F-type coupler
CMFSR**Y	Self terminating F-type coupler
CJRR**	RCA punchdown w/red insert
CJRY**	RCA punchdown w/yellow insert
CJRW**	RCA punchdown w/white insert
CMRP(x)**	RCA pass-through coupler
CM35MSC**Y	3.5mm stereo coupler
CM35MSS**	3.5mm stereo solder-type connector
CMBPB**Y	5-way binding post w/black stripe
CMBPR**Y	5-way binding post w/red stripe
CMD15HD**Y	Field terminable 15 pin HD D-sub connector
CJSV**	S-video punchdown module
CMSVC**Y	S-video pass-through coupler
CMDB**-X	2 pos module base for D-sub connectors
CMB**-X	Blank module

3. Fiber Optic Hardware

The **PANDUIT MINI-COM® Network Cabling System** or shall be used for the Work Area subsystem, including all modular connectors. The network cabling system shall be comprised of **PANDUIT** Fiber Optic modular work area adapters in support of high-speed networks and applications designed for implementation on multimode (both 62.5/125 and 50/125 μm) glass fiber cabling. All outlets shall utilize interchangeable and individual connector modules that mount side by side to facilitate quick and easy moves, adds, and changes. Approved components of the Fiber Termination Hardware for the Work Area Subsystem shall include but are not limited to:

- SC, and LC Style Connectors

Panduit SC and LC Optical Fiber Patch Cords shall be constructed from high performance 50/125μm multimode cable and **ST/SC/LC** simplex connectors with ceramic ferrules. Integral boots shall be provided to provide strain relief and help maintain consistent polarity. They shall come in standard lengths.

C. Outlets and Surface Mount Boxes

The outlets and surface mount boxes shall support the network system by providing high-density in-wall, surface mount or modular office furniture cabling applications. The outlets consist of faceplates for flush and recessed in-wall mounting as well as mounting to the modular office furniture systems. The surface mount boxes can be mounted where in-wall applications are not possible or to support applications where surface mount is the best option. All outlets shall utilize fully the interchangeable and individual **MINI-COM®** connector modules that mount side by side to facilitate quick any easy moves, adds and changes. All outlets shall be manufactured from high-impact thermoplastic material with a U.L. flammability rating of 94 HB or better.

1. Wall Faceplates

MINI-COM® Ultimate ID **Series** Faceplates shall be **2, 4 and 6 port vertical single gang and 8 and 10 port vertical double gang** faceplates with combination screw head covers. The faceplates shall mount to standard U.S. NEMA boxes and adapters with screw-to-screw dimensions of 3.28" (83.3mm). The insert labels shall meet UL 969. Each faceplate shall accept **MINI-COM** modules that can be individually inserted and removed as required.

Part Number	Description
Classic Faceplates	
CFPL(x)**Y	Single gang, vertical w/labels 2, 3, 4 or 6 ports
CFP(x)**	Single gang, vertical 1, 2 or 4 ports

CFPH(x)**	Horizontal 2 or 4 port
CFPSL(x)**Y	Single gang, sloped vertical w/labels 2, 4 or 6 ports
CFPHSL4**Y	Horizontal sloped w/labels 4 port
Executive Faceplates	
CFPE(x)**Y	Single gang, vertical w/labels 1, 2, 4 or 6 ports
CFPE10**-2GY	Double gang w/labels 10 ports
Ultimate ID Classic	
UICFP(x)**	Single gang vertical 2, 4 or 6 ports
UICFPH(x)**	Horizontal 2, 4 port
Ultimate ID Executive	
UICFPSE(x)**	Single gang sloped vertical 2, 4 or 6 ports
UICFPHSE(x)**	Horizontal sloped 2, 4 port
UICFPSE8**	Double gang sloped 8 port
Specialty faceplates	
UICFPRTR4**	Ultimate ID single gang tamper resistant faceplate 4 port
CFPTR4**	Single gang tamper resistant faceplate 4 port
CFPTR2B**	Single gang tamper resistant faceplate 2 secured ports and 2 accessible ports
CFPWR4**	Single gang water resistant faceplate 4 port IP56 rating

2. Furniture Faceplates

MINI-COM® Modular Furniture Faceplates shall be **4 port flat or angled and 2 port angled** faceplates that snap directly into TIA/EIA standard furniture openings. The 2 port, angled faceplate shall provide a 45° slope to the side, in-line with the cable running through the furniture channel. If required, an extender shall be used with the 4 port flat faceplate to provide 12.7 mm (0.5") additional depth. Each faceplate shall accept *MINI-COM* modules that can be individually inserted and removed as required.

Part Number	Description
UICFFP4**	Ultimate ID style for standard opening 4 ports
CFFPL4**	For standard opening w/label 4 ports
CFFP4**	For standard opening 4 ports
CFFPA2**	For standard opening sloped 2 ports
CFFPLA4**	For standard opening sloped w/label 4 ports
CFFFPHM4**	Herman Miller Ethospace Baseline 4 ports
CFFPEBSL4**	Herman Miller Ethospace Beltline sloped w/label 4 ports
MFFPE**	Extender plate for CFFPL4, CFFP4 & UICFFP4

3. Faceplate Frames and Inserts

MINI-COM Executive Series Faceplate Frames shall be vertical, **single and double** gang frames with combination head screws, screw covers, labels, and a curved designer appearance. The faceplates shall mount onto standard U.S. NEMA boxes and adapters with screw-to-screw dimensions of 3.28" (83.3mm). Each faceplate frame shall accept **flat, sloped, sloped shuttered, sloped recessed and blank 1/2 and 1/3 size** module inserts that can be individually inserted and removed as required from the front of the frame without removing the frame.

Part Number	Description
Frames	
CB**	Classic single gang frame
CB**-2G	Classic double gang frame
CBE**Y	Executive single gang frame w/label
CBE**-2GY	Executive double gang frame w/label
Inserts	
CHS2**-X	2 port 1/2 sloped insert
CHS2S**-X	2 port 1/2 sloped shuttered insert

CHF2**-X	2 port 1/2 flat insert
CHSRE2**-X	2 port 1/2 sloped recessed insert
CHS1S**-X	1 port 1/2 sloped shuttered insert
CHSB2**-X	1/2 blank insert
CHSF2M**-X	2 port 1/3 flat insert
CHB2M**-X	1/3 blank insert
CHD9C**Y	1/3 insert w/9 pin D-sub female coupler
CHD15HDC**Y	1/3 insert w/15 pin D-sub female coupler
CHD15HDSC**Y	1/3 insert w/15 pin D-sub field terminable connector
CHR3RGB**	1/3 insert w/3 RCA red, green, blue couplers
CHR3WYR**	1/3 insert w/3 RCA white, yellow, red couplers

4. Stainless Steel Outlets

MINI-COM Stainless Steel Faceplates shall be **2, 4 and 6 port vertical single gang and 4, 8 and 10 port double gang** faceplates with combination head stainless steel screws and with or without labels. Ultimate ID design available in 2, 4 and 6 port vertical single gang faceplates. The faceplates shall mount to standard U.S. NEMA boxes and adapters with screw-to-screw dimensions of 3.28" (83.3mm). Faceplates shall be flush mounted for clean look. Stainless steel material shall be riveted to high impact ABS backing to provide a durable faceplate with brush finish. Each faceplate shall accept individual copper and fiber optic connector modules that can be individually inserted and removed as required.

Part Number	Description
UICFP(x)S	Ultimate ID single gang stainless steel 2, 4 or 6 ports
CFPL(x)SY	Single gang stainless steel w/labels 2, 4 or 6 ports
CFPL(x)S-2GY	Double gang stainless steel w/labels 4, 6, 8 or 10 ports
CFP(x)SY	Single gang stainless steel 2, 4 or 6 ports
CFP(x)S-2GY	Double gang stainless steel 4, 8 or 10 ports

5. Surface Mount Boxes

MINI-COM® Low Profile Surface Mount Boxes shall be **1, 2, 4, 6 and 12** port low profile surface mount boxes with a 28 mm (1.1") maximum height. All connections (with exception of the 12 port low profile box) shall exit one side of the box, parallel to the wall. The boxes shall be capable of mounting with screws, adhesive, and/or magnets. The 2 port boxes shall include a removable blank for addition of a second port. The 4, 6 and 12 port boxes shall include breakouts for use with *PAN-WAY™* surface raceway and cable tie slots at each raceway entry point to provide strain relief on incoming cables. The 4 (except low profile 4), 6, and 12 port boxes shall include tamper resistant screws that securely fasten the cover to the base and are concealed by screw covers and labels. Boxes with spring shuttered doors also available in 1, 2, 3, 4 and 6 ports, 3, 4 and 6 ports shall include breakouts for use with *Pan-Way* and include a tamper resistant screw to fasten cover to the base. Each box shall accept individual connector modules that can be individually inserted and removed as required.

MINI-COM® Fiber/Multi-Media Surface Mount Boxes shall be **6 and 12** port surface mount boxes with all connections exiting one side of the box, parallel to the wall. The 6 and 12 port boxes shall contain a "captive" fiber spool that maintains a minimum 25.4 mm (1") bend radius. The 6 and 12 port boxes shall store up to 24 meters of buffered optical fiber. Ultimate ID box available in 12 ports with a figure 8 spool. The boxes shall be capable of mounting with screws, adhesive, and/or magnets. The boxes shall include breakouts for use with *PAN-WAY™* surface raceway on three sides and cable tie slots at each raceway entry point to provide strain relief on incoming cables. The boxes shall include tamper resistant screws that securely fasten the cover to the base and are concealed by screw covers and labels. Each box shall accept individual connector modules that can be individually inserted and removed as required.

Part Number	Description
Ultimate ID	
UICBX2**-A	2 port box
UICBX4**-A	4 port box w/adjustable mounting tabs for modular furniture
Low profile	
CBXJ2**-A	2 port box
CBXC4**-A	4 port box
CBXD6**-AY	6 port box
CBX12**-AY	12 port box
Elongated	
CBX(x)1**-A	1, 2, or 4 port box
CBXF(x)**-AY	Multimedia box with fiber spool 6 or 12 port
Shuttered	
CBXS(x)-A	Surface mount box w/ spring shuttered doors 1, 2, 3, 4 or 6
CBXSD6**-AY	Surface mount box w/spring shuttered door, deep cover and routing bridge 6 port
Specialty box	
CM6P**	MUTOA outlet box accepts up to 3 1/2 sloped inserts
UICBXA12**-A	Ultimate ID angled box 12 port
UICBXH6**-A	Ultimate ID Hybrid box 6 port accepts single gang faceplates
UICBXHC6**-A	Ultimate ID Hybrid box 6 port w/cover extension accepts single gang faceplates

D. MUTOA's and Consolidation Points

Consolidation Point and MUTO assembly configurations shall be implemented in open office applications where the office area is split into zones and the cabling system utilizes short runs from an intermediate connection to facilitate frequent moves, adds and changes (MAC's) as specified per TIA/EIA TSB-75. The MUTO and consolidation point equipment will be chosen to match the horizontal cabling medium and performance category. The same manufacturer shall provide the modular connectors and patch cords.

Maximum length of horizontal and work area cables

Horizontal Area Cable (H)	Max Combined Length of Patch Cords, Work Area & Equip. Cable (C)	Max Work Area Cable Length (W)
90 m (295 ft)	10 m (33 ft)	5 m (16 ft)
85 m (279 ft)	14 m (46 ft)	9 m (30 ft)
80 m (262 ft)	18 m (59 ft)	13 m (44 ft)
75 m (246 ft)	22 m (72 ft)	17 m (57 ft)
70 m (230 ft)	27 m (89 ft)	22 m (71 ft)
Formulas: $C = (102 - H)/1.2$		$W = C - 5, <22m$

1. Multi User Telecommunication Outlets Assembly (MUTOA's)

MUTO assemblies shall use *MINI-COM®* Fiber/Multi-Media Surface Mount Boxes. The Surface Mount Boxes shall be **6 and 12** port surface mount boxes with all connections exiting one side of the box, parallel to the wall. The 6 and 12 port boxes shall contain a "captive" fiber spool that maintains a minimum 25.4 mm (1") bend radius. The 6 and 12 port boxes shall store up to 24 meters of buffered optical fiber. The boxes shall be capable of mounting with screws, adhesive, and/or magnets. The boxes shall include breakouts for use with *PAN-WAY™* surface raceway on three sides and cable tie slots at each raceway entry point to provide strain relief on incoming cables. The 6 and 12 port boxes shall include tamper resistant screws that securely fasten the cover to the base and are concealed by screw covers and labels. MUTOA 6 port outlet box accepts up to 6 Mini Com modules when using ½ sloped inserts, shuttered or non-shuttered, not included.

Each box shall accept individual connector modules that can be individually inserted and removed as required. All installed MUTOAs shall be marked with the maximum allowable length for the equipment cables.

Part Number	Description
Surface Mount Boxes	
CBXF(x)**-AY	Multimedia box with fiber spool 6 or 12 port
CM6P**	MuTOA 6 port outlet box when combined w/3 1/2 sloped inserts
UICBXA12**-A	Ultimate ID angled box w/figure 8 fiber spool 12 port

2. Consolidation Points

Consolidation Points shall use ZONE CABLING BOXES to separate the barriers of plenum and non-plenum environments and the workspace. In-floor boxes shall be available in multiple sizes and mount into the allocated space for standard 24" x 24" raised floor panels, minimum 6" depth. In-ceiling boxes shall be available to accommodate 2' x 6' and 2' x 4' ceiling grids. All zone boxes shall support standard 19" patch panels and are plenum rated. Cable entry and exit openings should be no less than 11"W x 3.5"H x 3"D (279.4 x 88.9 x 76.2 mm). Each opening shall accommodate 96 4-pair UTP cables. The boxes shall be made of 14-gauge aluminum.

MINI-COM® Modular Patch Panels shall be of a metal design with snap in four position and six position molded faceplate frames. The patch panels shall be modular accepting all *MINI-COM* modules. The faceplate frames shall be releasable from the front to provide access to the modules and terminated cable, except for the Flush Mount design where faceplates are mounted through the back of the panel. Patch panels shall be available in standard or high-density configuration and flat or angled design. Modules shall be mounted to the patch panel using *MINI-COM* mounting features for added strength. Patch panels shall be available with and without labels

Part Number	Description
Flat patch panels	
UICMPP24WBLY	Ultimate ID 24 port panel 1RU
UICMPP48WBLY	Ultimate ID 48 port panel 2RU
CPP24FMWBLY	Flush Mount 24 port panel 1 RU
CPP48FMWBLY	Flush Mount 48 port panel 2 RU
CPPL24WBLY	Front access faceplate panel w/labels 24 port 1 RU
CPPL48WBLY	Front access faceplate panel w/labels 48 port 2 RU
CPP24WBLY	Front access faceplate panel 24 port 1 RU
CPP48WBLY	Front access faceplate panel 48 port 2 RU
CPPL24M6BLY	M6 faceplate panel 24 port 1 RU
CPPL48M6BLY	M6 faceplate panel 48 port 2 RU
Angled patch panels	
UICMPPA24WBLY	Ultimate ID angled 24 port panel 1RU
UICMPPA48WBLY	Ultimate ID angled 48 port panel 2RU
CPPA24FMWBLY	Flush Mount angled 24 port panel 1 RU
CPPA48FMWBLY	Flush Mount angled 48 port panel 2 RU
CPPLA24WBLY	Front access faceplate angled panel w/labels 24 port 1 RU
CPPLA48WBLY	Front access faceplate angled panel w/labels 48 port 2 RU
High Density patch panels	
CPPA48HDWBLY	Angled 48 port in 1 RU
CPPA48HDEWBL	Angled 48 port in 1 RU for UTP modules and enhanced labeling
CPPA48HDVNSWBL	Angled 48 port in 1 RU w/vertical numbering
CPPA72FMWBL	Angled 72 port flush mount panel 2 RU
CPPLA72WBLY	Angled 72 port faceplate panel 2 RU w/labels
CPP48HDWBLY	Flat 48 port in 1 RU
CPP48HDEWBL	Flat 48 port in 1 RU for UTP modules and enhanced labeling

CPP48HDVNSWBL	Flat 48 port in 1 RU w/vertical numbering sequence
CPP72FMWBLY	Flat 72 port flush mount panel 2 RU
CPPL72WBLY	Flat 72 port faceplate panel 2 RU w/labels
Recessed patch panels	
CPPL24WRBLY	Recessed faceplate panel w/label 24 ports 1RU
CPPL48WRBLY	Recessed faceplate panel w/label 48 ports 2RU
All metal shielded panels	
CP24BLY	Flat 24 port all metal panel 1 RU
CP48BLY	Flat 48 port all metal panel 2 RU
CP72BLY	Flat 72 port all metal panel 2 RU
CP24WSBLY	Flat 24 port all metal panel w/strain relief bar 1 RU
CP48WSBLY	Flat 48 port all metal panel w/strain relief bar 2 RU
CPA24BLY	Angled 24 port all metal angled panel 1 RU
CPA48BLY	Angled 48 port all metal angled panel 2 RU
CPA72BLY	Angled 72 port all metal angled panel 2 RU

8.4 Telecommunication Room

The telecommunications room (TR) includes those products that connect the networking equipment to the horizontal and backbone cabling subsystems. These products include termination hardware (connectors and patch cords), racks, cable management products and cable routing products.

6) Cable Termination Hardware

Each horizontal or backbone cabling run will be terminated using appropriate connectors or connecting blocks depending upon the cable type. Matching patch cords will be used to perform cross-connect activities or to connect into the networking/voice hardware.

7) Category 6 Enhanced Unshielded Twisted Pair (UTP)

Four-pair Category 6 UTP cabling shall be terminated onto a four-pair Category 6 module. All modules shall be terminated using the T568B wiring scheme. The eight-position module shall exceed the connector requirements of the TIA/EIA Category 6 standard. The jack termination to 4-pair, 100 ohm solid unshielded twisted pair cable shall be accomplished by use of a forward motion termination cap and shall not require the use of a punchdown or insertion tool.

TX-6™ Patch Cords shall be used between modular patch panels configured as a cross-connect or between the patch panel and networking hardware when the patch is used as an interconnect. The patch cords shall be factory terminated with modular plugs featuring a one-piece, tangle-free latch design and black strain-relief boots to support easy moves, adds and changes. They shall be constructed with Category 6 24-AWG stranded UTP cable. Each patch cord shall be 100% performance tested at the factory in a channel test to the Category 6 standard.

DP6™ Patch Panels - Four-pair Category 6 UTP cabling shall be terminated onto four-pair punchdown style connecting hardware mounted to the rear of integral patch panels and routed to Category 6 modules on the front face of the patch panel. Patch panels shall be universal for T658A and T568B wiring configurations. The patch panels shall have a removable 6-port design that allows a 6-port module to be removed without disrupting the other ports. Integral cable tie mounts shall be included in the panel for cable management on the back of the panel. Port and panels shall be easy to identify with write-on areas and optional label holder for color-coded labels. Rack mountable patch panels shall mount to standard EIA 19" and 23" racks.

TX-6™ PATCH Cords shall be used between modular patch panels configured as a cross-connect or between the patch panel and networking hardware when the patch is used as an interconnect. The patch cords shall be factory terminated with modular plugs featuring a one-piece, tangle-free latch design and black strain-relief boots to support easy moves, adds and changes. They shall be constructed with Category 6 24-AWG stranded UTP cable. Each patch cord shall be 100% performance tested at the factory in a channel test to the TIA/EIA Category 6 standard. The patch cords shall come in standard lengths of 3, 5, 7, 9, 14, and 20 feet

8) Fiber Termination Hardware

Fiber Connectors and Patch Cords

Panduit SC/LC Fiber Optic Connectors shall be field terminable simplex fiber optic connectors for both multimode and single mode glass fiber that fully complies with the fiber optic connector performance requirements specified in TIA/EIA-568-C.3 and the intermateability requirements specified by the TIA 604-2 FOCIS-2 document. The multimode ST connector shall be compatible with 62.5/125 μ m and 50/125 μ m, 3.0 mm jacketed or 900 μ m tight-buffered, multimode or 9/125 μ m single mode glass fiber. The connector shall have an insertion loss typically less than 0.3 dB per fiber. They shall be capable of field termination with commonly available tools. The boots of the multimode ST connector shall be available in beige or blue for single mode fiber. They shall incorporate pre-radiused ceramic ferrules to ensure consistent end face geometry and high performance connector mating.

Panduit ST, SC and LC Optical Fiber Patch Cords shall be constructed from high performance 50/125 μ m multimode cable and **ST / SC / LC** simplex connectors with ceramic ferrules. Integral boots shall be provided to provide strain relief and help maintain consistent polarity. They shall come in standard lengths of 1, 2, 3 and 10 meters. The following patch cord configuration(s) shall be used:

9) Rack, Cabinet, and Cabling Management Equipment Enclosures

PANDUIT Rack Mount and Wall Mounted fiber optic enclosures shall be capable of doubling the capacity by increasing fiber cable density within the allotted space when using LC connections. Enclosures shall provide patch cable protection. Enclosures shall protect fiber optic connections for patching or splicing requirements.

Cable Management

The 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. The system shall be a complete cable management system comprised of vertical and horizontal cable managers to manage cables on both the front and rear of the rack. The system shall protect network investment by maintaining system performance, controlling cable bend radius and providing cable strain relief.

A. Rack System

Cable Management shall be provided using the applicable rack system that supports heavy equipment and high capacity cable for cross connect or interconnect applications in a telecommunications closet. The Rack system shall be modular and support copper and fiber cables. The rack system solution shall be constructed of steel material and support both assembled to accommodate both 19" and 23" components. The rack system solution shall provide integral cable management including vertical channels, pass through holes and slots for additional cable management accessories. Pass through holes shall be located on the front, back and side of the rack for maximum flexibility. The rack shall accept removable, hinged doors.

B. Vertical Cable Management

Vertical cable managers shall include components that aid in routing, managing and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" or 23" racks and constructed of steel bases with PVC duct attached. The covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.

C. Horizontal Cable Management

Horizontal cable managers shall include components that aid in routing, managing and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" or 23" racks and constructed of steel bases with PVC duct attached. The duct fingers shall include retaining tabs to retain the cables in place during cover removal. The covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.

D. Cabinet Cable Management

IN-Cabinet cable management system shall include components that aid in routing, managing and organizing cable to and from equipment within a cabinet. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a flexible design with adjustable mounting. Panels shall be constructed of steel bases with PVC duct attached. Duct fingers shall have score lines for easy removal.

10) Grounding and Bonding

The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/J-STD-607-A Telecommunications Bonding and Grounding Standard.

The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications room shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TR or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.

All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

11) Fire stop

A firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.

All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestop system, stamped/embossed by the PE shall be provided to the Owner's Technical Representative prior to installing the firestop system(s).

Part 9 - Execution

9.1 Work Area Outlets

Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12" of UTP and 36" of fiber slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack shall be loosely configured and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-C document, manufacturer's recommendations and best industry practices.

Pair untwist at the termination shall not exceed 3.18mm (0.125 inch).

Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.

The cable jacket shall be maintained to within 25mm (one inch) of the termination point.

Data jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).

Voice jacks shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

9.2 Vertical Outlet Pole and Surface Raceway

- A. Vertical outlet poles and Surface Raceway refers to a surface raceway system used for branch circuit wiring and/or data network, voice, video and other low-voltage cabling. Surface raceway shall be used in solid wall applications or for applications where moves, additions and changes are very typical to the workflow.
- B. The raceway system shall consist of raceway, appropriate fittings and accessories to complete installation per electrical drawings. Non-metallic surface raceway is to be utilized in dry interior locations only as covered in Article 352, part B of the NEC, as adopted by the NFPA and as approved by the ANSI.
- C. Equivalent Products - Panduit shall manufacture all raceway products, including but not limited to those listed below. The raceway shall conform to the manufacturing and compatibility requirements listed in appendix E and there will be no substitutions allowed.

9.3 Horizontal Cross connect Installation

Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-C standard, manufacturer's recommendations and best industry practices.

Pair untwist at the termination shall not exceed 3.18 mm (0.125 inch).

Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

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.

The cable jacket shall be maintained as close as possible to the termination point.

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.

9.4 Optical Fiber Termination Hardware

Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

Each cable shall be individually attached to the respective fiber enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

A maximum of 12 strands of fiber shall be spliced in each tray
All spare strands shall be installed into spare splice trays.

9.5 Copper Termination Hardware

Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-C standard, manufacturer's recommendations and best industry practice.

Pair untwist at the termination shall not exceed 3.18mm (0.125 inch). Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

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.

The cable jacket shall be maintained to within 25 mm (one inch) of the termination point.

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.

9.6 Racks

Racks shall be securely attached to the concrete floor using minimum 3/8" hardware or as required by local codes.

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.

All racks shall be grounded to the telecommunications ground bus bar in accordance with Section 2.4 of this document.

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.

Wall mounted termination block fields shall be mounted on 4' x 8' x .75" void free plywood. The plywood shall be mounted vertically 12" above the finished floor. The plywood shall be painted with two coats of white fire retardant paint.

Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.

9.7 Fire stop System

All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance. The firestop solution must be DHEC approved.

9.8 Grounding System

The TBB shall be designed and/or approved by a qualified PE, licensed in the state that the work is to be performed. The TBB shall adhere to the recommendations of the J-STD-607-A standard, and shall be installed in accordance with best industry practice.

A licensed electrical contractor shall perform installation and termination of the main bonding conductor to the building service entrance ground.

9.9 Identification and Labeling

3. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
4. All label printing will be machine generated by Panduit PanMark software and Panduit desktop and hand-held printers using indelible ink ribbons or cartridges. Self-laminating labels will be

used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.

9.10 Testing and Acceptance

A. General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C-1 Section 11. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

2. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the PANDUIT® **CERTIFICATION PLUS**SM System Warranty guidelines and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.

B. Copper Channel Testing

All twisted-pair copper cable links shall be tested for compliance to the requirements in ANSI/TIA/EIA/568-C.2 for the appropriate Category of cabling installed.

C. Fiber Testing

1. All installed fiber shall be tested in accordance with ANSI/TIA/EIA-568-C.2 section 11.

For horizontal cabling system using multimode optical fiber, attenuation shall be measured in one direction at either 850 nanometer (nm) or 1300 nm using an LED light source and power meter.

Backbone multimode fiber cabling shall be tested at both 850 nm and 1300 nm (or 1310 and 1550 nm for single mode) in Both directions.

Test set-up and performance shall be conducted in accordance with ANSI/TIA/EIA-526-14 Standard, Method B.

Where links are combined to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. **ONLY BASIC LINK TEST IS REQUIRED.** The contractor can optionally install patch cords to complete the circuit and then test the entire channel. The test method shall be the same used for the test described above. The values for calculating loss shall be those defined in the ANSI/TIA/EIA Standard.

Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements.

9.11 System Documentation

A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer/End User for approval. Documentation shall include the items detailed in the sub-sections below.

B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 working days of the completion of each testing phase. At the request of the Engineer, the telecommunications contractor shall provide copies of the original test results.

C. The Engineer may request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined

above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

- D. **Test Results** documentation shall be provided in electronic format within three weeks after the completion of the project. The media shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.
- E. The field test equipment shall meet the requirements of ANSI/TIA/EIA-568-C. The appropriate level III tester shall be used to verify Category 6 cabling systems.
- F. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. Alternately, the telecommunications contractor may furnish this information in electronic form. The media shall contain the electronic equivalent of the test results as defined by the specification along with the software necessary to view and evaluate the test reports.
- G. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.
- H. The **As-Built** drawings are to include cable routes and outlet locations. Their sequential number as defined elsewhere in this document shall identify outlet locations. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (DWG, AutoCAD rel. 14) formats on which as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.
- I. The Contractors shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD rel. 14) form

END OF SECTION



CSI SECTION 271619

COMMUNICATIONS PATCH CORDS, STATION CORDS, AND CROSS CONNECT WIRE

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a standard specification applicable to commercial building structured cabling applications.

The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines.

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SECTION 271619 – COMMUNICATION PATCH CORDS, STATION CORDS AND CROSS CONNECT WIRES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 & 1 Specification Sections, apply to this Section.
2. Section 270500 “Common Work Results for Communications”

1.2 SUMMARY

A. Section Includes:

1. Twisted-pair jumper wires;
2. Twisted-pair patch cords.
3. Fiber Optic patch cords.
4. Related cross-connect components;
5. Cross-connection and patching

B. Related Sections:

1. Section 270500 “Common Work Results for Communications”
2. Section 271323 “Communications Optical Fiber Backbone Cabling”
3. Section 271315 “Communications Copper Horizontal Cabling”
4. Section 271313 “Communications Copper Backbone Cabling”
5. Section 271119 “Termination Blocks and Patch Panels”

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For Category-6a patch cords, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
2. For Fiber Optic patch cords, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.

B. Source quality-control reports.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled by a qualified testing agency, and marked for intended location and application.
- B. Warranty
 - 1. See Section 270500 “Common Work Results for Communications”.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test optical fiber cables to determine the continuity of the strand end to end. Use optical loss test set.
 - 2. Test each pair of UTP cable for open and short circuits.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

- A. PATCH CABLES
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
 - a. PANDUIT
- B. General Requirements: Comply with TIA/EIA-569-C.
- C. Patch Cords: Factory-made, four-pair cables terminated with eight-position modular plug at each end in lengths as indicated in pricing sheet.
 - 1. Patch cords shall have bend-relief-compliant boots to ensure Category 6a performance.
 - 2. .
 - 3. UTP Patch Cords will be available in the following lengths:

Description	Est. Qty (See E)
4- pair UTP Category-6A Non-plenum Modular Patch Cords - 4ft	2000
4- pair UTP Category-6A Non-plenum Modular Patch Cords - 7ft	5000
4- pair UTP Category-6A Non-plenum Modular Patch Cords - 10ft	5000
4- pair UTP Category-6A Non-plenum Modular Patch Cords - 12ft	5000
4- pair UTP Category-6A Non-plenum Modular Patch Cords - 15ft	200
4- pair UTP Category-6A Non-plenum Modular Patch Cords - 20ft	200

D. Patch Cords: Factory-made, dual-fiber cables with NC connectors.

1. Fiber patch cords will be available in the following lengths.

Description	Standard Part Number	Non-Standard Part Number	Est. Qty (See E).
2-Strand 50µm Multimode LC-LC Patch Cords - 3ft	FXE10-10M1Y	FXE10-10F3Y/N	50
2-Strand 50µm Multimode LC-LC Patch Cords - 9ft	FXE10-10M3Y	FXE10-10F9Y/N	300
2-Strand 50µm Multimode LC-LC Patch Cords - 15ft	FXE10-10M5Y	FXE10-10F15Y/N	300
2-Strand 50µm Multimode LC-LC Patch Cords - 24ft	FXE10-10M8Y	FXE10-10F24Y/N	300
2-Strand 50µm Multimode LC-LC Patch Cords - 30ft	FXE10-10M10Y	FXE10-10F30Y/N	200
2-Strand Single Mode LC-LC Patch Cords - 3ft.	F9E10-10M1Y	F9E10-10F3Y/N	50
2-Strand Single Mode LC-LC Patch Cords - 9ft.	F9E10-10M3Y	F9E10-10F9Y/N	150
2-Strand Single Mode LC-LC Patch Cords - 1 5ft.	F9E10-10M5Y	F9E10-10F15Y/N	150
2-Strand Single Mode LC-LC Patch Cords - 24ft.	F9E10-10M8Y	F9E10-10F24Y/N	150
2-Strand Single Mode LC-LC Patch Cords - 30ft	F9E10-10M10Y	F9E10-10F30Y/N	150

E. Estimated Quantities

1. The estimate of cable counts and lengths is given for bid purposed only; the final count and lengths will be provided in the integration phase of the project.
2. Pricing should include single cable pricing and quantity discount pricing.

F. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA568-C.3.
2. Quick-connect, simplex and duplex, Type LC connectors. Insertion loss not more than 0.75 dB.

2.2 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, and inks used by label printers.

- B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.3 SOURCE QUALITY CONTROL

- A. Factory test UTP cables according to TIA/EIA-568-C.2.
- B. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-C.3.
- C. Provide test and inspection reports.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling connections for compliance with TIA/EIA-568-C.1.
 - 2. Visually confirm Category 6a, marking of patch cables.
 - 3. Visually confirm Fiber patch cable marking.
 - 4. Visually inspect cable placement, and patch cords, and labeling of all components.

- B. Use copper patch cord lock-in devices to prevent the disconnection of critical equipment connections.

END OF SECTION 271619



CSI SECTION 2711613

COMMUNICATIONS CUSTOM CABLE ASSEMBLIES QUICKNET COPPER

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a standard specification applicable to commercial building structured cabling applications.

The documentation includes: Product specifications, minimum product performance, structured cabling design considerations and installation guidelines.

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SECTION 271613 – COMMUNICATION Custom Cable Assemblies
QUICKNET™ Copper Cabling Solution (Pre-Terminated)

- 1 The QUICKNET™ Copper Cabling System is a custom, pre-terminated cabling solution that is easy to install and provides quick network deployment, increased reliability and reduced labor costs compared to traditional field terminated installations.
- 2 Cable assemblies include cassettes, jack modules, plug pack and/or modular plug terminations with UTP cable for Category 6 applications or UTP/STP cable for Category 6A applications. QUICKNET™ Cassettes snap in and out of angled and flat modular patch panels with one hand for easy deployment.
- 3 The QUICKNET™ assemblies consist of six cables pre-bundled utilizing a Kevlar overwrap material. Kevlar overwrap material binds the six pre-bundled cables together and is therefore a critical element of the assembly. It has become apparent that not all Kevlar material is the same and that some forms are prone to fraying. The Kevlar material used in our QUICKNET™ assemblies* was designed specifically for PANDUIT. *NOTE: We also use the same type of Kevlar overwrap material for our non-pre-terminated cable looms.
- 4 Once binding is complete, the pre-bundled cable is then customized to Microsoft's specific requirements: length, connector type, connector color, Plug Pack, or customized labeling. Prior to packaging, each assembly is 100% factory tested to permanent link standards and a Fluke Linkware report will accompany each assembly.

PANDUIT QUICKNET® Plug Pack Assemblies facilitate quick and easy connection and disconnection of patch cords to a variety of switches, reducing time and cost associated when installing and maintaining structured cabling links.

ALTERNATIVE TO SPECIFICATION– QUICKNET™ Fiber Cabling Solution (Pre-Terminated)

The *PANDUIT QuickNet™* Fiber Optic Cabling Solution is ideal for high-density network applications delivering high reliability and scalability in a cost effective design. Providing quick and easy deployment, the system consists of pre-terminated SC or LC connectivity to MTP (Mechanical Transfer multiple fiber Plug) cassettes, cable assemblies and enclosures. *QuickNet™* cassettes incorporate high-density laser optimized OM3 fiber, or OM1, OM2 or OS1/OS2 fiber. The cassettes can be interconnected by a jacketed patch cord version of the same high-density ribbon fiber used within the cassette and/or trunk cable assemblies constructed with the same fiber quality. System components work together to achieve up to 96 fiber connections in a single rack space with superior cable access and management capabilities. *QuickNet™* MTP* Interconnect Patch Cords are FOCIS-5 compliant that are fully tested per IEEE 802.3ae 10GbE to support network transmission speeds up to 10Gb/s for link lengths up to 300 meters at 850nm with 50/125µm (OM3) laser optimized fiber. These interconnect cords are backward compatible with all 50/125µm (OM2) MPO or MTP* system requirements. MTP interconnect cords are factory terminated, assembled and 100% tested for insertion loss (Insertion loss data recorded for every MM patch cord with lifetime traceability of test data to a Q.C. number on each cord). *Panduit QuickNet™* Trunking Solutions are preterminated optical fiber cabling systems designed

to streamline the process of deploying optical infrastructure in the premises environment. These innovative value-added systems significantly reduce installation time and cost. Since all the components are preterminated and simple to plug together, an optical network infrastructure can be installed, connected and operational in a fraction of the time when compared to using conventional methods. Additionally, the systems' modular design guarantees compatibility, flexibility and system performance for all optical connection spans. Combined with modular high-density components, the systems deliver the highest density solution – doubling the density of traditional optical components. Panduit offers the following products to provide value-added solutions for traditional LAN network infrastructures and also the latest data center applications.

END OF SECTION



CSI SECTION 271613

STRUCTURED CABLING SYSTEM SPECIFICATION

For

Multi-Gb/s Ethernet & ANSI Fibre Channel Compliant OM3 & OM4 Cabling Systems

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Introduction

1.1.Purpose

The purpose of this document is to provide documentation to cabling professionals interested in providing their customer a best practice standard specification applicable for a Multimode optical fiber based (OM) data center cabling systems that are compliant to multiple higher speed telecommunications protocols for commercial building structured cabling applications.

These telecommunications standards include (but are not limited to):

IEEE802.3ae 10Gb/s Ethernet:

- 10GBASE-SR/SW (10Gb/s Ethernet over OM3*)
**- OM4 not listed in standard, but considered in this document to add design flexibility*

ANSI T11 4Gb/s and 8Gb/s Fibre Channel:

- 400-M5E-SN-I (4Gb/s FC over OM3)
- 400-M5F-SN-I (4Gb/s FC over OM4)
- 800-M5E-SN-I (8Gb/s FC over OM3)
- 800-M5F-SN-I (8Gb/s FC over OM4)

The documentation includes

- Product specifications
- Minimum product performance
- Structured cabling design considerations
- Installation guidelines

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1.2.Applicable Standards

The following industry standards are the basis for the structured cabling system described in this document. The list is incorporated by this reference to them.

1.2.1.TIA/EIA

- TIA/EIA-568-C (Commercial Building Telecommunications Cabling Standard)
- TIA/EIA-569-A (Commercial Building Standard for Telecom, Pathways and Spaces)

- TIA/EIA-606 (Administration Standard for the Telecommunications, Infrastructure of Commercial Buildings)
- TIA/EIA-607 (Commercial Building Grounding/Bonding Requirements)
- TIA 942, Telecommunications Infrastructure Standard for Data Centers or most recent draft or revision at the time of installation, as well as any applicable addenda
- TIA/TSB-140, Additional Guidelines For Field-Testing Length, Loss And Polarity Of Optical Fiber Cabling Systems

1.2.2.ISO/IEC

- ISO/IEC 11801 (Generic Cabling for Customer Premises)

1.2.4 IEEE

- 802.3ae (Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications)

1.2.5 ANSI T11.2

- FC-PI-5 (Fibre Channel Physical Interface-5)

The most recent versions of all documents apply to this project. FC-PI-5 includes 16GFC, 8GFC and 4GFC. FC-PI-5 supersedes FC-PI-4. For older technologies such as 2GFC and 1GFC refer to FC-PI-2.

If there is a conflict between applicable documents, the order above shall dictate the order of precedence in resolving the issue unless an enforceable local or national code is in effect.

1.3.Additional Support

1.3.1.[Panduit® Certification Plus™ System Warranty](#)

A **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 25 years.

1.3.2.[Panduit® PCI Contractor Agreement](#)

A factory registered [Panduit PCI contractor](#) shall complete network installation. The contractor shall have completed standards based product and installation training. A copy of the PCI Contractor Registration shall be submitted in the proposal.

1.3.3.[Product Guarantee](#)

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. Applications may include, but are not limited to those listed in section 1.1 of this document

In order to qualify for the guarantee, the structured cabling system must be installed per the following:

1. Meet all TIA/EIA (or ISO/IEC) commercial building wiring standards
2. Panduit Products must be installed per Panduit instruction sheets.

Note: All Networks shall be installed per applicable standards and manufacturer's guidelines.

If any Panduit Pan-Net® product fails to perform as stated above, Panduit will provide new components at no charge.

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.

2. Telecommunication/Storage Network System Requirements

2.1. Description

The Fiber Structured Cabling System shall consist of any one or all of the following structured cabling elements or subsystems:

- High Density LAN/SAN Switch Equipment Distribution Area Cabling
- Cross Connect/Main Distribution Area Connectivity
- Zone Distribution Area Cabling
- Host Equipment Distribution Area Cabling

2.2. Supported Applications

The Fiber Structured Cabling System shall be capable of supporting and/or integrating the following:

- Data applications
- Local area network services
- Wide area network services
- Storage Network applications and services

The applications that shall be supported include, but are not limited to:

Data Communications

- Ethernet (10GBASE-SR/SW, 10GBASE-LRM, 10GBASE-LX4, 1000BASE-SX and 1000BASE-LX)
- Fibre Channel (100-M5E-SN-I thru 1600-M5F-SN-I)
- FCOE (ANSI T11 FC-BB-6 Fibre Channel Backbone 6)
- Any other application designed to run on a generic structured cabling system designed and installed to TIA or ISO structured cabling standards.

Data Processing

- Mainframe access client server, enterprise server, messaging systems and electronic mail, client database, etc.

Video

- Analogue video, digital video, and video conferencing

Multiple Services

- The structured cabling system shall also support backward and forward migration of applications with minimal disruption to existing services or personnel, allowing for quick moves, adds, and changes.

2.3. Additional Requirements

- In order to be 10GBASE-SR/SW and Fibre Channel compliant, all components of the cabling system must be Panduit® 10Gig product unless other-wise approved or authorized by Panduit.
- All structured cabling products shall be installed according to any applicable instructions.
- All networks and other applications shall be installed per applicable standards and manufacturers' guidelines and transmitted over the appropriate minimum Category copper cable or fiber cable for which it was intended to operate on.
- All applicable local, state, national, and federal electrical and fire safety standards shall be adhered to during and after installation.

2.4. Fiber Connector Components/Technology

The fiber solution used for higher speed channels described in this document must be sourced from a single solution vendor and be supported by a warranty for performance and application support using the configurations such as those outlined in this document.

Mixing and matching of fiber SCS components from different vendors is not permitted.

Throughout all data centers the preferred **multimode** fiber types used are:

- OM3 Multimode Laser Optimized 50/125µm
- OM4 Multimode Laser Optimized 50/125µm

Such multimode solutions will support an OF-300 (300m) channel throughout the installation when configured using any LC Duplex OM3 patch cords (including LC to gender change cords) necessary to connect the active equipment.

For Multimode Laser Optimized 50/125µm (OM3/OM4) products the fiber used in the production of cords, cables and pigtails must be from the same source of manufacture (ex. - mixing of Bend Tolerant and Non-Bend intolerant fibers is not permitted).

For all new installations, the preferred fiber shall be OM3 or OM4 Laser Optimized 50/125 µm, capable of supporting 10GB Ethernet @ 850nm for a minimum distance of 300m and 8GB Fibre Channel for a minimum distance of 150m, including the multiple connectors in the channel (given that the total connector insertion loss is below that allowed in the applicable standard)

The preferred connector type for presentation on the cabling infrastructure is the LC (TIA FOCIS compliant) duplex connector. All connectors shall be supplied as factory assembled and pre-terminated, using the same fiber type, performance and manufacturer source for the fiber in the connectorized components (patch cords, harnesses and cassettes) as that of the fiber optic cable backbones (Trunk assemblies and ribbon interconnect cordage).

Test results from the manufacturer shall be provided for all components supplied. Also, factory data to validate return loss will be collected and be available upon request. This data shall include the following key and critical parameters:

Component	Component Overall Loss	Connector Loss	Component Return Loss	Connector Return Loss
LC/SC Patchcords		✓		✓
MPO/MTP Cassettes	✓		✓	
Harnesses/Hydras		✓		✓
Trunk Assemblies	✓	✓		✓
MTP Interconnect Cords		✓		✓

✓ - Customer Data for link budget purposes; ✓ - Factory Data for validation purposes

Connector end face finish and geometry is critical for high speed application support and repeatability of mated loss performance between connectors.

Paragraph 52.14.2.2 from IEEE 802.3ae states that “*the maximum discrete reflectance from an individual connector for 10GBASE-SR shall be less than -20dB*”; also, Paragraph 8.2.5 from ANSI T11 FC-PI-5 states that “*Connectors and splices shall each have a return loss greater than 20dB*”. These are equivalent statements and generally require that all connectors must have physically contacting fiber ends.

In order to meet these application requirements, every terminated connector in the channel must be inspected using interferometer evaluation tools to qualify the geometry against standards that guarantee such physical contact. In general the cabling contractors do not have the time or skill set to undertake this task as part of their normal process. For this reason the use of direct field terminated (hand polished) connectors is not permitted.

Care must be taken to accurately measure the cable lengths as there will be little to no spare capacity in the containment to host loops of excess cable.

Only approved fiber optic components and products may be used throughout the installation.

- Bend radius should be maintained at 10x cable outside diameter, no less
- Avoid excessive slack in the frames and cable tray, and abrupt bends
- Tie wraps are not permitted, Panduit Tak-Ty® recommended
- Waterfalls should be installed in every location where cables are dropped down into a frame or a rack out from the overhead cabling
- Where fiber backbone must be placed in the same cable routing solution as copper backbone, great care must be taken to segregate them in the containment
- Fiber backbone should be the top most cable in all cable routing solutions. Fiber should never be buried under any other cables
- Alternate routing of fiber cables from the left side and right side, every other panel within a given rack for ease of cable management. This applies for distribution frames and cabinets
- As per the requirements from any local or national governing code or standard; plenum rated cables must be used in plenum rated spaces
- For ease of access to the fiber ports and for cable management generally fiber patch panels located in cabinets should be installed facing the hot aisle
- Dust plugs will be provided and should be maintained on all fiber outlets and patch panel ports to protect the connection from contamination when not in use
- Mechanical splices and fiber adapter products shall not be used for joining fibers mid-span of any fiber link.

2.4.1. MPO/MTP Fiber Cabling System

Customer shall deploy optical fiber circuits consisting of trunk cables, cassettes, harnesses/hydras, patch cords and optical fiber patch panels as a standard configuration. A typical end-to-end data circuit will begin at the end equipment, and be constructed using standard components that includes a patch cord, a cassette, trunk cable, another cassette, and another patch cord, which terminates in the end equipment at the far end.

Channels may be deployed that include multiple cassettes, harnesses and trunks that produce worst case channel loss above the standards depending on physical channel length (such as cross-connected systems). Such “engineered links” must be individually validated against the IEEE reference model to assure performance.

Multimode circuits shall contain only 50/125µm OM3 or OM4 fiber, cables, cassettes, and patch cords. The trunk cables shall be comprised of optical fiber cable terminated with the appropriate number of 12-fiber multi-fiber push-on (MPO/MTP) connectors.

The cassettes shall be comprised of optical fibers terminated in one or two MPO/MTP-style connectors on one end and SC duplex or LC connectors on the other end and patch cords shall be of the same connector type, (LC or SC). The optical fibers and connectors shall be fully contained in a protective metal and/or plastic modular housing.

Patch cords shall be duplex (two-fiber) cable assemblies with SC duplex or LC connectors on the each end. Hybrid patch cords (patch cords with different connectors on each end) may be used between the electronics and the first cassette if necessary to match the end equipment interface.

2.4.1. MPO/MTP Fiber Cabling System Polarity Management

MPO/MTP polarity management for the cabling system shall be standards-based. Method ‘A’ is the preferred system to be deployed in new DC infrastructure builds and is the most widely deployed polarity technique among the fiber structured cabling vendors. To best understand the pros and cons of the varied polarity schemes, Panduit has produced a polarity white paper (available on the Panduit website) “Best Practices for Ensuring Polarity of Array-Based Fiber Optic Channels”:

http://www.panduit.com/groups/MPM-OP/documents/WhitePaper/CMSCONT_032945.pdf

For all of the cabling scenarios discussed in the document, (that include a cross connect), patch cord flipping is not required. See the following Panduit document for an architecture-based discussion of polarity management “MTP Solutions and Correct Gender”:

http://www.panduit.com/groups/MPMOP/documents/TechnicalReference/CMSCONT_036513.pdf

2.5. Fiber/Cable Technology

The maximum length or reach of a channel link is determined by the channel configuration, component performance, fiber bandwidth/attenuation and optical transceiver characteristics.

The IEEE 802.3ae standard for 10Gb Ethernet and the ANSI T11 Fibre Channel standard specify the minimum transceiver performance characteristics (e.g., Jitter, RIN, and receiver sensitivity) and based on these characteristics the minimum reach for a given fiber fiber solution (based on its attenuation and bandwidth).

If the transceiver exceeds the minimum specified output power and/or the receiver has higher sensitivity the link will have a larger power budget. However, one cannot assume the additional power budget can be equated to longer reach by considering fiber attenuation alone. Longer fiber links will introduce more modal dispersion and increased effects of other power penalties; primarily Intersymbol Interference (ISI).

Also, additional connectors and particularly, individual connectors that have high individual connector loss can introduce significant Modal Noise (MN) into the channel.

The IEEE 802.3ae 10Gb Ethernet standard only supports a minimum reach of 300m (based on OM3) and the ANSI T11 8Gb standard supports a minimum reach of 150m or 190m (based on OM3 and OM4 respectively) , and as such all claims for a longer reach are only supported by the optical fiber manufacturer for the given channel configuration.

The minimum reach for higher bandwidth fibers such as enhanced OM4 (fiber with greater than 4700 MHz .km) strongly depends on the transceiver characteristics and is not supported by the application specified, IEEE (but is supported by ANSI T11 under the designation M5F).

The minimum requirements for fiber media deployed in cabling systems described in the document are covered below:

Fiber Type	OFL Bandwidth 850nm (MHz•km)	OFL Bandwidth 1300nm (MHz•km)	Laser Bandwidth 850nm* (MHz•km)	Laser Bandwidth 1300nm (MHz•km)
50/125µm OM3	1500	500	2000	500
50/125µm OM4	3500	500	4700	500

Minimum Fiber Cable Bandwidth

* - Effective Modal Bandwidth, per TIA/EIA-492AAAC (OM3), TIA/EIA-492AAAD (OM4) and IEC 60793-2-10, ensured by EMBc or DMD performance specifications for sources meeting launch conditions specified in 10 Gigabit Ethernet (IEEE 802.3ae), and ANSI Fibre Channel.

Fiber Type	Attenuation 850nm (db/km)	Attenuation 1300nm (db/km)
50/125µm OM3	3.5	1.0
50/125µm OM4	3.0	1.0

Maximum Fiber Cable Attenuation

Application	50/125µm OM3	50/125µm OM4
10GBASE-SR	300	550*
10GBASE-LX4	300	300
10GBASE-LRM	220	220
400-M5E-SN-I	380	
400-M5F-SN-I		400
800-M5E-SN-I	150	
800-M5F-SN-I		190

Ethernet and Fibre Channel Supported Distances (in meters)

*-550 meter reach assuming 3.5 dB/KM maximum cabled attenuation at 850 nm plus 1.0 dB of total connection and splice loss, or 3.0 dB maximum cabled attenuation at 850 nm and 1.3 dB total connection and splice loss.

Additionally, the fiber media must exceed the requirements of TIA and IEC bandwidth requirements and must adhere to more stringent (and discriminating) Differential Mode Delay (DMD) mask methods for verifying the ultimate integrity of the Effective Modal Bandwidth (EMB) metric.

The fiber shall be manufactured with a Modified Inside Chemical Vapor Deposition (MICVD) or Plasma assisted Inside Chemical Vapor Deposition (PCVD) process and meet at least one of the following DMD templates, each of which consists of both an inner and outer mask specification, and the sliding mask specifications shown below.

OM3 Media

Template Number	850 nm DMD-Inner Mask (ps/m) (Radius 0-18 µm)	850 nm DMD-Outer Mask (ps/m) (Radius 0-23 µm)
1	≤ 0.23	≤ 0.70
2	≤ 0.24	≤ 0.60
3	≤ 0.25	≤ 0.50
4	≤ 0.26	≤ 0.40
5	≤ 0.27	≤ 0.35
6	≤ 0.33	≤ 0.33

Sliding Interval Masks: ≤ 0.25 ps/m

OM4 Media

Template Number	850 nm DMD-Inner Mask (ps/m) (Radius 0-18 μm)	850 nm DMD-Outer Mask (ps/m) (Radius 0-23 μm)
1	≤ 0.10	≤ 0.30
2	≤ 0.11	≤ 0.17
3	≤ 0.14	≤ 0.14

Sliding Interval Masks: ≤ 0.11 ps/m

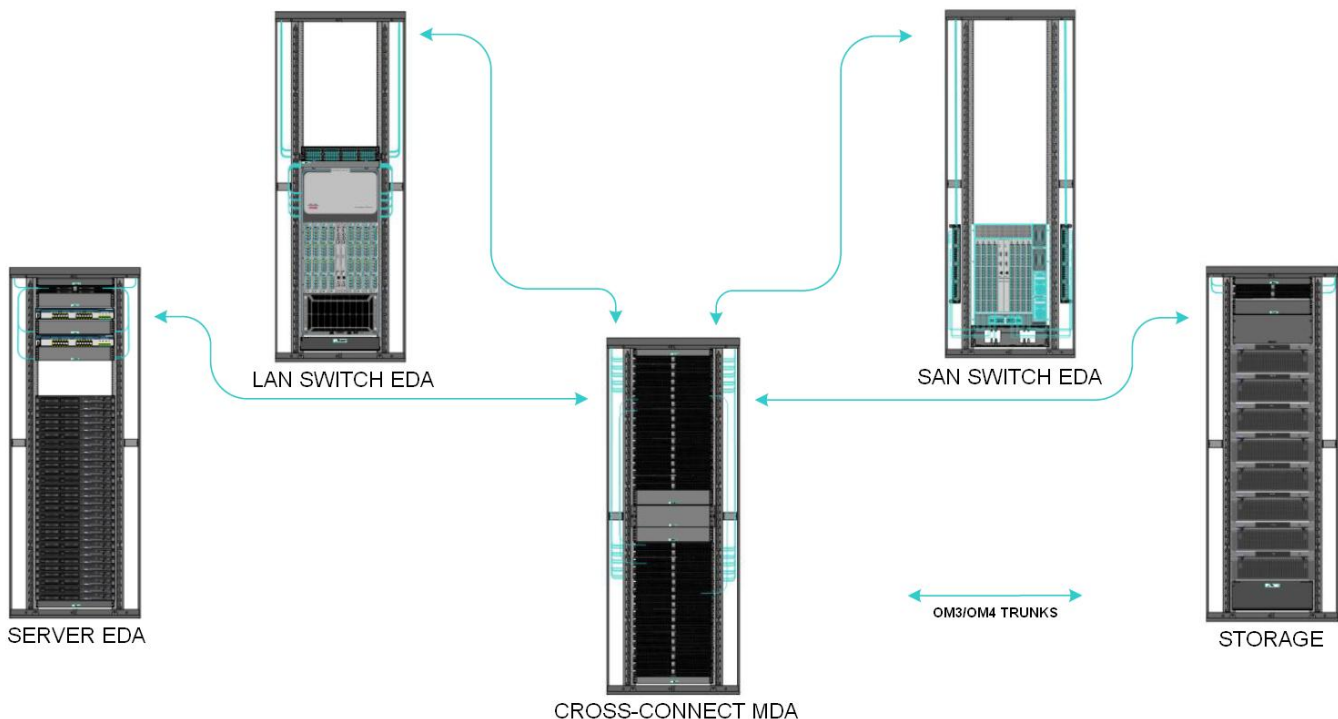
3. Reference Fiber Cabling Model

Cable management in high density SAN/LAN switch EDAs is a challenge. In traditional point to point installations there are typically large numbers of duplex zip-cord fiber assemblies in the proximity of the SAN director.

In high-density switch EDA fabrics, it can be very difficult to locate and alter cables. It is also important in this area to keep equipment LEDs visible and to prevent having to disconnect the cables when removing neighboring blades. Cabling must also not block airflow or access to the power supply chassis.

LAN/SAN cabling shall consist of the connectivity used to connect the switch ports to hosts (storage/servers). The connectivity equipment shall include the following options:

- Modular cassette and MTP trunking solutions
- High performance media and connectivity to support higher speed channels
- High density switch EDA patching solutions
- Port mapped switch patching solutions in cross connect MDA



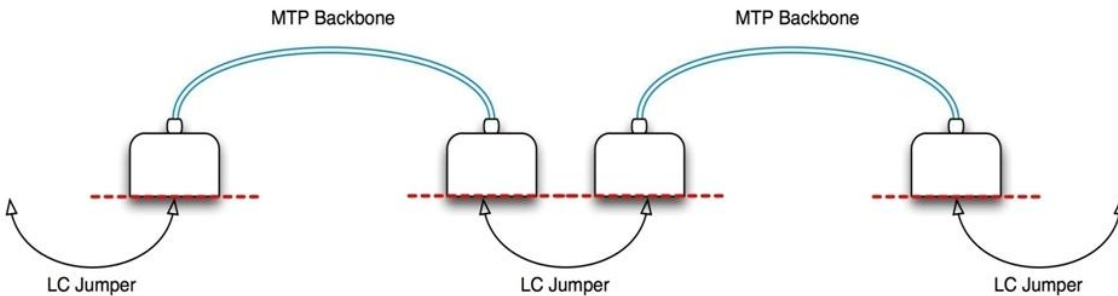
Small form factor cabling solutions (hydra breakout assemblies) coupled with QuickNet SFQ HD assemblies provision patch panels in the Switch EDA that will serve to minimize switch fabric cable

congestion. Hydra assemblies on the switch side connect to our tethered SFQ HD trunking assemblies mounted in close proximity to the director Blades (or panelized SFQ MTP adapter assemblies). These trunking assemblies connect the switching fabric through a QuickNet cassette-equipped MDA that ultimately cross-connects to the NICs/HBAs/CNAs present in host equipment.

The main distribution area in a data center includes the main cross-connect (MC), which is the central point for distribution of the structured cabling system. The SFQ HD cabling system can be designed in along with QuickNet modular cassettes (or Panduit QuickNet port-mapping 'jumbo', 1U cassettes) and pre-terminated array connector hydra assemblies that span MC to host/switch electronics with a consolidated and SFF cabling footprint.

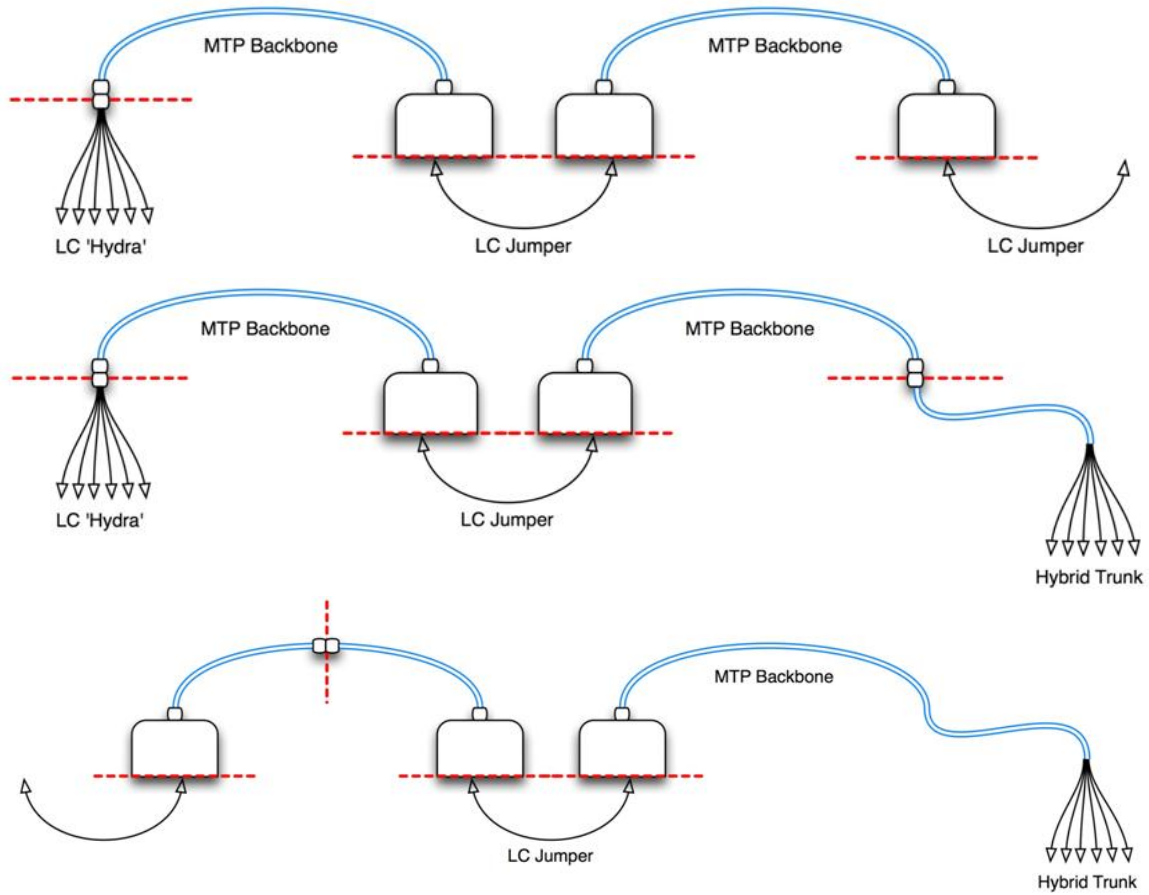
3.1.LAN/SAN Reference Model Channel Schematic

The basis plug and play reference model consist of 4 concatenated and discrete cassettes with standard LC jumpers in host and switch EDAs and at the cross connect.



3.2. LAN/SAN Alternate Channel Schematic Models

There are several different structured cabling models for SAN/LAN currently in use. A few of the most common ones are depicted below:



3.2. LAN/SAN Channel Model Reach and Loss Budgets

The various channel configurations presented previously place constraints on both the optical power budget per the applicable standards and the ultimate reach of the configuration. The optical power budgets and reach for each of the previous cable models denoted as Scenario 'A' (the four cassette cross connector model) through Scenario 'D' (the three cassette cross connect model with direct attach trunking on the host EDA end) are tabulated below for the applicable DC higher speed protocols. This tabulation serves as guidance for both planning for commissioning testing (power budget) and layout planning based on solution reach (spaces, pathways)

The total connector insertion loss values are calculated based on standard, "loss optimized" and "super loss optimized" MPO/MTP plug and play cabling systems available from Panduit:

Cabling Scenario	Total Connector Loss (Worst Case)		
	"STD"	"O"	"SO"
A	3.0dB	2.0dB	1.4dB
B	2.75dB	1.85dB	1.3dB
C	2.5dB	1.7dB	1.2dB
D	2.75dB	1.85dB	1.3dB

The reach for each of these cabling configurations is a function of the connectivity arrangement shown in the scenarios, but is also a function of the attenuation of the fiber deployed and its bandwidth. High bandwidth fiber such as OM4 consumes lower ISI power penalty than is allocated for in the IEEE Ethernet and ANSI channels models, so this 'bonus' ISI can be used to deploy more connectors and/or increase reach of the channel.

Calculations of reach based on fiber type/connectivity scenario are shown below for each of the application standards in question. Values are stated as the minimum reach for each model:

Cabling Scenario	Application Standard	Fiber Type	Reach (meters) vs. Solution Loss Grade		
			"STD"	"O"	"SO"
A	10GBASE-SR	OM3	163	266	307
	400-M5E-SN-I		150	320	386
	800-M5E-SN-I		35	125	162
	10GBASE-SR	OM4	249	437	513
	400-M5F-SN-I		200	370	420
	800-M5F-SN-I		50	160	200
B	10GBASE-SR	OM3	194	278	312
	400-M5E-SN-I		209	350	391
	800-M5E-SN-I		66	139	166
	10GBASE-SR	OM4	305	459	522
	400-M5F-SN-I		246	376	427
	800-M5F-SN-I		81	169	205
C	10GBASE-SR	OM3	221	289	317
	400-M5E-SN-I		258	364	394
	800-M5E-SN-I		90	148	170
	10GBASE-SR	OM4	354	480	532
	400-M5F-SN-I		288	392	434
	800-M5F-SN-I		110	180	210
D	10GBASE-SR	OM3	194	278	312
	400-M5E-SN-I		209	350	391
	800-M5E-SN-I		66	139	166
	10GBASE-SR	OM4	305	459	522
	400-M5F-SN-I		246	376	427
	800-M5F-SN-I		81	169	205

4. High Density LAN/SAN Switch Equipment Distribution Area Cabling

LAN/SAN EDAs shall consist of the connectivity used to connect the switch ports to adjacent patch panels in the switch EDA.

The connectivity equipment shall include the following options:

- Patch (equipment) cords
- Hydra (MTP breakout assemblies)
- Modular high Density Patch System

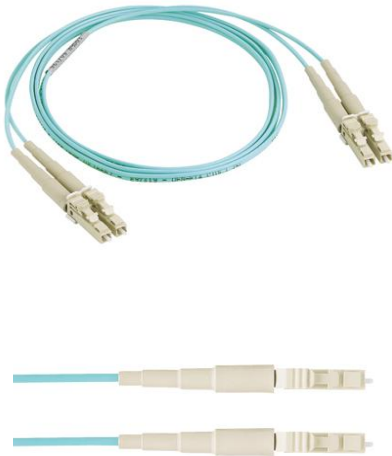
4.1. Patch (equipment) Cords

Panduit® Opti-Core® 10Gig™ Standard OM3/OM4 and Optimized OM3/OM4 Patch Cords work in conjunction with Panduit's 10Gig™ Fiber Optic High Speed Data Transport System to deliver the next progression in high performance optical connectivity and media with seamless integration of 10 Gb/s Ethernet and 8 Gb/s Fiber Channel network capability.

This scalable solution is designed to deploy long channels and/or cascaded connectivity (cross-connects) with ample headroom. These high performance 10Gig™ OM3/OM4 Patch Cords and Pigtails are the optimum solution for demanding high-density fiber optic data center applications with minimal physical infrastructure risk.

Panduit OM3/OM4 Patch Cords and Pigtails minimize the cost of ownership and provide a future-proof network migration path. Opti-Core® 10Gig™ OM3/OM4 Patch Cords are available with LC and SC connector combinations. Patch cord fiber options include 1.6mm and 3mm duplex jacketed cable and simplex pigtail 900 micron tight-buffered fiber in 1 – 10, 15, 20, 25 and 30 meter lengths.

Insertion loss for standard OM3/OM4 patch cords < 0.25dB/mated pair
Insertion loss for "optimized" OM3/OM4 patch cords < 0.15dB/mated pair).

<ul style="list-style-type: none">▪ Patch cords are tested to support network transmission speeds up to 10 Gb/s for link lengths up to 300 meters with an 850nm source per IEEE 802.3ae 10 GbE Standards▪ Pass all TIA/EIA-568-B.3 performance requirements▪ Backward compatible for use with all 50/125µm system requirements▪ Factory terminated and 100% tested for insertion loss▪ Insertion loss data recorded for every multimode patch cord▪ Lifetime traceability of test data to a Q.C. number on each patch cord▪ Jacketed cable is compliant with UL910 (OFNP) or IEC 606332.3C (LSZH) flame rating	
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4.2. Hydra (MTP breakout assemblies)


QuickNet™ Staggered Hydra Assemblies allow for rapid deployment of multi-port patch field connectivity in high-density Storage Area Network (SAN) and Data Center LAN applications. Built with modular MTP* connectivity and traditional LC connectivity, these assemblies provide compatibility, flexibility and system performance ensuring efficient use of cabinets and horizontal and vertical pathways through the use of small form factor cable.

All QuickNet™ Staggered Hydra Cable Assemblies are factory terminated and tested to deliver verified optical performance and reliability. OM3 fiber versions provide 10 Gb/s Ethernet network performance up to 300 meters* and 8Gb/s Fibre Channel network performance up to 150 meters*. OM4 fiber versions provide 10 Gb/s Ethernet network performance up to 550 meters† and 8Gb/s Fibre Channel network performance up to 190 meters*. QuickNet™ Staggered Hydra Assemblies are available as individual hydra cable assemblies that are switch and application specific or kits of 6, 8, or 12 cable assemblies for improved design flexibility.

Insertion loss for standard OM3/OM4 Hydra < 0.5dB/ MTP mated pair

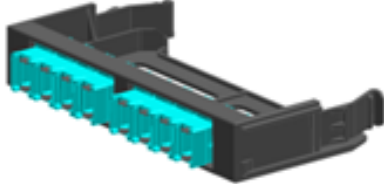

Insertion loss for “optimized” OM3/OM4 Hydra < 0.35dB/MTP mated pair

Insertion loss for “super optimized” OM3/OM4 Hydra < 0.25dB/MTP mated pair

<ul style="list-style-type: none">▪ Factory terminated and 100% tested for insertion loss;▪ 10GIG™ assemblies are also tested for return loss (test data supplied with each assembly)▪ 10GIG™ laser optimized fiber is tested per IEEE 802.3ae▪ Supports data rates up to 10 Gb/s for link lengths <300 meters @ 850nm▪ Pulling hardware to facilitate routing through difficult/inaccessible pathways▪ Jacketed cable is compliant with UL910 (OFNP) or IEC 606332.3C (LSZH) flame rating	
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4.3 Modular QuickNet Patch Panel System

Modular fiber adapter panels contain TIA/EIA-604 FOCIS compliant or compatible simplex or duplex fiber optic adapters and meet or exceed TIA/EIA-568-B.3 requirements. Fiber adapter panels include 4, 6, 8 LC, and SC, or 4/ 6 or 8 MTP fiber optic adapters. LC & SC fiber optic adapters include zirconia ceramic split sleeves to satisfy higher speed network requirements. LC and SC adapter housing colors follow the TIA/EIA-568-C.3 suggested color identification scheme. Multimedia modular panels allow customization of installation for applications requiring integration of fiber optic and copper cables. Blank fiber adapter panels reserve fiber adapter panel space for future use. All fiber adapter panels snap quickly into the front of fiber optic patch panels and enclosures for easy network deployment or moves, adds and changes.

<ul style="list-style-type: none"> ▪ Snap quickly into the front of all <i>QuickNet</i> component panels ▪ MTP fiber optic adapters are provided for greater Flexibility ▪ Offered in 4, 6 & 8 MTP adapters per adapter panel 	
<ul style="list-style-type: none"> ▪ Accept QuickNet™ Copper Cable Assemblies and QuickNet™ SFQ Series MTP* Fiber Optic Cassettes which snap in and out with one hand ▪ High-density patch panels conserve valuable rack space ▪ Angled patch panels facilitate proper bend radius control and minimize the need for horizontal cable managers ▪ Zero RU brackets accept fiber adapter panels or pre-terminated cassettes by mounting directly to rack or enclosure without utilizing additional rack space 	


5. Cross Connect/Main Distribution Area Connectivity

MDA cross connect shall contain a logical plug & play based patching system that “port maps” HD LAN/San switch ports to equivalent LC patchfield in the main distribution area. This area will consist of the following logical building blocks to cross connect switch ports efficiently to host EDAs:

- Port Mapping ‘Jumbo’ 1RU cassettes
- QuickNet™ MTP* Trunk Cable Assemblies
- QuickNet™ SFQ Series MTP* Fiber Optic Cassettes
- Patch (equipment) cords
- QuickNet™ Cassette Rear Cable Manager

5.1.Port Mapping ‘Jumbo’ 1RU cassettes

Pre-terminated HDQ series high density fiber optic cassette shall comply with IEEE 802.3ae 10 GbE and ANSI T11.2 Fibre Channel requirements. Fiber optic cassettes shall support network data rates up to 10 Gb/s for link lengths up to 300 meters using laser optimized OM3 fiber, and up to 550 meters using laser optimized OM4 fiber. Optimized cassettes shall provide insertion loss no greater than 0.5dB, and standard cassettes shall provide insertion loss no greater than 0.75dB to meet IEEE 802.3ae max. Channel loss specification of <2.6dB. Cassettes shall employ high performance MTP* connectors on the rear of the units routed to 6 or 4 duplex LC adapters on the patch field side. Adapter housing colors shall follow TIA/EIA-568-C.3 suggested identification scheme. Cassettes shall interconnect with high-density SFF MTP* ribbon interconnect cable assemblies. High density cassettes shall mount into 19" wide telecommunications racks, allowing 96 fiber connections to be deployed in one rack unit (1 RU) without additional support infrastructure..



<ul style="list-style-type: none"> ▪ Optimized performance enhancement ▪ High-density design - Maximizes density with up to 96 fiber connections in 1RU ▪ MTP* 12-fiber connector Pre-terminated modular cassette system ▪ Angled profile design (Panduit exclusive) ▪ Consistent port labeling mapping from switch blade to patch field - Product configurations port mapped specifically for Cisco and Brocade HD switch blades; customer can design the fiber cable distribution port labels consistent with specific switch blade manufacturer conventions 	
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5.2.QuickNet™ MTP* Trunk Cable Assemblies

QuickNet™ MTP Trunk Assemblies allow for rapid deployment of single fiber cassette breakout cassettes for patch field connectivity in high-density Storage Area Network (SAN) and Data Center LAN cross connect MDAs. Fiber optic trunks shall support network data rates up to 10 Gb/s for link lengths up to 300 meters using laser optimized OM3 fiber, and up to 550 meters using laser optimized OM4 fiber. Optimized trunks shall provide insertion loss no greater than 0.35dB, and standard trunks shall provide insertion loss no greater than 0.5dB to meet IEEE 802.3ae max. channel loss specification of <2.6dB. Trunks shall employ high performance MTP* connectors on each end. Cassettes shall interconnect with high-density such SFF MTP* ribbon interconnect cable assemblies. High density cassettes shall mount into 19" wide telecommunications racks, allowing 96 fiber connections to be deployed in one rack unit (1 RU) without additional support infrastructure.


Trunks are offered in ruggedized distribution style form factor with fiber counts of up to 144 (12 MTPs per end) for deployment in basket trays and in ribbon interconnect form-factor (single 12 fiber MTP on each end) for deployment in protected pathways such as FiberRunner.

Insertion loss for standard OM3/OM4 Trunk/Interconnect < 0.5dB/ MTP mated pair
 Insertion loss for "optimized" OM3/OM4 Trunk/Interconnect < 0.35dB/MTP mated pair
 Insertion loss for "super optimized" OM3/OM4 Trunk/Interconnect < 0.25dB/MTP pair

<ul style="list-style-type: none"> ▪ Connectivity Meets or exceeds all TIA/EIA-568-B.3 and ISO/IEC 11801 performance requirements ▪ FOCIS-5 compliant MTP connectors ▪ Proprietary MTP polishing provides low insertion loss and high return loss ▪ Support transmission speeds up to 10 Gb/s for link lengths up to 300 meters at 850nm with 50/125µm (OM3) ▪ Jacketed cable is compliant with UL910 (OFNP) or IEC 606332.3C (LSZH) flame rating 	
<ul style="list-style-type: none"> ▪ Passes all TIA/EIA-568-B.3 performance requirements ▪ Support transmission speeds up to 10 Gb/s for link lengths up to 300 meters at 850nm with 50/125µm (OM3) laser optimized fiber ▪ Jacketed cable is compliant with UL910 (OFNP) or IEC 606332.3C (LSZH) flame rating 	

5.3.QuickNet™ SFQ Series MTP* Fiber Optic Cassettes

Pre-terminated high-density modular fiber optic cassettes shall comply with IEEE 802.3ae 10 GbE and ANSI T11.2 Fibre Channel requirements. Fiber optic cassettes shall support network data rates up to 10 Gb/s for link lengths up to 300 meters using laser optimized OM3 fiber and link lengths up to 550 meters using OM4 fiber. Optimized cassettes shall provide insertion loss of 0.5dB max., and standard cassettes shall provide 1.0dB max. to meet IEEE 802.3ae max. channel loss specification of <26dB. Cassettes shall employ high performance MTP* connectors on the rear of the units routed to 6 or 4 duplex LC or 3 duplex SC adapters on the patch field side. Adapter housing colors shall follow TIA/EIA-568-C.3 suggested color identification scheme. Cassettes shall interconnect with high-density SFF MTP* ribbon interconnect cable assemblies. High-density cassette patch panels shall hold up to 8 cassettes, allowing up to 96 fiber connections to be deployed in one rack unit (1 RU).


<ul style="list-style-type: none"> ▪ Compatible with QuickNet™ SFQ Patch Panels,; up to 96 fibres/RU ▪ Low insertion loss of 0.5dB max. per optimized cassette and 0.35dB max. per “super optimized” cassette ▪ 10Gig™ 50/125µm Fiber Cassettes are tested per IEEE 802.3ae 10 GbE to support network transmission speeds up to 10 Gb/s for link lengths up to 300 meters at 850nm 	
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5.4.Patch (equipment) cords

See section 4.1 above for a description of cords to facilitate cross connect patching in the MDA.

5.5.QuickNet™ Cassette Rear Cable Manager

The fiber cassette rear cable manager organizes MTP* interconnect cable and traditional fiber cable for SFQ series MTP* fiber optic cassettes, HDQ series high density fiber optic cassettes, and pre-terminated cable assemblies with cassettes. The cassette rear cable manager mounts to the rear of a standard EIA 19" wide telecommunications rack and provides a secure location to support a maximum of sixteen MTP* interconnect cable assemblies. Interconnect cables and traditional fiber cables shall be secured with fiber management spools.

<ul style="list-style-type: none">▪ Rear mounting design - easy access to cable; rear mounting▪ Conserves DC floor space by reducing need for horizontal cable managers; occupies less than 1 RU▪ Fiber spools Improved fiber protection, ease of maintenance, and enhanced cable management▪ For use with QuickNet™ SFQ Series MTP* Fiber Optic Cassettes, QuickNet™ HDQ Series High Density Fiber Optic Cassettes, and QuickNet™ Pre-Terminated Cable Assemblies with Cassettes	
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6. Zone Distribution Area Cabling

Zone Distribution Area Cabling utilizing an underfloor enclosure allows for End of Row (EOR) or Middle of Row (MOR) patching configurations and allows for ease of full adds, moves or changes within a row.

This cabling area shall contain a logical plug & play system based upon the the maximum number of ports necessary to not only accommodate the present amount of ports required in the equipment area, but to future proof the same area so minimum overbuild of the horizontal cabling is required. This area will consist of the following logical building blocks to connect the horizontal cabling system to the equipment cabinets.

- PanZone® Raised Floor Enclosure
- QuickNet™ MTP* Trunk Cable Assemblies
- QuickNet™ SFQ Series MTP* Fiber Optic Cassettes
- Patch (equipment) cords
- Modular High Density Patch System

6.1 PanZone® Raised Floor Enclosure

The enclosure shall require the removal of only one floor tile and drop through a single tile opening without disassembly to install. The mounting brackets shall be of a one-piece design without any loose hardware for easy attachment to raised floor pedestals. The enclosure shall be properly grounded and bonded to the raised floor system when installed without the need of additional jumpers or other components. The enclosure shall meet UL2043 requirements for use in a plenum space, be available in multiple sizes, and be configurable for both field-terminated and pre-terminated connectivity. The enclosure and cable openings shall have the capacity to support 48 Category 6A/6/5e cables per rack space. Enclosure shall have flexible cable ingress/egress grommets that allow for quick and easy moves, adds, and changes, while still maintaining a plenum rating. The enclosure shall be capable of being secured and protected from unauthorized access with an optional lockable cover.

- Saves Valuable real estate in the data center by allowing cable terminations below raised floors, relieves congestion in racks and cabinets
- Allows for quicker and easier moves, adds and changes while maintaining a plenum rating to help conserve energy.
- Allows greater network design flexibility
- Manages and organizes up to 576 Cat 6A/6/5e, or 1152 fiber optic connections.
- Accommodates field-terminated or pre-terminated connectivity
- Secure Lockable Cover (if required)



6.2 QuickNet™ MTP* Trunk Cable Assemblies

See section 5.2 above for a description of trunk cable assemblies to facilitate cabling in the Zone Distribution Area.

6.3 QuickNet™ SFQ Series MTP* Fiber Optic Cassettes

See section 5.3 above for a description of fiber optic cassettes to facilitate connectivity in the Zone Distribution Area.

6.4 Patch (equipment) Cords

See section 4.1 above for a description of cords to facilitate patching in the the Zone Distribution Area.

6.5 Modular High Density Patch System

See section 4.3 above for a description of the patching solution to facilitate connectivity and cabling the Zone Distribution Area.

7. Host Equipment Distribution Area Cabling

LAN/SAN Host EDAs shall consist of the connectivity used to connect the patch panels in the switch EDA to switch uplinks, NICs, CNAs & HBAs. The connectivity equipment shall include the following options:

- QuickNet patch panels
- QuickNet™ SFQ Series MTP* Fiber Optic Cassettes
- Patch (equipment) cords

7.1.QuickNet patch panels

The modular connectors and patch cords will be chosen to match the horizontal cabling.

7.2.QuickNet™ SFQ Series MTP* Fiber Optic Cassettes

See section 4.1 above for a description of cassettes that are used to distribute fiber for patching to host uplinks, NICs, CNAs & HBAs.

7.3.Patch (equipment) cords

See section 4.1 above for a description of cords to facilitate cross connect patching in the MDA.