



Category 6A 10Gig

DATA/TELECOMMUNICATIONS

REQUEST FOR PRICING

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HORIZONTAL CABLING REQUIREMENTS

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 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 B; 569; 606-A; 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 one termination 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 that 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 Augmented 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 Augmented rated jacks to populate a modular 48 port angled patch panel. All cables should be patched at cutover as an interconnection into the floor serving active equipment using RJ45 modular equipment cables rated to Cat 6 Augmented as per EIA/TIA Standards.

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 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 when applicable 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
 - Optical Fiber from TR to Work Area
 - UTP/Fiber/Coax WA Patch Cords
 - Category 6A 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 (see attached Panduit PN390 Installation Guidelines). 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.

1.3. 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-B Commercial Building Telecommunications Cabling Standard
 - TIA/EIA-568-B.1 General Requirements
 - TIA/EIA-568-B.2-10 Balanced Twisted Pair Cabling Components Standard
 - TIA/EIA-568-B.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.

1.4. Quality Assurance

- A. Cabling System Warranty (See Appendix A)
 - 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.
 - 2. Upon submission of all bid documents, a current Panduit Certified Installer document MUST be submitted or the bid documents will be automatically rejected (unless specifically noted elsewhere in the contract documents).

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 and fiber 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 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.

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 (current PCI certificate and valid installer PCT Certification) 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.

1.5. Approved Products

- A. Approved UTP 4-pair Cable: PUP6X04BU-Ux
 - B. Approved Optical Fiber Cable manufacturer: Panduit
 - C. Approved UTP connector product manufacturer: Panduit
 - D. Approved Fiber Optic cabinet product manufacturer: Panduit *
 - E. Approved Fiber Optic connectors/splices/couplers: Panduit *
 - F. Approved Rack and Cabinet manufacturer: Panduit *
 - G. Approved Patch Panel manufacturer: Panduit *
 - H. Approved UTP Patch Cord manufacture: Panduit *
- * See Attached Appendix A for suggested B.O.M.

2. Products

2.1. Equivalent Products

- A. Panduit shall manufacture all products, including but not limited to cable management, faceplates, copper modules, patch panels, racks, Pre-terminated, end to end structured cabling systems for copper and fiber, 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.

2.2. Substitutions – (no exceptions)

- A. This is a performance-based 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, section 2.
- 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.

2.3. 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-6A™ • Exceeds draft requirements of TIA/EIA-568-B.2-AD10 and ISO 11801 Class EA Edition 2.1, and IEEE 802.3an-2006 ratified standard channel requirements for supporting 10GBASE-T • Each jack is 100% tested to ensure NEXT and RL performance and is individually serialized for traceability • Utilizes patent-pending enhanced Giga-TX™ Technology for jack terminations which optimizes performance by maintaining cable pair geometry and eliminating conductor untwist • No punchdown tool required; termination tool (EGJT) ensures conductors are fully terminated by utilizing a smooth forward motion without impact on critical internal components for maximum reliability • Optional termination tool (TGJT) reduces termination time by 25%, ideal for high volume installations • Can be re-terminated a minimum of twenty times • Blue termination cap designates 10Gig™ Augmented Category 6 performance and provides a positive strain relief; helps control cable bend radius and securely retains wires • Terminates 4-pair, 22 – 26 AWG, 100 ohm, solid or stranded twisted pair cable • Termination cap is color coded for T568A and T568B wiring schemes • Accepts 6 and 8-position modular plugs without damage • Can be clearly identified with optional labels and icons

TX-6A™ Category 6 Patch Cords • Exceed draft requirements of TIA/EIA-568-B.2-AD10 and ISO 11801 Class EA Edition 2.1 and IEEE 802.3an-2006 ratified standard channel requirements for supporting 10GBASE-T • Each patch cord is 100% performance tested and wired T568B

• Constructed of TX6™ 10Gig™ 24 AWG solid copper cable (nominal cable diameter is .275 inches) and TX6™ PLUS Modular Plugs for superior performance • Plug meets all applicable FCC part 68 Subpart F requirements and exceeds IEC 60603-7 specifications • Slender strain relief boot provides easy access in high density applications • Plug uses an integral pair manager to optimize performance and consistency by reducing untwisting of conductors within the plug • Plug performance in center of TIA/EIA component range, ensuring interoperability and 10GBASE-T Ethernet channel performance • Labels on patch cords provide identification of performance level, length, and quality control number • Patented tangle free latch prevents snags and provides easy release, saving time on frequent moves, adds, and changes

- **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: Panduit Corp. PUP6X04BU-Ux

- and
- Exceeds draft requirements of TIA/EIA-568-B.2-AD10 and ISO 11801 Class EA Edition 2.1, IEEE 802.3an-2006 ratified standard channel requirements for supporting 10GBASE-T
 - Conductors are tightly twisted in pairs and all four pairs are placed into a jacket
 - Internal separators are used to improve NEXT performance
 - 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)
- Patent-pending cable design suppresses alien crosstalk w/enhanced internal electrical performance

- Cable supplied on a reel in a box
- Descending foot markings on cable to ease installation
- Third party tested to 650 MHz

1. 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 50/125µm [OM2 & OM3]) 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.

D. 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 1, 2, 4 and 6 port vertical single gang and 10 port vertical double gang faceplates with combination head screws, screw covers, labels, and a curved, designer appearance. 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.

2. Furniture Faceplates

MINI-COM® Modular Furniture Faceplates shall be 4 port flat or 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.

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.

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. 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.

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. 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 (2") 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 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.

E. 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 (2") 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.

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

2.4. 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

2.5. 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 Augmented Unshielded Twisted Pair (UTP)

Four-pair Category 6A UTP cabling shall be terminated onto a four-pair Category 6A module. All modules shall be terminated using the T568B (B) wiring scheme. The eight-position module shall exceed the connector requirements of the TIA/EIA Category 6A standard. The jack termination to 4-pair, PUP6X04BU-U 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-6A™ 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 6A 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™ 10Gig™ UTP Patch Panels - • Exceeds draft requirements of TIA/EIA-568-B.2-AD10 and ISO 11801 Class E_A Edition 2.1 and IEEE 802.3an-2006 ratified standard channel requirements for supporting 10GBASE-T • Each port is 100% tested to ensure NEXT and RL performance and is individually serialized to support traceability • Utilizes 110 punchdown termination on back panel and includes retention cap for each port • Each port contains a universal label that is color coded for T568A and T568B wiring schemes • Angled versions allow for higher density applications by easily routing the patch cords to each side of the panel eliminating the need for horizontal cable management
• Terminates 4-pair, 22 – 26 AWG, 100 ohm, solid or stranded twisted pair cable • Mount to standard EIA 19" rack or 23" racks with optional extender bracket • Write-on areas for port and panel identification • Can be clearly identified with labels and icons • Label kits (DPLK24 and DPLK48) contains adhesive label holder and labels for easy port and panel identification

TX-6A™ 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 6A standard. The patch cords shall come in standard lengths of 3, 5, 7, 9 14, and 20 feet

3) 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-B.3 and the intermateability requirements specified by the TIA 604-2 FOCIS-2 document. The multimode SC/LC connector shall be compatible with 62.5/125µm and 50/125µm, 3.0 mm jacketed or 900 µm tight-buffered, multimode or 9/125µm 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 SC/LC 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 SC and LC Optical Fiber Patch Cords shall be constructed from high performance 50/125µm multimode cable and 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:

4) Fiber Optic/Multi-media Equipment

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.

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.

5) 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 or as referenced specifically in the TIA 942 Standard regarding Data Centers.

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 but shall be adequately sized according to distance requirements as per TIA/EIA 942 Standards.

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.

6) 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).

3. Execution

3.1. 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 manufacturer's 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 coiled in a figure 8 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-B 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. To improve bend radius control of TX6 10GIG copper cables in junction boxes, it is recommended the Panduit sloped faceplates (i.e. P/N UICFPSE2) be used in this area.

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).

3.2. Horizontal Distribution Cable Installation

Cable shall be installed in accordance with manufacturer's recommendations and best industry practices. Please refer to Installation Instruction PN390 from Panduit for specific Cable Installation methods for Horizontal Distribution.

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. For Data Center applications, it is recommended to use PANDUIT FiberRunner for cable raceway management. The fittings provide minimum 2-inch bend radius to protect against signal loss due to excessive cable bends.

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 or be mixed with any other brand or category cables in a bundle and shall maintain a minimum .5 inch space between other category copper cables throughout the entire cable run.

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.

3.3. Vertical Outlet Pole and Surface Raceway – See Appendix “E”

- 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.

3.4. 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.

3.5. 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.

3.6. 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.

3.7. Copper Termination Hardware

Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-A 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.

3.8. 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.

3.9. Firestop 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.

3.10. Grounding System - Please see Appendix "F"

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. Any Data Center installations, (herein referenced DC, MDF, IDF, TR, etc) shall be Bonded and Grounded to the TIA/EIA 942 standard.

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

3.11. Identification and Labeling – Please See Appendix "D"

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.

3.12. Testing and Acceptance - See Appendix "C"

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-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 PLUSSM 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.

Testing required for 10GBASE-T operation warranty

Panduit requires that internal channel performance be verified for each link to obtain the warranty. Panduit does not require that field alien crosstalk testing be performed, as the TX6 10Gig system has been thoroughly lab tested and verified to meet alien crosstalk requirements under worse case conditions of 6-around-1 tightly bundled configuration. The customer may wish to perform optional alien testing and this procedure is included for reference.

Fluke DTX-1800 Series Digital Cable Analyzer

PANDUIT Corp. has evaluated the Fluke DTX-1800 Series Digital Cable Analyzer and approves the use of this tester for the certification of installed 10Gig cabling channels. In order to verify that the installed cabling will meet or exceed the performance requirements of the designated classification defined in the IEEE 802.3an Standard, it is important that the following steps are followed.

Perform a Set Reference procedure in the special functions prior to testing. Fluke Networks recommends that a Set Reference procedure be performed every 30 days to ensure the maximum accuracy of the test results.

B. Copper Channel Testing

Channel Testing

- 1) Verify that your DTX-1800 Series tester has the most up-to-date software (Software Version 2.04 or better is required). The latest software updates can be found on the Fluke website at: <http://www.flukenetworks.com/fnet/enus/supportAndDownloads/downloadsAndUpdates/?pid=500043>) Select the Fluke Channel Adapter (# DTX-CHA001 or DTX-CHA002) and attach them to the DTX-1800 Series Main and Remote unit.
- 2) Select from the following Fluke Autotests, for which warranty is desired:
 - 10GBASE-T
 - TIA Cat 6A ch draft 6.0
 - TIA Cat 6A PL draft 6.0
 - ISO ClassEa Ch 25N1255
- 3) For channel testing, install all patch cords prior to testing. A Channel measurement is only valid for the patch cords used at that moment. As soon as you replace any patch cords, the Panduit Corp. 2007 Testing Procedures version 2.1 For Technical Support: www.panduit.com/resources/install_maintain.asp recorded measurement is no longer valid. This is because no two patch cords have the exact same performance. Note: Panduit recommends for installers to install and test a few channels before completing the entire system.
- 4) Begin testing your installed channels with the Fluke DTX-1800 Series Digital Cable Analyzer and save all test results.
- 5) Troubleshoot and repair any failing channels. Channels resulting in a PASS* are considered a PASS and will be acceptable for warranty. Note: The Fluke HDTDX analyzer and HDTDR test are very helpful when troubleshooting failing channels.

Both can be found on the SINGLE TEST menu and will also run automatically when a failure occurs.

6) Submit electronic channel test reports to the Panduit Warranty Department with all required warranty paperwork. A channel warranty will then be given based on passing test results. Note: Panduit recommends for installers to install and test a few channels before completing the entire system.

C. Fiber Testing

1. 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 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.

3.13. 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-B. 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

Appendix A – Partial List of Materials

Appendix “C” - Testing

Approved Test Leads For PANDUIT MINI-COM® TX6™ 10Gig™ Jack Modules and DP6™ 10Gig™ Patch Panels

Approved: PANDUIT independently verifies field testers report values consistent with a Laboratory Network Analyzer for adherence to the standards. The following testers are fully approved for internal testing:

Permanent Link

	Firmware Version	Software Version	Calibration Equipment	Autotest	Test Leads	Personality Module	Comments
Fluke: Networks DTX-1800 Series Cable Analyzer Fluke Networks Website	Software: V2.04 or later	Linkware Software V3.01 or later	-	TIA Cat5A Perm. Link	Part # DTX-PLA001 or PLA002 Universal Permanent Link Interface Adapter	PM06 N/A	1. Consult Fluke Networks' web site for the latest Firmware and Software Version. 2. It is STRONGLY RECOMMENDED that the tester is calibrated prior to testing.
Agilent: WireScope Pro N2640A Agilent Technologies Website	WireScope Pro Software 2.1.9 or later	WireScope Pro (ScopeData Pro II) Software 2.19 or later	-	Cat5A: Link	Part # N2644A-101 Universal Cat5A Link SmartProbes	N/A	1. Consult Agilent's web site for the latest Software Version. 2. Calibration with the Precision Calibration Cable is STRONGLY RECOMMENDED . 3. Tester holds last calibration. Tester must be recalibrated if using a different DualRemote, upgrading the software, when transitioning from Cat7/Class F copper cable test to Cat5A/Class E or lower performance categories, or after 30 days. 4. Universal Cat5A Link SmartProbes should be in optimal condition. See owner's manual.

Channel

	Firmware Version	Software Version	Calibration Equipment	Autotest	Test Leads	Personality Module	Comments
Fluke: Networks DTX-1800 Series Cable Analyzer Fluke Networks Website	Software: V2.04 or later	Linkware Software V3.01 or later	-	TIA Cat5A Channel	Part # DTX-CHA001 Cat5 / Class E Channel Adapter	N/A	1. Consult Fluke Networks' web site for the latest Firmware and Software Version. 2. It is STRONGLY RECOMMENDED that the tester is calibrated prior to testing.
Agilent: WireScope Pro N2640A Agilent Technologies Website	WireScope Pro Software 2.1.9 or later	WireScope Pro (ScopeData Pro II) Software 2.19 or later	-	Cat5A: Channel	Part # N2644A-100 Universal Cat5A Channel SmartProbe	N/A	1. Consult Agilent's web site for the latest Software Version. 2. Calibration with the Precision Calibration Cable is STRONGLY RECOMMENDED . 3. Tester holds last calibration. Tester must be recalibrated if using a different DualRemote, upgrading the software, when transitioning from Cat7/Class F copper cable test to Cat5A/Class E or lower performance categories, or after 30 days. 4. Universal Cat5A Channel SmartProbes should be in optimal condition. See owner's manual.

Appendix D – Labeling Solution

Labeling Solutions for TIA/EIA-606-A

The TIA/EIA-606-A 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, any Telecommunications Main Grounding Busbar, and all elements of the horizontal links.

For a copper horizontal link, the elements include:

- the connecting hardware (e.g., patch panel port or the section of a patchdown block terminating a four-pair horizontal cable)
- a four-pair horizontal cable
- a telecommunications outlet/connector terminating a four-pair horizontal cable in the work area

If a consolidation point (CP) is present:

- the segment of four-pair horizontal cable extending from the TS to the CP connecting hardware
- the CP connecting hardware or section of a patchdown block terminating a four-pair horizontal cable
- the segment of four-pair horizontal cable extending from the CP connecting hardware to the outlet/connector of a multi-user telecommunications outlet assembly (MUTOA) or to the work area outlet

If a MUTOA is present:

- a telecommunications outlet/connector in the MUTOA

For an optical fiber horizontal link, the elements include:

- a pair of optical fiber terminations on a patch panel in the TS
- a pair of optical fibers in a cable
- a pair of optical fiber terminations in the work area
- a telecommunications outlet/connector terminating a pair of optical fibers in the work area

If a consolidation point (CP) is present:

- the segment of optical fiber cable extending from the TS to the CP connecting hardware.
- the CP connecting hardware or section terminating a pair of optical fibers
- the segment of optical fiber cable extending from the CP connecting hardware to the outlet/connector of a multi-user telecommunications outlet assembly (MUTOA) or to the work area outlet.

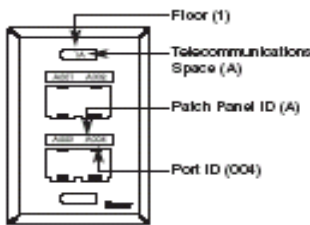
Class 2 administration provides for telecommunications infrastructure administration needs of a single building or tenant that is served by a single or multiple TSs within a single building. Class 2 administration includes all elements of class 1 administration, plus identifiers for backbone cabling, multiple-element grounding and bonding systems, and firestopping.

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 interbuilding cabling. Administration of pathways and spaces, and of outside plant elements is recommended.

Class 4 administration addresses the needs of a multi-site 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.

Horizontal Link Identifier Labeling Format

A horizontal link identifier shall have a format of *fs-an* where:



- f* = numeric character(s) identifying the floor of the building occupied by the Telecommunications Space (TS)
- s* = alpha character(s) uniquely identifying the TS on floor *f*, or the building area in which the space is located
- a* = one to two alpha characters uniquely identifying a single patch panel, a group of patch panels with sequentially numbered ports, an IDC connector, or a group of IDC connectors, serving as part of the horizontal cross-connect
- n* = two to four numeric characters designating the port on a panel in the TS, or the section of an IDC connector on which a four pair horizontal cable is terminated in the TS

EXAMPLE- "1A-A004" = Origination Point 1st Floor, Closet A, Panel A, Position 004

Identifier	Text Clauses	Description of Identifier	Class of Administration			
			1	2	3	4
<i>fs</i>	5.1.1	telecommunications space (TS)	R	R	R	R
<i>fs-an</i>	5.1.2	horizontal link	R	R	R	R
<i>fs-TMGB</i>	5.1.3	telecommunications main grounding busbar	R	R	R	R
<i>fs-TGB</i>	5.1.4	telecommunications grounding busbar	R	R	R	R
<i>fs₁/fs₂-n</i>	6.1.1	building backbone cable		R	R	R
<i>fs₁/fs₂-n.d</i>	6.1.2	building backbone pair of optical fiber		R	R	R
<i>fFSLn(h)</i>	6.1.3	firestop location		R	R	R
<i>[b₁-fs₁]/[b₂-fs₂]-n</i>	7.1.2	campus backbone cable			R	R
<i>[b₁-fs₁]/[b₂-fs₂]-n.d</i>	7.1.3	campus backbone pair of optical fiber			R	R
<i>b</i>	7.1.1	building			R	R
<i>c</i>	8.1.1	campus or site				R
<i>fs-UUU.n.d(q)</i>	annex B	intra-space pathway		○	○	○
<i>fs₁/fs₂-UUU.n.d(q)</i>	annex B	building pathway		○	○	○
<i>c-UUU.n.d(q)</i>	annex B	outside plant pathway			○	○
<i>[b₁-fs₁]/[b₂-fs₂]-UUU.n.d(q)</i>	annex B	campus pathway			○	○
<i>[c₁-b₁-fs₁]/[c₂-b₂-fs₂]-UUU.n.d(q)</i>	annex B	inter-campus element				○

R = required identifier for class, when corresponding element is present
 ○ = optional identifier for class

Appendix F – Grounding/Bonding Detail

