Section 271119
Communications Termination Blocks and Patch Panels
Part 1 - 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. Termination blocks and patch panels are covered under this document.
B. The Telecommunication 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:
    1. Termination blocks
    2. Patch panels
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. All products, services, materials and documentation provided by the Installer shall meet the requirements of the following where applicable:
    1. National Electrical Manufacturer's Association (NEMA)
    2. American National Standards Institute (ANSI)
    3. National Fire Prevention Act (NFPA)
        a. National Electric Code 2020 (NEC)
    4. Relevant State Electric and Fire Codes
    5. Institute of Electrical and Electronic Engineers (IEEE)
    6. Underwriters Laboratories, Inc. (UL)
    7. Telecommunications Industry Association / Electronic Industries Alliance (TIA/EIA)
        a. TIA-526-7A Fiber-Optical Power Loss Measurements SM

b. TIA-526-14C Fiber Optical Power Loss Measurements MM
c. TIA-568_0-D Generic Telco Cabling Customer Premises
d. TIA-568_0-D1 Generic Telecom Cabling for Customer Premise Addendum
e. TIA-568_1-D Commercial Building Telcom Infrastructure Std
f. TIA-568_1-D1 Commercial Building Infrastructure Standard Addendum
g. TIA-568_2D Balanced Twisted Pair Cabling and Components
h. TIA-568_3-D Optical Fiber Cabling Components Standards
i. TIA-569-E Telecom Pathways and Spaces
j. TIA-598-D Optical Fiber
k. TIA-598-D Optical Fiber Addendum
l. TIA-598-D1 Optical Fiber Color Coding Addendum
m. TIA-606-C Admin for Telecom Infrastructure
n. TIA-607-D Grounding and Bonding
o. TIA-758-B Customer Owned OSP
p. TIA-942-B Data-Centers

8. Building Industry Consulting Service International (BICSI) publications:
   a. Telecommunications Distribution Methods Manual (TDMM), 14th ed.
   b. Outside Plant Design Reference Manual (OSPDRM), 6th ed.
   c. Information Technology Systems Installation Methods Manual (ITSIMM), 7th ed.
   d. Telecommunications Project Management Manual (TPMM), 1st edition
   e. ANSI/BICSI 006, Distributed Antenna System (DAS) Design and Implementation Best Practices
   f. ANSI/BICSI 008, Wireless Local Area Network (WLAN) Systems Design and Implementation Best Practices
   g. ANSI/BICSI 005, Electronic Safety and Security (ESS) System Design and Implementation Best Practices
   h. ANSI/BICSI 007, Information Communication Technology Design and Implementation Practices for Intelligent Buildings and Premises
   i. ANSI/BICSI 001, Information and Communication Technology Systems Design and Implementation Best Practices for Educational Institutions and Facilities
9. Manufacturer's recommendations and installation guidelines
10. All cabling shall comply with all appropriate requirements of NEC Articles 770 and 800 and shall comply with the State Fire Codes as interpreted by the State Fire Marshall's Dept.

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

1.4 - Quality Assurance

A. Panduit Certification Plus System Warranty shall provide a complete system warranty to guarantee end-to-end high performance cabling systems that meet application requirements. The guarantee shall include cable and connectivity components and have one point of contact for all cabling system issues. The system shall be warranted for a period of at least 25 years.

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

Part 2 - Products

2.1 - Approved Products

A. Approved Category 6A cable termination hardware manufacturer: Panduit
B. Approved patch panel manufacturer: Panduit
C. Approved patch cord manufacturer: Panduit

2.2 - Equivalent Products

A. Panduit shall manufacture all products, including but not limited to termination blocks and patch panels. Substitutions for patch panels, faceplates and jacks will not be allowed.

2.3 - Cable Termination Hardware - Category 6A UTP

A. 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.

B. Category 6A Unshielded Twisted Pair UTP. Four-pair Category 6A cabling shall be terminated onto modular patch panels, punchdown style patch panels or punchdown style connecting blocks where specified in the plans.

C. Four-pair Category 6A UTP cabling shall be terminated onto a four-pair Category 6A 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 6A standard. The module termination to four-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.

D. Ultimate ID Products shall provide labeling options that comply with the TIA/EIA-606-A Standard. All products shall be clearly identified with the use of a thermal transfer printer; hand-printed labels are not acceptable and will be rejected. Products shall include faceplates, surface mount boxes, patch panels, marker ties, printers and accessories. All label heights shall be the same to allow for consistent labeling. Panels shall be available in flat and angled versions.

E. Mini-Com Modular Patch Panels shall be of a metal design with snap in four position molded faceplate frames. 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 Panduit Mini-Com mounting features for added strength. Patch panels shall be available with and without labels.

Part Number	Number of Ports	Material	Rack Units	Patch Panel Type	Labels	Installation/ Termination	Installed on Campus
CPPA48HDWBLY	48	Plastic	1	Angled	No	Rear	Yes
CPPLA48WBLY	48	Plastic	2	Angled	Yes*	Rear Faceplate	Yes
CPA48BLY	48	Metal	2	Angled	Yes		Yes
CPPA48FMWBLY	48	Plastic	2	Angled	Yes*	Rear	Yes
CPPA48HDEWBL	48	Plastic	2	Angled	Enhanced	Rear	Yes
CPP24FMWBLY	24	Plastic	1	Flat	Yes*	Rear Faceplate	Yes
CPP48FMWBLY	48	Plastic	2	Flat	Yes*	Rear Faceplate	Yes
CPP48HDEWBL	48	Plastic	2	Flat	Enhanced	Rear	Yes
CPPL24WBLY	24	Plastic	1	Flat	No	Rear	Broad
CPPL48WBLY	48	Plastic	2	Flat	No	Rear	Broad
UICMPP24BLY	24	Plastic	1	Flat	Yes	Rear	Broad
UICMPP48BLY	48	Plastic	2	Flat	Yes	Rear	Broad
CP24BLY	24	Metal	1	Flat	Yes*		Yes
CP48BLY	48	Metal	2	Flat	Yes*		Yes

Yes* = Write on area provided, no space for Ultimate ID Labels.

Part 3 - Execution

3.1 - Horizontal Cross Connect Installation

A. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B standard, manufacturer's recommendations and best industry practices.
B. Pair untwist at the termination shall not exceed 3.18 mm (0.125 inch).
C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
D. 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.
E. The cable jacket shall be maintained as close as possible to the termination point.
F. 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.

3.2 - Copper Termination Hardware

A. 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.
B. Pair untwist at the termination shall not exceed 3.18mm (0.125 inch).
C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable
D. 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.
E. The cable jacket shall be maintained to within 25 mm (one inch) of the termination point.
F. The cable jacket shall be properly supported in the strain relief mechanisms built into modular jacks.
G. 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 - Testing and Acceptance

A. General
    1. All cable dressing, labeling and final installation shall be completed prior to testing.
    2. 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
        a. TIA-568_0-D Generic Telco Cabling Customer Premises
        b. TIA-568_0-D1 Generic Telecom Cabling for Customer Premise Addendum
        c. TIA-568_1-D Commercial Building Telcom Infrastructure Std

d. TIA-568_1-D1 Commercial Building Infrastructure Standard Addendum
e. TIA-568_2D Balanced Twisted Pair Cabling and Components

3. 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.
4. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Panduit Certification Plus 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
1. Certification Tester
a. Certification
i) The field-test instrument shall be within a 12-month calibration period.
b. Accuracy
i) Level IIIe accuracy in accordance with ANSI/TIA-1152
ii) Independent verification of accuracy shall be provided.
iii) RJ45 plug must meet the requirements for NEXT, FEXT and Return Loss in accordance with ANSI/TIA-568-C.2 Annex C
iv) Twisted pair Category 5e, 6, 6A, 7 or 7A cords are not permitted as their performance degrades with use and can cause false Return Loss failures
c. Measurement Capabilities
i) Wire Map
ii) Length
iii) Propagation Delay
iv) Delay Skew
v) DC Loop Resistance
vi) DC Resistance Unbalance within a pair
vii) DC Resistance Unbalance between pairs
viii) Insertion Loss
ix) NEXT (Near-End Crosstalk)
x) PS NEXT (Power Sum Near-End Crosstalk)
xi) ACR-N (Attenuation to Crosstalk Ratio Near-End)
xii) PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End)
xiii) ACR-F (Attenuation to Crosstalk Ratio Far-End)
xiv) PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
xv) Return Loss
xvi) TCL (Transverse Conversion Loss)
xvii) ELTCTL (Equal Level Transverse Conversion Transfer Loss)
xviii) Time Domain Reflectometer
xix) Time Domain Xtalk Analyzer
xx) PS ANEXT (Power Sum Alien Near-End Crosstalk)

xxi) Average PS ANEXT (Average Power Sum Alien Near-End Crosstalk)
xxii) PS AACR-F (Power Sum Alien Attenuation to Crosstalk Ratio Far-End)
xxiii) Average PS AACR-F (Average Power Sum Alien Attenuation to Crosstalk Ratio Far-End)

C. System Documentation

1. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Engineer for approval. Documentation shall include the items detailed in the sub-sections below.
2. 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.
3. 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.
4. Test results documentation shall be provided in digital form within three weeks after the completion of the project. The files shall be clearly marked 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.
5. 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 using a file format agreed to by the Owner.
6. 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.
7. 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) 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. Numbering, icons, pathways and other drawing conventions are to be assigned their own individual AutoCAD layer.

8. The Contractor shall annotate the base drawings and return a hard copy (same plot size as originals) and electronic (AutoCAD or as agreed to by Caltech) form.

End Section