

SECTION 271513

COMMUNICATIONS HORIZONTAL TWISTED PAIR CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Horizontal twisted pair cabling
- B. Base Bid Work
 - 1. Provide pre-construction services (e.g., submittals, coordination with other trades, etc.), materials, apparatus, labor, tools, equipment, and transportation required for complete communications horizontal twisted pair cabling described in this section and shown on related drawings.
 - 2. In general, the base bid work includes:
 - a. Submittals
 - b. Horizontal cables, terminations, and outlets
 - c. Cable support and management
 - d. Patch cords, and cord management
 - e. Cable identification tags and system labeling
 - f. Closeout documents
 - g. Warranty
 - 3. Identifiers and Labeling: The scope of work herein includes the responsibility for assigning identifiers to each horizontal cabling link and related cabling media in addition to providing physical labeling to each component.
- C. Related Divisions and Sections
 - 1. Comply with the Related Divisions and Sections requirements of section 270000
 - 2. 270811, "Communications Twisted Pair Testing"
 - 3. 271313, "Communications Backbone Twisted Pair Cabling"
 - 4. 270528, "Communications Building Pathways"
 - 5. 270536, "Communications Building Pathways – Cable Trays"
- D. Work Provided Under Other Sections
 - 1. Pathways: Communications pathways (cable tray, conduits, stubs, etc.) are covered under another section. Refer to the drawings for type, size/capacity and route information. Refer to sections 270528 and 270536 and to the drawings for requirements, buildout information and layouts.
 - 2. Rooms: Telecommunications room buildout (e.g., backboards, rack bays, overhead and vertical cable support, etc.) is covered under another section. Refer to section 271100 and to the drawings for requirements, buildout information and layouts.
 - 3. Testing: The horizontal cabling system testing requirements are covered under another section. Refer to section 270811 for testing requirements.

1.2 REFERENCES

- A. Comply with the References requirements of section 270000.

- B. In addition to the codes and standards listed in section 270000, comply with the latest edition (or as noted) of the following applicable specifications and standards except as otherwise shown or specified:
1. National Fire Protection Agency (NFPA)
 - a. NFPA 255, "Standard Method of Test of Surface Burning Characteristics of Building Materials"
 - b. NFPA 259, "Standard Test Method for Potential Heat of Building Materials"
 - c. NFPA 262, "Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces"
 2. Underwriters Laboratories (UL): Applicable listing and ratings, including but not limited to the following standards:
 - a. UL 444, "Communications Cables"
 - b. UL 1863, "Communications-Circuit Accessories"
 3. Insulated Cable Engineers Association (ICEA):
 - a. ICEA S-116-732, "Standard for Category 6 and 6A, 100 Ohm, Individually Unshielded Twisted Pairs, Indoor Cables (With Or Without An Overall Shield) for Use in LAN Communications Wiring Systems"
 - b. ANSI/ICEA S-107-704, "Standard for Broadband Buried Service Wire, Filled, Polyolefin Insulated, Copper Conductor Technical Requirements"

1.3 DEFINITIONS

- A. The Definitions in section 270000 apply to this section.
- B. In addition, define the following list of terms as used in this specification as follows:
1. "Cabling": cabling consists of cables, connectors (jacks, plugs), termination apparatus (panels, blocks, outlets, etc.), consolidation points, connecting media (patch cords, line cords, etc.), and labeling/identification.
 2. "CAT6A": Category 6 Augmented performance grade
 3. "Channel": End to end transmission path; e.g., the Permanent Link and connecting media such as line cord (at the workstation), patch cord, and (if a full crossconnection is implemented) the crossconnect termination/connecting apparatus and equipment cord.
 4. "CMP": Communications Media Plenum [plenum rating]
 5. "FEP": Fluorinated Ethylene Propylene
 6. "F/UTP": twisted pair cabling with an overall foil shield
 7. "FTP": synonymous with "F/UTP", unless otherwise noted
 8. "ID": identifier
 9. "BDF": Building Distribution Facility
 10. "PE": Polyethylene
 11. "Permanent Link": Test configuration for a horizontal cabling link excluding patch cords, equipment cords, and line cords; e.g., the permanent portion of the horizontal cabling to each outlet consisting of cable, consolidation point (if used), termination/connecting apparatus in the telecommunications and the connector at the outlet.
 12. "PVC": Polyvinyl chloride
 13. "IDF": Intermediate Distribution Facility
 14. "U/UTP": twisted pair cabling with no shield
 15. "UTP": synonymous with "U/UTP", unless otherwise noted

1.4 SYSTEM DESCRIPTION

- A. Horizontal twisted pair cabling shall consist of the cabling from telecommunications rooms to outlets/connectors at work areas, to equipment, to devices, or other items that require network connections or other telecommunications services.
 - 1. Refer to other sections for pathways and cable support.
 - 2. Refer to other section for testing.

- B. Cabling Length Requirements: Note that cable length means the electrical length (pair length), not the sheath length. Also, length requirements must account for test equipment accuracy tolerances (for example, TIA568-C.2 allows for 10% uncertainty).
 - 1. The maximum electrical length of any permanent link shall not exceed 90 meters. If consolidation points or multi-user outlets are used, then the lengths shall not exceed those listed in the TIA-568 standard and the cabling system manufacturer's guidelines (whichever is shorter).
 - 2. The maximum electrical length of any channel shall not exceed 100 meters. If consolidation points or multi-user outlets are used, or if the total length of cords needs to exceed 10 meters, then the permanent link lengths shall not exceed those listed in the TIA-568 standard and the cabling system manufacturer's guidelines (whichever is shorter).
 - 3. The minimum electrical length of any permanent link shall be no shorter than as required by the manufacturer (as described in written guidelines).

- C. Jack Wiring: Jacks shall be wired to T568B configuration.

1.5 SUBMITTALS

- A. Comply with the Submittals requirements of section 270000.

- B. Quantity: Furnish quantities of each submittal as noted in section 270000.

- C. Substitutions: Conform to substitutions requirements and procedures in section 270000.

- D. Submittal requirements prior to the start of construction:
 - 1. Product Data submittal, indicating specifications and conformance with CEC, UL, TIA listings, and other applicable certifications.
 - 2. Schedule submittal, consisting of proposed schedule of work. This schedule may be combined with the schedule developed for 27xxxx series sections
 - 3. Shop Drawings submittal, consisting of proposed changes to cable routing, or termination locations/configurations

- E. Submittal requirements at closeout:
 - 1. As-Built Drawings: Submit a set of floor plans and (as appropriate) RCPs showing the location of every complement of cabling with its respective ID – these as-built drawings may be combined with those showing the pathways (cable trays, conduits, etc.). The IDs on the shop drawings shall exactly match the physical labeling applied to cabling components.
 - 2. Link ID –to– Office Number Key: Submit a “link ID-to-office number key” as an electronic format (such as an MS-Excel spreadsheet file or cloud-based medium) that lists every permanent link associated with the final location / office number.
 - 3. Crossconnection records/cut sheets

4. Operations and Maintenance (O&M) Manuals

F. Posted Documentation

1. Post one full size plot of as-built drawings, specifically the floor plans and (as applicable) reflected ceiling plans, within TRs showing each TR's serving area. Coordinate location with Owner.

1.6 QUALITY ASSURANCE

- A. Comply with the Quality Assurance requirements of section 270000.

B. Contractor Qualifications

1. In addition to the Contractor Qualifications requirements of section 270000, the Contractor shall be an approved member in good standing of the Leviton Certified Installer network. The Contractor shall maintain a certified RCDD on staff and utilize manufacturer trained, Union certified, or BICSI certified installers.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Delivery, Storage and Handling requirements of section 270000.

1.8 WARRANTY

- A. Provide to the Owner a Limited Lifetime Product and Performance Warranty covering all components of the horizontal cabling system (cables, jacks, panels, patch cords, equipment, workmanship, etc.). The warranty shall guarantee the cabling system performance to the Category specified herein. Submit a written warranty statement with system documentation. The warranty period shall begin on the system's first use by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Berk-Tek Leviton Technologies cabling system (no other substitutions allowed)

2.2 SUBSTITUTIONS

- A. Comply with the Substitutions requirements of section 270000.

2.3 HORIZONTAL CABLE – CAT6A U/UTP PLENUM RATED (CMP)

- A. Application: Suitable for indoor installation, within ceiling space in primary and secondary pathways, within access/raised floor space.

- B. Conductors:
 1. Insulated Conductors: 23 AWG solid copper, fully insulated with a flame retardant thermoplastic material (material = FEP, or similar).
 2. Twisted Pairs: Two insulated conductors “twisted” into a “pair” (twisted pair) color-coded to industry standards (EIA-230).
- C. Cable Sheath:
 1. Shielding: none
 2. Outer Jacket: seamless outer jacket (material = LS-PVC, or similar) applied to and completely cover the internal components (twisted pairs).
- D. Flame Rating: CMP, UL listed as such, and the rating shall be printed on the jacket.
- E. Electrical and Mechanical Performance: Meet or exceed requirements of TIA-568 standard series, ANSI/ICEA S-116-732, ISO 11801 Class E_A Edition 2.2, and IEEE Std. 802.3an channel for CAT6A cabling.
- F. Limited Power: UL certified as “Limited Power (LP)”, and the rating shall be printed on the jacket.
 1. Listed to 0.5 A per conductor.
- G. Jacket marking: “CMP–LP (0.5A)”
- H. Manufacturer:
 1. Berk-Tek LANmark-SST CAT6A U/UTP Plenum Rated (CMP) Cable
 - a. #11101842; CAT6A 4 pair U/UTP cable, CMP, blue

2.4 HORIZONTAL CABLE – CAT6A U/UTP INDOOR/OUTDOOR PLENUM RATED (CMP)

- A. Application: Suitable for outdoor installation, within underground pathways (conduit, pull boxes) and/or in slab (slab-on-grade).
- B. Conductors:
 1. Insulated Conductors: 23 AWG solid copper, fully insulated with a thermoplastic material (material = PE, or similar).
 2. Twisted Pairs: Two insulated conductors “twisted” into a “pair” (twisted pair) color-coded to industry standards (EIA-230).
- C. Cable Sheath:
 1. Separator: optional
 2. Filled: Cable core (interior to the sheath) shall be flooded with filling compound to protect against moisture penetration. Filling compound: “FLEXGEL”, or similar.
 3. Outer Jacket: seamless outer jacket (material = PE, or similar) applied to and completely cover the internal components (twisted pairs), embedded with UV inhibitors, and black in color.
- D. Flame Rating: CMP, UL listed as such, and the rating shall be printed on the jacket.
- E. Electrical Signal Performance: Meet or exceed TIA-568 standard series, ISO 11801 Class E_A Edition 2.2, and IEEE Std. 802.3an channel requirements for supporting 10GBASE-Limited Power: UL certified as “Limited Power (LP)”, and the rating shall be printed on the jacket.

- 1. Listed to 0.8 A per conductor.
- F. Jacket marking: "CMP-LP (0.8A)"
- G. Color: Black
- H. **Manufacturer:**
 - 1. **Berk-Tek LANmark-RDT I/O CAT6A U/UTP Plenum Rated (CMP) Cable**
 - a. **#11142753 (Addendum 03)**

2.5 TERMINATION APPARATUS – CAT6A PATCH PANEL, PUNCH DOWN TYPE

- A. Application: Panels shall be suitable for installation within a TR for the termination of the horizontal cables specified herein. Panels shall be horizontally oriented for a rack-mounted configuration. Panels shall be capable of supporting, organizing, labeling and patching/crossconnecting between the horizontal termination field and the equipment termination field.
- B. Modular patch panel shall have 110-type termination, and shall be compatible with the specified horizontal cables both electrically and physically.
- C. Mechanical Performance: Each port shall be an 8-position modular jack, compliant to ANSI/TIA-568.
- D. Electrical Performance: Each port shall meet or exceed TIA-568 standard series and ISO/IEC 11801 requirements for CAT6A U/UTP cabling through the cable termination and patch cord connection.
- E. Manufacturer:
 - 1. Leviton 110-Style CAT6A Patch Panels
 - a. #6A586-U24; flat modular patch panel, 1U, 24 CAT6A ports
 - b. #6A586-U48; flat modular patch panel, 2U, 48 CAT6A ports

2.6 TERMINATION APPARATUS – CAT6A MODULAR 8-POSITION CONNECTORS, UNSHIELDED

- A. Application: Modular connectors, i.e., jacks and plugs, shall be used for the termination of 4-pair U/UTP cables, and shall be compatible – both electrically and physically – with the cables specified herein.
- B. Mechanical Performance: Modular connectors shall be 8-position, compliant to TIA-568 standard series.
- C. Electrical Performance: Modular connectors shall meet or exceed TIA-568 standard series and ISO/IEC 11801 requirements for CAT6A U/UTP cabling.
- D. Manufacturer:
 - 1. Leviton "Atlas-X1" Series CAT6A Jacks
 - a. #6AUJK-RL6; modular 8-position jack, CAT6A, blue

2.7 WORK AREA OUTLETS – FLUSH-MOUNT FACEPLATES

- A. Application: Faceplates shall be suitable for indoor installation for standard 1-gang and 2-gang flush-mount devices.
- B. Faceplates shall have 2, 4, or 6 ports, and shall include required accessories, such as icons, blank inserts, label windows and labels.
- C. Color: White
- D. Manufacturer:
 - 1. Leviton “QuickPort” Type, with label windows
 - a. #42080-2WS; “QuickPort” faceplate, 1-gang, 2 ports, white
 - b. #42080-4WS; “QuickPort” faceplate, 1-gang, 4 ports, white
 - c. #42080-6WS; “QuickPort” faceplate, 1-gang, 6 ports, white

2.8 WORK AREA OUTLETS – FACEPLATES FOR WALL PHONE OUTLETS

- A. Application: Faceplates shall be suitable for indoor installation for standard 1-gang flush-mount device equipped with 1 modular jack and two mounting studs for standard wall-mount telephones.
- B. Faceplates shall include required accessories, such as icons, blank inserts, label windows and labels.
- C. Color: Finish shall be stainless steel.
- D. Manufacturer:
 - 1. Leviton
 - a. #4108W-1SP; wall phone faceplate, stainless steel, recessed port
 - b. #4108W-0SP; wall phone faceplate, stainless steel

2.1 SURFACE MOUNT BACK BOXES – INDOOR

- A. Application: Surface mount back boxes shall be suitable for indoor installation for surface mounting to support an outlet or device.
- B. Color: White
- C. Manufacturer, or equal:
 - 1. Leviton
 - a. #42777-1WA; surface mount back box, 1 gang, 1.89"D, white
 - b. #42777-2WA; surface mount back box, 2 gang, 1.89"D, white

2.2 CONNECTOR ADAPTERS AND BRACKETS

- A. Drop Wire Jack/Box Bracket
 - 1. Application: Brackets shall retain and hold in place connectors and attach to a drop wire, such as within a ceiling space; brackets shall be fully compatible with the connectors/connector accessories specified herein.

2. Manufacturer, or equal:
 - a. Leviton
 - 1) #49223-CBC; QuickPort bracket with clip for drop wire, galvanized
 - 2) #49223-W10; Plenum Rated In-Ceiling Bracket
- B. In-Box Jack Bracket
 1. Application: Brackets shall retain and hold in place connectors within a back box; brackets shall be fully compatible with the connectors/connector accessories specified herein and with a standard gang ring.
 2. Manufacturer, or equal:
 - a. Leviton
 - 1) #49223-BA5; QuickPort in-wall / in-box bracket, galvanized
- C. Adapters for Poke-Thru Devices
 1. Application: Adapters shall retain and hold in place connectors within a poke-thru floor device; adapters shall be fully compatible with both the poke-thru floor device and the connectors/connector accessories specified herein. An example use is a termination configuration serving a wireless access point (Wi-Fi WAP).
 2. Manufacturer, or equal:
 - a. Wiremold
 - 1) #CM2-U2KEYA-WH; bezel adapter, accepts 2 keystone mount connectors, white

2.3 FACEPLATES FOR FURNITURE FEEDS

- A. Application: Suitable for indoor installation for standard 1-gang flush-mount device box with round opening allowing cables to freely exit (towards furniture system entry).
- B. Color: White
- C. Manufacturer, or equal:
 1. Leviton
 - a. #80704-W; faceplate with 1.4" round opening, white

2.4 LABELS

- A. Labels shall be machine printable with a laser printer, ink jet printer, thermal transfer printer, or hand-held printer.
- B. Labels shall be permanent, unless otherwise noted.
- C. Cable and Wire Labels
 1. Labels for cables and wires shall be either of the following types:
 - a. Tape – adhesive-backed, wrap-around, self-laminating
 - b. Strip – adhesive backed, under shrink-wrap
 2. Face stock (print area) shall be white.
 3. Size: as needed per cable size/diameter and to fit the full identifier (at least 1" wide).

4. Manufacturer, or equal:
 - a. Brady
 - b. Brother
 - c. DYMO XTL or Rhino
 - d. Panduit
 - 1) #S100X125YAJ; self-laminating cable label, white face stock (1"W x 0.38"W), for cable diameters 0.12"-0.28"
 - 2) #S100X150YAJ; self-laminating cable label, white face stock (1"W x 0.5"W), for cable diameters 0.16"-0.32"
 - 3) #S100X225YAJ; self-laminating cable label, white face stock (1"W x 0.75"W), for cable diameters 0.24"-0.48"

D. Patch Panel Labels

1. Application: For patch panels that do not have an integrated labeling feature and do not come packaged with labeling parts.
2. Patch panel labels shall be adhesive backed, and shall fit within the area suitable for labeling the ports on the panel.
3. Face stock (print area) shall be white.
4. Size: as needed.
5. Manufacturer, or equal:
 - a. Brady
 - b. Brother
 - c. DYMO XTL or Rhino
 - d. Panduit
 - 1) #C061X030FJJ; component label, laser/inkjet print, white face stock, 0.61"W x 0.3"H
 - 2) #C125X030FJJ; component label, laser/inkjet print, white face stock, 1.25"W x 0.3"H
 - 3) #C150X030Y1J; component label, laser/inkjet print, white face stock, 1.50"W x 0.3"H
 - 4) #C188X030FJJ; component label, laser/inkjet print, white face stock, 1.88"W x 0.3"H
 - 5) #C252X030FJJ; component label, laser/inkjet print, white face stock, 2.52"W x 0.3"H

E. Faceplate Labels

1. Application: For faceplates that do not have an integrated labeling feature and do not come packaged with labeling parts.
2. Labels for faceplates shall be adhesive backed, and shall fit within the area for labeling the faceplate.
3. Face stock (print area) shall be white.
4. Size: as needed.

5. Manufacturer, or equal:
 - a. Brady
 - b. Brother
 - c. DYMO XTL or Rhino
 - d. Panduit
 - 1) #C061X030FJJ; component label, laser/inkjet print, white face stock, 0.61"W x 0.3"H
 - 2) #C125X030FJJ; component label, laser/inkjet print, white face stock, 1.25"W x 0.3"H
 - 3) #C150X030Y1J; component label, laser/inkjet print, white face stock, 1.50"W x 0.3"H
 - 4) #C188X030FJJ; component label, laser/inkjet print, white face stock, 1.88"W x 0.3"H
 - 5) #C252X030FJJ; component label, laser/inkjet print, white face stock, 2.52"W x 0.3"H

F. Faceplate Port Labels

1. Application: For faceplates that do not have an integrated port identifying feature.
2. Labels for ports of faceplates shall be adhesive backed, and shall fit within the area suitable for applying a label per port on the faceplate.
3. Face stock (print area) shall be white.
4. Size: as needed.

G. Surface Outlet Labels

1. Application: For surface outlets that do not have an integrated labeling feature and do not come packaged with labeling parts.
2. Labels for surface mount outlets shall be adhesive backed, and shall fit within the area for labeling the outlet box and for labeling ports of the outlet box.
3. Face stock (print area) shall be white.
4. Size: as needed.
5. Manufacturer, or equal:
 - a. Brady
 - b. Brother
 - c. DYMO XTL or Rhino
 - d. Panduit
 - 1) #C061X030FJJ; component label, laser/inkjet print, white face stock, 0.61"W x 0.3"H
 - 2) #C125X030FJJ; component label, laser/inkjet print, white face stock, 1.25"W x 0.3"H
 - 3) #C150X030Y1J; component label, laser/inkjet print, white face stock, 1.50"W x 0.3"H
 - 4) #C188X030FJJ; component label, laser/inkjet print, white face stock, 1.88"W x 0.3"H

- 5) #C252X030FJJ; component label, laser/inkjet print, white face stock, 2.52"W x 0.3"H

2.5 MISCELLANEOUS COMPONENTS

A. Loom Tubing

1. Application: manage and protect cables from feed point to furniture system, or similar
2. Manufacturer, or equal:
 - a. Panduit
 - 1) #CLT100F-C20; split corrugated loom tubing (polyethylene), 0.91" ID, black
 - 2) #CLT125F-L20; split corrugated loom tubing (polyethylene), 1.28" ID, black
 - 3) #CLT150F-T20; split corrugated loom tubing (polyethylene), 1.58" ID, black
 - 4) #CLT188F-C20; split corrugated loom tubing (polyethylene), 1.85" ID, black

B. Velcro Cable Ties

1. Width: .75".
2. Manufacturer, or equal:
 - a. Panduit "Tak-Ty" series cable ties
 - b. Panduit
 - 1) #HLS-15R0; black, 15' roll, cut to length

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with the Execution requirements of section 270000.

3.2 EXAMINATION AND PREPARATION

- A. Rooms: Prior to installation, verify equipment rooms are suitable to accept the horizontal cables and terminations.
- B. Pathways: Prior to installation verify that pathways and supporting devices, provided under other sections, are properly and completely installed (at least the portions into which cables will be placed), and that temporary supports, devices, etc., have been removed. Cable tray shall be complete prior to placing cables within them, per CEC (at least the portions into which cables will be placed). Verify dimensions of pathways, including length (for example, "True Tape" the conduits) to ensure that the resulting cable lengths will not exceed the maximum allowable length specified herein.
- C. Cable Integrity: Prior to installation, verify the cable's integrity – both sheath and conductors. Documentation of pre-installation testing is not a close out requirement, and is the responsibility of the Contractor.

3.3 INSTALLATION

A. Cable Installation and Routing

1. No cable length shall violate the requirements stated in "System Description".
2. Cables shall have continuous sheath continuity. Splices are not permitted anywhere.
3. Install cables within the cable manufacturer's published installation temperature range.
4. Place cables within designated pathways, such as cable tray, cable hangers, etc. Do not fasten (such as with cable ties) or attach cables to other building infrastructure (such as ducts, pipes, conduits, etc.), other systems (such as ceiling support wires, wall studs, etc.), or to the outside of conduits, cable trays, or other non-approved pathway systems.
5. Place and suspend cables during installation and termination in a manner to protect them from physical interference or damage. Place cables with no kinks, twists, or impact damage to the sheath. Replace cables damaged during installation or termination.
6. In general, route cables at 90-degree angles, along corridors (for improved maintenance and access).
7. Do not bend cables tighter than 2 inches during and after installation.
8. Do not exceed manufacturer's limits for pulling tension.
9. Do not use cable-pulling compounds / pulling lubricants for indoor installations.
10. Route cables under building infrastructure (such as ducts, pipes, conduits, etc.) – to result in easy accessibility to the cables for future maintenance.
11. Place cables at least 6 inches away from power sources – to reduce interference from EMI.
12. Neatly dress and organize cables using designated cable routing facilities, and fasten to support devices via Velcro-type straps.
13. When exiting primary pathways (such as cable tray) to the work area, exit via the top of the pathway.
14. Cable Ties: Install cables ties, where allowed, tight enough to keep cables organized/managed but loose enough to be moved about the cables/cable bundles. Cable ties shall not deform or cinch cables too tightly. Tie installed too tightly per the Engineer's opinion shall be subject to removal upon direction from the Engineer.

B. Cable Routing and Dressing within the TR

1. Place cables within the overhead cable support. When routing vertically, fasten the cables onto vertical cable support approximately every 24 inches using approved cable fastening means.
2. At the rack bay, route cables within the back of the vertical management sections (do not route cables into the front as this space is reserved for patch cords only). Divide the cables equally between both sides of an equipment rack such that a cable does not travel past the midpoint of the rack prior to termination. Dress and cut cables to length required to reach the designated termination point (maintaining bend restrictions) with no excess cable slack left in the horizontal cable manager (if used) and vertical management section.
3. Do not provide slack within the TR.

C. Termination in the TR

1. Install and assemble termination apparatus, accessories and associated management apparatus according to the manufacturer's instructions.
2. Properly strain relieve cables at termination points per manufacturer's instructions.
3. For OSP cables, apply sealant (such as B-sealant) where the pairs exit the cable jacket to seal the end of the cable and prevent water-blocking gel from leaking from the cable's sheath.

4. Terminate cables and twisted pairs in accordance with manufacturer's latest installation requirements and TIA-568 series standard installation practices. Terminate cable pairs onto the termination apparatus. Terminate twisted pairs compliant to TIA-568 series standards and wired per 1.04 System Description.
 5. Patch Panels and Horizontal Management Panels
 - a. Quantity: Provide patch panels to support termination of cables. Provide horizontal management panels based on the quantity of patch panels.
 - b. Install and assemble discrete port patch panels and horizontal management panels according to the manufacturer's instructions.
 - c. Install the patch panels and the horizontal management panels as shown on the contract drawings. If configuration is not shown, install the patch panels in association with the horizontal management panels such that a management panel is mounted above and below given patch panel.
 6. Termination Sequence
 - a. Terminate the cables in sequential order using the link's identifier starting at the top left and completing a panel before moving to the next panel below.
- D. Cable Routing and Dressing at the Work Areas
1. Leave 2-4 feet sheathed cable slack (20 feet for WAPs and SEC WAPs) – length not to exceed permanent link maximum length requirement. Store slack within ceiling space neatly on a cable hanger.
 2. Routing to Type "B" Furniture-Mount Faceplates
 - a. While placing cables into furniture, exercise caution to prevent scraping, cutting, or other damage to cable's jacket.
 - b. Provide spiral wrap around cables from furniture-feed pathway (such as a wall feed to the point where cables enter furniture).
- E. Termination at the Work Areas
1. Mount faceplates plumb, square, and at the same level as adjacent device faceplates.
 2. Patch gaps around faceplates so that faceplate covers the entire opening.
 3. Terminate cables and twisted pairs in accordance with manufacturer's latest installation requirements and TIA-568 series standard installation practices and wired per 1.04 System Description.
- F. Perform post-installation testing as described in the Telecommunication Testing specification (refer to section 270811). Replace permanent links (cables, terminations and connectors) not passing the required tests.

3.4 LABELING

- A. General Requirements
1. Labeling, identifier assignment, and label colors shall conform to the TIA-606 standard and as approved by the Owner before installation.
 2. Label text shall be machine-generated; hand written labels will not be accepted.
- B. Label Formats and Text Attributes
1. Horizontal Cable Labels
 - a. Labels for cables shall be wrap-around self-laminating type.
 - b. Labels shall be permanent.
 - c. Text Attributes: color: black; size: approx. 1/8" high (#12 font size).

2. Termination Field \ Patch Panel Labels
 - a. Labels for cables shall be adhesive-backed polyester (or similar) type.
 - b. Label color shall be white.
 - c. Text Attributes: color: black; size: approx. .35" high
3. Termination Field \ Termination Block Labels
 - a. Use labels included in the block kit packaging. Any deviation from this requirement must be approved in writing by the Owner
 - b. Label color shall be white.
 - c. Text Attributes: color: black; size: approx. .50" high.
4. Outlet Labels
 - a. Labels for cables shall be adhesive-backed polyester (or similar) type.
 - b. Label color shall be white.
 - c. Text Attributes: color: black; size: approx. .35" high.
5. Outlet Port Labels
 - a. (These labels are in the case that the faceplate/surface outlet does not have port numbers stenciled or molded into the product.)
 - b. Labels for cables shall be adhesive-backed polyester (or similar) type.
 - c. Label color shall be white.
 - d. Text Attributes: color: black; size: approx. .35" high.

C. Identifier System

1. General: Separate fields of the identifier with a hyphen.
2. Individual Ports at Patch Panels
 - a. First field: the end user room number; for example: "D107".
 - b. Second field: outlet port number, for example "D1".
 - c. Example: "D107-D1"
3. Outlets (Faceplates, Surface Outlets, etc.)
 - a. First field: the originating BDF/IDF room number; for example: "AD1.1".
 - b. Second field: the destination room number; for example: "D107".
 - c. Third field: a unique sequential number; for example: "01".
 - d. Example: "AD1.1-D107-01"
4. Individual Ports at the Outlets
 - a. The specified faceplate has individual port numbers molded into the product. However, if a substitution is accepted that does not have port numbers, provide port labels as follows.
 - b. First field: the cables intended service type followed by a unique sequential number, for example "D1".
5. Horizontal Cables
 - a. First field: the originating BDF/IDF room identity; for example: "AD1.1".
 - b. Second field: the destination room number; for example: "D107".
 - c. Third field: a unique sequential outlet number, for example "01".
 - d. Fourth field: a unique port number, for example "D1".
 - e. Fifth field: the cable type; for example: "CAT6A"
 - f. Example: "AD1.1-D107-01-D1-CAT6A"

D. Label Installation

1. Horizontal Cable Labels
 - a. Install labels on both ends of cables no more than 4" from the edge of the cable jacket.
 - b. Install labels such that they are visible during normal maintenance.
2. Termination Group\Patch panel ports
 - a. Install labels on the front and on left side.

- b. Install labels such that they are visible during normal maintenance.
- 3. Termination Port\Patch panel ports
 - a. If the patch panel does not have individual port numbers stenciled on the product, then install port labels at each port – above the top row and below the bottom row.
- 4. Outlet Labels
 - a. Install label in the top label window. Leave the bottom label window blank.
- 5. Outlet Port Labels
 - a. If the outlet does not have individual port numbers stenciled or molded into the product, then install port labels at each port – either to the sides (preferred) or above the top row and below the bottom row.

3.5 FINAL INSPECTION AND CERTIFICATION

- A. Punch the work of this section compliant to the requirements of section 270000.
- B. Remove cables and replace with new without impact to cost and schedule those failing to meet the indicated standards and not passing the testing requirements of section 270811. The Owner will not accept the installation until testing has indicated a 100% availability of cables and conductors. Any deviation from this requirement must be approved in writing by the Owner.
- C. Comply with system acceptance and certification requirements of section 270000.

END OF SECTION

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