SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 and Division 27 Specification Sections, apply to this Section.

B. Refer to appendices at the following hyperlink: https://www.pdx.edu/technology/telecom-infrastructure-wiring-standards

1.2 SUMMARY

A. Section Includes:
1. UTP cabling.
2. 50/125-micrometer, optical fiber cabling.
3. Multiuser telecommunications outlet assemblies.
4. Cable connecting hardware, patch panels, and cross-connects.
5. Telecommunications outlet/connectors.
6. Cabling system identification products.
7. Cable management system.

1.3 DEFINITIONS

A. See 270500, Common Work Results for Communications.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate layout and installation of telecommunications cabling with PSU's telecommunications and LAN equipment and service suppliers.

B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 ACTION SUBMITTALS

A. Comply with submittal requirements in Section 270500, Common Work Results for Communications.

B. Shop Drawings:
1. Wiring diagrams to show typical wiring schematics, including the following:
   a. Cross-connects.
   b. Patch panels.
   c. Patch cords.
2. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration and faceplates for color selection and evaluation of technical features.

D. Delegated-Design Submittal: For seismic restraints.
1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.
2. Design Calculations: Calculate requirements for selecting seismic restraints.
3. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

B. Software and Firmware Operational Documentation per Closeout Submittals in Section 270500, Common Work Results for Communications.

1.7 QUALITY ASSURANCE

A. Comply with requirements of Quality Assurance in 270500.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
   1. Test optical fiber cables to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
   2. Test optical fiber cables while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; including the loss value of each. Retain test data and include the record in maintenance data.
   3. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
   1. TIA/EIA-568-C.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
   2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
   3. Bridged taps and splices shall not be installed in the horizontal cabling.
   4. Splitters shall not be installed as part of the optical fiber cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

D. PSU Description: Communications outlets for workstations and other end-user jack locations -- shall minimally consist of two gang wall plates equipped with two 8-pin modular (RJ-45) jacks. The preferred standard for communications outlets in new construction is four gang wall plates equipped with four 8-pin modular (RJ-45) jacks. The number of modular jacks per face plate shall be decided by the use of the area and with the approval of PSU OIT.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-C.1 when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Grounding: Comply with J-STD-607-A.

2.3 BACKBOARDS

A. See Specification 271100, Communications Equipment Room Fittings

2.4 UTP CABLE

A. Products: Subject to compliance with requirements, provide the following:
   a. CommScope, Inc.

B. Description: 100-ohm, four-pair UTP, covered with a thermoplastic jacket, in color readily available from the manufacturer, typically blue or white.
   1. Comply with ICEA S-90-661 for mechanical properties.
   2. Comply with TIA/EIA-568-C.1 for performance specifications.
   3. Comply with TIA/EIA-568-C.2, Category 6 and Category 6A cables.
   4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
      a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
      b. Communications, Riser Rated: Type CMR; or CMP, complying with UL 1666.
   5. Horizontal to Desktop applications: Commscope Uniprise 75 series, Category 6-inch cable.
   6. Horizontal to Wireless Access Points and Data Intensive applications such as lab or data center applications: Commscope Uniprise 10G4 Category 6A cable.

2.5 UTP CABLE HARDWARE

A. Products: Subject to compliance with requirements, provide the following:
   1. Commscope, Inc.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-C, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
   1. Number of Jacks per Field: One and one half for each four-pair UTP cable indicated.

D. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals. Jack color shall be specified or selected by OIT representative from manufacturer’s standard colors.

E. Patch Cords: Factory-made, four-pair cables in 48-inch lengths; terminated with eight-position modular plug at each end.
   1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2.6 OPTICAL FIBER CABLE

A. Products: Subject to compliance with requirements, provide the following:
   1. CommScope, Inc.
   2. See 271300 Communications Backbone Cabling for specific requirements of 50/125 laser optimized tight buffer and indoor/outdoor cable for horizontal application suitability.

2.7 OPTICAL FIBER CABLE HARDWARE

A. Products: Subject to compliance with requirements, provide the following:
   1. Commscope, Inc.
   2. See 271300 Communications Backbone Cabling for specific hardware requirements for horizontal application suitability

2.8 CONSOLIDATION POINTS

A. Products: Subject to compliance with requirements, provide the following:
   1. Commscope, Inc.; Uniprise.

B. Description: Consolidation points shall comply with requirements for cable connecting hardware.
   1. Number of Terminals per Field: One for each conductor in assigned cables.
   2. Number of Connectors per Field:
      a. One for each four-pair UTP cable indicated.
   3. Mounting: Recessed in ceiling or flush on wall, desk, or furniture depending on application.
   4. NRTL listed as complying with UL 50 and UL 1863.
   5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.9 MULTIUSER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

A. Products: Subject to compliance with requirements, provide the following:
   1. Commscope, Inc.; Uniprise.

B. Description: MUTOAs shall meet the requirements for cable connecting hardware.
   1. Number of Terminals per Field: One for each conductor in assigned cables.
   2. Number of Connectors per Field:
      a. One for each four-pair UTP cable indicated.
   3. Mounting: Recessed in ceiling or flush on wall, desk, or furniture depending on application.
   4. NRTL listed as complying with UL 50 and UL 1863.
   5. Label shall include maximum length of work area cords, based on TIA/EIA-568-C.1.
   6. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.10 TELECOMMUNICATIONS OUTLET / CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-C.

B. Workstation Outlets: Two and Four-port-connector assemblies mounted in single or multigang faceplate.
   1. Plastic Faceplate: High-impact plastic. Coordinate color with PSU.
   2. Metal Faceplate: Stainless steel, complying with specific PSU project requirements .
   3. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
      a. Flush mounting jacks, positioning the cord at a 45-degree angle
   4. Legend: Factory labeled by silk-screening or engraving for stainless steel faceplates.
   5. Legend: Machine printed, in the field, using adhesive-tape label.
   6. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.11 GROUNDING

A. Comply with Specification 270526, Grounding and Bonding for Communications Systems.

B. Comply with J-STD-607-A.

2.12 IDENTIFICATION PRODUCTS

A. Comply with Specification 270500 Common Work Results for Communications.

B. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.13 CABLE MANAGEMENT SYSTEM

A. Comply with Specification 271100 Communications Equipment Room Fittings.

2.14 SOURCE QUALITY CONTROL

A. Testing Agency: PSU will engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-C.

C. Factory test UTP cables according to TIA/EIA-568-C.

D. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-C.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters. Conceal pathways and cables except in unfinished spaces.
1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements in Section 270528 "Pathways for Communications Systems."
3. Comply with requirements in Section 270536 "Cable Trays for Communications Systems."

B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures:
1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
2. Install lacing bars and distribution spools.
3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:
1. Comply with TIA/EIA-568-C.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. MUTOA shall not be used as a cross-connect point.
4. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
5. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
6. Locate consolidation points for UTP at least 49 feet from communications equipment room.
7. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
8. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
9. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
10. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
11. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
12. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
13. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
14. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:
1. Comply with TIA/EIA-568-C.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:
1. Comply with TIA/EIA-568-C.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.

G. Group connecting hardware for cables into separate logical fields.

H. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 FIRESTOPPING

A. Comply with Specification 270500 Common Work Results for Communications.

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding

electrode conductor from grounding bus bar to suitable electrical building ground. Lengths over 66-feet require a 3/0 conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.5 IDENTIFICATION

A. Comply with requirements in specification 270500, Common Work Results for Communication.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Visually inspect UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-C.1.
   2. Visually confirm Category 6 and Category 6A, marking of outlets, cover plates, outlet/connectors, and patch panels.
   3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
   4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
      a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C. Perform tests with a tester that complies with current TIA standards.
   5. Optical Fiber Cable Tests:
      a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
      b. Link End-to-End Attenuation Tests:
         1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA-526-14-A, Method B, One Reference Jumper.
         2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-C.
   6. UTP Performance Tests:
      a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-C:
         1) Wire map.
         2) Length (physical vs. electrical, and length requirements).
         3) Insertion loss.
         4) Near-end crosstalk (NEXT) loss.
         5) Power sum near-end crosstalk (PSNEXT) loss.
         6) Equal-level far-end crosstalk (ELFEXT).
         7) Power sum equal-level far-end crosstalk (PSELFEXT).
         8) Return loss.
         9) Propagation delay.
         10) Delay skew.
   7. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to TIA/EIA-568-C.1 and TIA/EIA-568-C.3.

B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 DEMONSTRATION

A. Train PSU's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION 271500