SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pathways.
   2. UTP cabling.
   3. Coaxial cable.
   4. Cable connecting hardware, patch panels, and cross-connects.
   5. Telecommunications outlet/connector.
   6. Cabling system identification products.
   7. Cable management system.

1.2 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel.
D. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
E. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
F. EMI: Electromagnetic interference.
G. IDC: Insulation displacement connector.
H. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
I. LAN: Local area network.
K. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
L. RCDD: Registered Communications Distribution Designer.
M. UTP: Unshielded twisted pair.
N. Owner: Salt River Project.
1.3 HORIZONTAL CABLE 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 "permanent link," a term that is used in the testing protocols.

1. Minimum of three telecommunications outlet/connectors be installed for each work area. (one voice / two data)
2. Horizontal cabling shall contain no 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 includes the components that extend from the telecommunications outlet/connectors to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) in the horizontal cross-connect.

1.4 PERFORMANCE REQUIREMENTS

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

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
3. Cabling administration drawings and printouts.
4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

C. Source quality-control reports.

D. Field quality-control reports.

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

F. Testing Documentation

1. Provide three hard copies and one electronic copy (CD-rom) of test reports for horizontal UTP cables, coaxial cables, and fiber-optic cables. Test reports provided in electronic
format shall include a shareware copy of the appropriate software for managing the reports in CSV format.

2. Documentation (printed form) shall be submitted to the Architect within five working days of the completion of each testing phase (e.g., subsystem, cable type, area, floor, etc.).

1.6 QUALITY CONTROL

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

B. 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.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.


1.7 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
   1. Test each pair of UTP cable for open and short circuits.
   2. Delivery and receipt of products shall be at the site described in the Scope section.
   3. Cable shall be stored according to manufacturers’ recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. Air temperature at cable storage location shall not exceed 50°F minimum, 130°F maximum. Storage location shall be well ventilated to prevent condensation. If necessary, cable shall be stored offsite at the Contractor’s expense.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Cable shall be stored according to manufacturer’s recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. Air temperature at cable storage location shall not exceed 50°F minimum, 130°F maximum. Storage location shall be well ventilated to prevent condensation. If necessary, cable shall be stored offsite at the Contractor’s expense.

1.9 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.
B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

C. Refer to Division 27 Section 27 05 13 “Communication Services”.

PART 2 - PRODUCTS

2.1 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by:

1. Berk-Tek; a Nexans company.

B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 5e for renovation of existing facility and Category 6 for new construction.
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, complying with UL 1666.
   c. Communications, Limited Purpose: Type CMX.
   d. Multipurpose: Type MP or MPG.
   e. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
   f. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.2 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ortronics.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, 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 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.

E. Patch Cords: Factory-made, four-pair cables in [36-inch (900 mm)] [48-inch (1200-mm)] Length as directed by SRP; 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. Patch cords shall have latch guards to protect against snagging.

2.3 COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Belden CDT Inc.; Electronics Division.
   2. CommScope, Inc.
   3. Berk-Tek A Nexans Company

B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-6/U: NFPA 70, Type CATVP.
   1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
   2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
   3. Jacketed with Copolymer jacket.
   4. Suitable for indoor installations.

D. RG59/U (Plenum Rated): NFPA 70, Type CMP.
   1. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
   2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
   3. Copolymer jacket.

E. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
   1. CATV Plenum Rated: Type CATVP, complying with NFPA 262.

2.4 COAXIAL CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ortronics.
   2. Blonder – Tongue.

B. Coaxial-Cable Connectors: Type BNC, 75 ohms.
2.5 TELECOMMUNICATIONS OUTLET/CONNECTORS


B. Workstation Outlets: Four port-connector assemblies mounted in single faceplate.
   1. Plastic Faceplate: High-impact plastic. Coordinate color with Division 26 Section 26 27 26 "Wiring Devices."
   2. 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 90-degree angle.
   3. Legend: Machine printed, in the field, using adhesive-tape label for cable.

2.6 IDENTIFICATION PRODUCTS

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

B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

C. Cable identification shall be by means of permanently applied, pre-printed, wraparound wire markers (i.e., "Brady-Wrap" B-292, LAT-18, or LAT-19 self-laminating markers). These labels must withstand the requirements of UL 969 as outlined in the EIA/TIA-606 Standard.

D. Patch panel labels shall be pre-printed and enclosed in self-adhesive clear strips (Panduit, Ortronics or as accepted by the Engineer).

E. Data/Telecommunications Outlet Face Plates: Permanent, clear, pre-printed laminated label with black lettering (Brady Label #CL-311-621 or LAT-7-722-10, or as accepted by the Engineer).

2.7 SOURCE QUALITY CONTROL

A. Factory test UTP on reels according to TIA/EIA-568-B.1.

B. Factory test UTP cables according to TIA/EIA-568-B.2.

C. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

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

E. Prepare test and inspection reports. Provide software to read original test results on disc provided to owner.
PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

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

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer’s limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Cabling shall be installed in continuous runs from cross-connect fields to cross-connect fields, to patch panels, workstation outlets, etc. Cabling shall be free from splices, taps, splitters, baluns and any other in-line connections.
6. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Unsupported spans between cable trays and conduit sleeves shall not exceed 12" (305 mm) horizontally, 24" (607 mm) vertically.
8. All cables shall be new and as specified on the drawings. Cables shall be shipped on 1,000 ft. reels or boxed. Coiled cables are not acceptable. Factory shorts and/or factory seconds, salvaged, leftover and reused cables are not acceptable. Cables of a given type shall be of a single manufacturer and part number. All unapproved or unacceptable cable shall be removed and replaced at the Contractor’s expense.
9. Cables routed above a suspended ceiling in exposed space, and not installed in a conduit system, shall be supported by a cable tray, channel or hangers.
10. Cables shall not be supported from ceiling support wires, lighting fixture support wires, ductwork, plumbing line, fire suppression systems, mechanical systems or electrical conduits. Cables shall not come in contact with ductwork or piping, or lay on top of ceiling systems and lighting fixtures.
11. Where cables are routed through inaccessible ceilings, the Contractor shall install conduit sleeves extending 1 foot beyond the inaccessible area, sized in accordance with ANSI/TIA/EIA-569-A Guidelines, as outlined in Table 1. Install insulated conduit bushing
on both ends of sleeve and ground conduit per Division 27 Specification Section 27 05 26 “Grounding & Bonding for Communications Systems”.

12. Install conduit sleeves where cables pass through walls. Conduits shall be sized in accordance with ANSI/TIA/EIA-569-A Guidelines, as outlined in Division 27 Specification Section 27 05 28 “Pathways for Communications Systems” Table 1. Install insulated conduit bushing on both ends of sleeve and ground conduit per Division 27 Specification Section 27 05 26 “Grounding & Bonding for Communications Systems.

13. Cables supported by hangers shall utilize Caddy Cable-Cat hangers or approved equal communication cable hangers. Hangers shall be supported from the building structure. Hangers shall not utilize other system support wires or rods.

14. A maximum of 36 (three groups of 12) cables shall be supported in a single hanger with a spacing of 48" on center. Cables shall be loosely bundled.

15. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

16. 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. Use lacing bars and distribution spools.

17. 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.

18. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.

19. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of voice cable.

20. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

21. Cables requiring additional length shall be stored in an extended loop or in a "Figure 8" configuration. Do not store additional length in bundled loops. Each individual loop shall be tagged with cable number.

22. The Contractor shall make certain that during the installation and upon completion, all cables have been installed in good condition, free from jacket cuts or tears, kinks, twist, knots, sharp bends, etc., or any other physical damage. During the installation, the Contractor shall not allow the cables to be exposed to foot, vehicle or equipment traffic, or be exposed to any other form of abuse which shall cause damage to cables, altering the electrical characteristics. Cables exhibiting such damage or an attempt by the Contractor to correct, hide or otherwise conceal such damage, shall result in cables being replaced at the Contractor’s expense.

23. Cable pulls shall not exceed 100 feet in length. Cables shall be neatly coiled in a figure "8" pattern at the completion of a pull in preparation for the next pull.

24. Data/telecommunication and fiber-optic cables shall not be stored or installed in an unheated building where the temperature is less than 40°F. The structure and the cable must be brought to a minimum 50°F ambient for a minimum of 48 hours prior to installation of the cables. Failure to observe this precaution may result in damage to the cable and shall result in the cable being replaced at the Contractor’s expense.

C. UTP Cable Installation:

2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. 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 (200 mm) above ceilings by cable supports not more than 48 inches (1524 mm) apart. Refer to Part B Item 10 for support requirements.

3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. 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 (1800 mm)] long in Figure 8 configuration not less than [12 inches (300 mm)] in diameter below each feed point.

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

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A 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 (127 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).

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 (64 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

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:
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
3.3 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."
B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
C. Comply with BICSI TDMM, Chapter 11 "Firestopping Systems" Article.

3.4 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
   1. Administration Class: 4.
   2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
C. Comply with requirements in Division 09 Section 09 91 23 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
D. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 4 level of administration.
E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
G. Cable and Wire Identification:
   1. Label each cable within 4 inches (100 mm) of each termination point.
   2. Exposed Backbone Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
   3. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
      a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
      b. Label each unit and field within distribution racks and frames.
4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Installing Contractor to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:


2. Visually confirm Category 5e or Category 6, 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-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

5. UTP Performance Tests:

   a. Test for each outlet. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

      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.
6. Coaxial Cable Tests: Conduct tests according to Division 27 Section "Master Antenna Television System."

D. 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.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections. Minimum acceptable level above testing standard is 3dBA. Although test equipment may "pass" a cable based on standard valves, SRP reserves the right to reject any cable test report indicating 3.0 dBA or less. Contractor shall repair or replace unaccepted cable at their expense.

F. Prepare test and inspection reports.

END OF SECTION 271500