

SECTION 271500 – 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following items for wiring systems used as signal pathways for voice and high-speed data transmission:
 - 1. Mounting elements.
 - 2. Unshielded twisted-pair cabling.
 - 3. Coaxial cable.
 - 4. Workstation outlets.
 - 5. Backboards.
 - 6. Identification products.

1.3 DEFINITIONS

- A. Backbone: A facility (e.g., pathway, cable, or conductors) between telecommunications rooms or floor distribution terminals, the entrance facilities, and the equipment rooms within or between buildings.
- B. BICSI: Building Industry Consulting Service International.
- C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- D. EMI: Electromagnetic interference.
- E. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. Also the cabling between and including the building automation system outlet or the first mechanical terminations on the horizontal connection point and the horizontal cross-connect.
- F. IDC: Insulation displacement connector.
- G. LAN: Local area network.
- H. RCDD: Registered Communications Distribution Designer.
- I. RMC: Rigid metallic conduit.

- J. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For features, ratings, and performance of each component specified.
 - 1. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
- B. Shop Drawings:
 - 1. Include dimensioned plan and elevation views of telecommunications equipment rooms, labeling each individual component. Show equipment rack assemblies, method of field assembly, workspace requirements, and access for cable connections.
 - 2. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - 3. Cabling Administration Drawings.
 - 4. Wiring diagrams to show typical wiring schematics including the following:
 - a. Workstation outlets, jacks, and jack assemblies.
 - b. Patch cords.
 - c. Patch panels.
 - d. Fiber-optic boxes.
 - e. Distribution racks.
 - f. Terminal racks.
- 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. Qualification Data: For Installer.
- E. Field quality-control test reports.
- F. 25 year system warranty documentation.

1.5 QUALITY ASSURANCE

- A. All bidders shall visit the site prior to bid, to inspect the existing cabling system, and include in their bid any additional labor and materials as required for a complete installation to match the existing system.
- B. Installer Qualifications: Cabling installer must have on staff personnel certified by BICSI.
 - 1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings by an RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of a Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
- C. Source Limitations: Obtain all products except cables through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NFPA 70, "National Electrical Code."

1.6 COORDINATION

- A. The telecommunications subcontractor shall coordinate layout of all rooms with the Owner and Engineer prior to beginning any work.
- B. Coordinate layout and installation of voice and data communication cabling with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 2. Record agreements reached in meetings and distribute to other participants.
 3. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

1.7 EXTRA MATERIALS

- A. Provide for the following quantity of devices, in addition to those indicated on the drawings. Allowances shall include all labor and materials required for a complete installation, including, but not limited to coverplates, conductors, patch panels, conduit, junction boxes, etc. to support the installation of these devices. The location of these devices shall be determined in the field by the architect during construction.
 1. Ten (5) standard two-port voice/data workstation outlets, either surface or flush mounted.
 2. Ten (5) standard 4-port voice/data workstation outlets, either surface or flush mounted.
 3. Five (2) standard single-port wall phone outlets.
- B. In addition to the items above, furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Outlet Assemblies: One of each type for every 25 outlets shown on plans, but no fewer than one.
 2. Connecting Blocks: One of each type.

3. Device Plates: Ten of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Hubbell Premise Wiring is the preferred vendor for this facility.

2.2 SYSTEM REQUIREMENTS

- A. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.
- B. Expansion Capability: Unless otherwise indicated, provide spare positions in cross-connect and patch panels to accommodate 25% percent future increase in the number of workstations shown on Drawings and in addition to those required to accommodate Item 1.7.A. 1. thru 3. above.

2.3 UNSHIELDED TWISTED-PAIR CABLING

- A. Cable Manufacturers:
 1. Belden Inc.; Electronics Division. DataTwist Category 6.
 2. Superior Essex; Superior Telecommunications Inc., Cobra Category 6 Plus.
- B. Terminal and Connector Component and Distribution Rack Manufacturers:
 1. Allen Tel Products, Inc.
 2. Leviton Voice & Data Division.
- C. 100-Ohm UTP: Comply with UL 444.
- D. Horizontal Copper Cable:
 1. No. 24 AWG, 100 ohm, four pair.
 2. Comply with TIA/EIA-568-B.2, Category 6.
 3. NFPA 70, types CMR and CMP.
 4. Cable Jacket Color: Blue for data, white for voice.
- E. Cable Connecting Hardware: Comply with TIA/EIA-568, IDC type, using modules designed for punch-down caps or tools.
 1. IDC Terminal Block Modules: Integral with connector bodies, including plugs and jacks where indicated.
 2. IDC Connecting Hardware: Consistent throughout Project.

- F. Jacks and Jack Assemblies: Modular, color-coded, RJ-45 receptacle units with integral IDC-type terminals. Use keyed jacks for data service.
- G. Patch Cords: Factory-made, four-pair cables in 48-inch lengths; terminated with RJ-45 plug at each end. Use keyed plugs for data service.

2.4 COAXIAL CABLE

- A. Manufacturers:
 - 1. Belden Inc.; Electronics Division.
 - 2. West Penn Wire/CDT; a division of Cable Design Technologies.
- 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, and shall be listed to comply with NFPA 70, Articles 810 and 820.
- C. RG59/U: No. 20 AWG, solid, silver-plated, copper-covered steel conductor; gas-injected, foam-PE insulation. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip. Color-coded PVC jacket. NFPA 70, Type CATVR.
- D. RG-6/U: No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid. Jacketed with black PVC or PE. Suitable for indoor installations; NFPA 70, Type CATV or CM.
- E. RG59/U: No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid. PVC jacket. NFPA 70, Type CATV.
- F. RG59/U (Plenum Rated): No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid. Copolymer jacket. NFPA 70, Type CMP.
- G. Coaxial-Cable Connectors: Type BNC, 75 ohms. Of three-piece construction, consisting of a crimp-type center tip, sleeve, and main body.

2.5 WORKSTATION OUTLETS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, modular, RJ-45. Wiring configuration shall be T568B.
- B. Workstation Outlets: Jack-connector assemblies mounted in single gang faceplate.
 - 1. Faceplate: High-impact plastic; color as selected by Architect.
 - 2. Mounting: Flush, unless otherwise indicated.
 - 3. Legend: Machine-printed adhesive label identifying the circuit.

2.6 GROUNDING AND BONDING

- A. Materials: Comply with NFPA 70, TIA/EIA-607, and UL 467.

2.7 IDENTIFICATION PRODUCTS

- A. Available Manufacturers:
 - 1. Brady Worldwide, Inc.
 - 2. HellermannTyton.
 - 3. Kroy LLC.
 - 4. Panduit Corp.
- B. Comply with TIA/EIA-606-A and with applicable requirements in Division 16 Section "Electrical Identification."
- C. Cable Labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

PART 3 - EXECUTION

3.1 INSTALLATION STANDARDS

- A. Comply with BICSI TCI, TIA/EIA-568-B.1, TIA/EIA-568-B.2, and TIA/EIA-568-B.3.

3.2 EXAMINATION

- A. Examine pathway elements intended for cables.
 - 1. Verify proposed routes of pathways. Check raceways, cable trays, and other elements for compliance with space allocations, clearances, installation tolerances, hazards to cable installation, and other conditions affecting installation. Verify that cabling can be installed complying with EMI clearance requirements.
 - 2. Prepare wall penetrations and verify that penetrations of rated fire walls are made using products labeled for type of wall penetrated.
 - 3. Identify plan to support cables and raceways in suspended ceilings. Verify weight of individual types and sizes of cables. Verify that load capacity of cable support structures is adequate for each pathway.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 APPLICATION OF MEDIA

- A. Horizontal Cable for Data Service: Use UTP Category 6 cable for runs between wiring closets and workstation outlets.
- B. Horizontal Cable for Voice Service: Use UTP Category 6 cable for runs between wiring closets and workstation outlets.

- C. Cables shall be plenum rated throughout the project except for backbone cables that are ran in plenum rated innerduct.

3.4 INSTALLATION

- A. Where shown on the drawings, the standard workstation outlet shall have (1) phone port and (3) data ports, except for the following locations. Provide one 4-pair UTP cable per workstation port:
 - 1. At phone locations, install (1) phone port at phone locations.
 - 2. Install one coax cable and one f-type connector at TV locations
- B. Provide (2) Category 6 patch cords for each horizontal data link. Color and length to be selected by the owner. Allow in the bid for all patch cords to be at least 10'-0" in length, but verify exact lengths with owner after the bid, prior to ordering.
- C. Comply with NECA 1.
- D. Wiring Method: Install cables in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces. Cable trays are specified in Division 16 Section "Cable Trays." Raceways and boxes are specified in Division 16 Section "Raceways and Boxes."
- E. Cable Installation:
 - 1. All horizontal cabling shall be run to the nearest equipment room, or wiring closet on the same floor.
 - 2. Install exposed cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
 - 3. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 4. Pulling Cable: Do not exceed manufacturer's written recommended pulling tensions. 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.
 - 5. 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.
 - 6. Install UTP cables using techniques, practices, and methods that are consistent with Category 6 rating of components and that ensure Category 6 performance of completed and linked signal paths, end to end.
 - a. Do not untwist more than 1/2 inch of Categories 6 cables at connector terminations.
- F. Separation from EMI Sources: Comply with BICSI TDM and TIA/EIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment. Comply with the following minimum separation distances from possible sources of EMI:
 - 1. Separation between unshielded power lines or electrical equipment in proximity to open cables or cables in nonmetallic raceways is as follows:

- a. Electrical Equipment Rating Less Than 2 kVA: 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: 24 inches.
2. Separation between unshielded power lines or electrical equipment in proximity to cables in grounded metallic raceways is as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: 12 inches.
 3. Separation between power lines and electrical equipment located in grounded metallic conduits or enclosures in proximity to cables in grounded metallic raceways is as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: 6 inches.
 4. Electrical Motors and Transformers, 5 kVA or HP and Larger: 48 inches.
 5. Fluorescent Fixtures: 5 inches.

G. Conduit:

1. Comply with TIA/EIA-569-B for maximum length of conduit and bends between pull points, and for pull-box sizing.
2. Use manufactured conduit sweeps and long-radius ells whenever possible.
3. In telecommunications rooms, position conduit ends adjacent to a corner on backboard (in case of a single piece of plywood) or in the corner of room (where multiple sheets of plywood are installed around perimeter walls of room). Use cable trays to route cables if conduits cannot be located in these positions. Secure conduits to backboard when entering room from overhead. Extend conduits 1 to 3 inches in finished floor.

- H. Backboards: Install plywood with 84-inch dimension from floor up toward ceiling. Butt adjacent sheets tightly, and form smooth gap-free corners.

3.5 GROUNDING

- A. Comply with Division 16 Section "Grounding and Bonding" and with TIA/EIA 607.

B. Grounding Points:

1. Locate grounding terminals in each equipment room, wiring closet, rack, and cabinet.
2. Telecommunications Grounding Busbars: Mount on wall of telecommunications entrance facility, equipment room, and closet, with standoff insulators.

C. Bonding Conductors:

1. Extend from telecommunications entrance facility to electrical entrance facility and connect to grounding electrode.
2. Extend from telecommunications entrance facility to grounding busbars.

3. Extend from grounding busbars to ground terminals in equipment racks and cabinets.

D. Special Requirements:

1. Bonding conductors shall be insulated copper, No. 6 AWG minimum.
2. Install only in nonmetallic conduit, unless specifically required for protection of conductor. Metallic conduit, if used, shall be RMC. For RMC that exceeds 36 inches in length, conductors shall be bonded at each end of conduit.
3. Bonding conductors shall be installed without splices unless approved by Architect because of special circumstances. Where splices are necessary, they shall be accessible and shall be located in telecommunications spaces. Splices shall be by irreversible compression connectors or by exothermic welding.

3.6 IDENTIFICATION

A. In addition to requirements in this Article, comply with TIA/EIA-606-A and with applicable requirements in Division 16 Section "Electrical Identification."

1. Coordinate identification scheme with the owner.
2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Use logical and systematic designations for facility's architectural arrangement and nomenclature, and a consistent color-coded identification of individual conductors.

C. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. All wiring conductors connected to terminal strips shall be individually numbered, and 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.
5. 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.
6. At Workstations: Label cables within outlet boxes and attach label to device plate.

D. 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.

- E. Cabling Administration Drawings: Show building floor plans with cable 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.

3.7 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
- B. Category 6 UTP Cabling Tests:
 - 1. 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 Annex I, complying with measurement accuracy specified in Annex H. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Wire-map test that reports open circuits, short circuits, crossed pairs, reversed pairs, split pairs, and improper terminations.
 - 4. Channel and permanent link tests for cable length, insertion loss, near-end crosstalk loss, power sum near-end crosstalk loss, equal-level far-end crosstalk loss, power sum equal-level far-end crosstalk, return loss, propagation delay, and delay skew. Performance shall comply with minimum criteria in TIA/EIA-568-B.2.
- C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- E. Retest and inspect cabling to determine compliance of replaced or additional work with specified requirements.

3.8 DEMONSTRATION

- A. Train Owner'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. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 271500