

## **SECTION 271513 - COPPER HORIZONTAL CABLING**

### **PART 1 - GENERAL**

#### **1.1 SUBMITTALS**

- A. Product Data:
  - 1. Product Datasheets.
  - 2. Bill of Materials (BOM).
  - 3. Warranty documentation, including connectivity/cabling manufacturer product warranty data and certificates of complete connectivity solution provider status for the Contractor.
  
- B. Quality Assurance
  - a. Cable and connectivity manufacturers' certification of quality and performance, including:
    - 1) List of manufacturers and products approved for use by the cabling and connectivity manufacturers to meet the required extended warranty and warranty registration procedures.
    - 2) Warranty documentation, including cabling and connectivity manufacturers' current product warranty data and certificates of complete connectivity solution provider status for the Contractor.
  
- C. Shop Drawings:
  - a. Floor Plans
  - b. Labeling Schema.
  
- D. Closeout Submittals:
  - 1. Product Datasheets.
  - 2. As-Built Drawings:
    - a. Floorplans
    - b. Rack Elevations.
    - c. Wall Elevations.
    - d. Labeling Schema.
  - 3. Field Quality Control / Test Results.
  - 4. Cable and connectivity manufacturers' certification of quality and performance.
    - a. Warranty documentation, including cabling and connectivity manufacturers' current product warranty data and certificates of complete connectivity solution provider status for the Contractor.

- b. Executed warranty documentation: Site specific, supplied from the manufacturer.

## 1.2 REFERENCES

### A. Definitions:

1. Consolidation Point (CP): A location for interconnection between horizontal cables extending from Telecommunications Rooms and horizontal cables extending to the communications outlet/connector. Typically used to feed office furniture or similar re-configurable areas.
2. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
3. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors. Similar function as CP except the horizontal cables are terminated with RJ45 interfaces at both ends and the cable extends to the workstation as a station attachment cable.
4. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
5. Twisted-Pair: Two individually insulated copper wires physically twisted together to form a balanced pair.
6. Twisted-Pair Cable: A multi-conductor cable comprising two or more copper conductors twisted in a manner designed to cancel electrical interference. Also called balanced twisted-pair cable.

### B. Reference Standards:

1. TIA/EIA-568-C, including TIA/EIA-568-C.0, Generic Telecommunications Cabling for Customer Premises; TIA/EIA-568-C.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements; TIA/EIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard; and TIA/EIA-568-C.3, Optical Fiber Cabling Components Standard.
2. TIA/EIA-569-C, or most current version, Telecommunications Pathways and Spaces.
3. TIA/EIA-606-B, or most current version, Administration Standard for Commercial Telecommunications Infrastructure.
4. TIA/EIA-607-B, or most current version, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
5. The most current published version of the "Telecommunications Distribution Methods Manual (TDMM)" published by the Building Industry Consulting Services International (BICSI).
6. The most current published version of the "Information Transport Systems Installation Methods Manual (ITSIMM)" published by the Building Industry Consulting Services International (BICSI).

### **1.3 COORDINATION**

- A. Review and coordinate the sizes, quantity, routing and spacing of pathways to ensure they will adequately support the work of this Section.
  - 1. Confirm that cables to be installed will not exceed maximum fill capacities of raceways and shall meet the minimum requirements of Local, State and Federal laws and requirements.
  - 2. Confirm that cables to be installed within the pathways will not exceed the maximum standards-based distance limitations (90 meters (295 feet)) for horizontal cabling.
- B. Coordinate communications outlet/connector locations with the location of power receptacles at each work area. Coordinate so that power receptacles are immediately adjacent and same height.
- C. Coordinate layout and installation of communications cabling with telecommunications and LAN equipment and service suppliers.

### **1.4 QUALITY ASSURANCE**

- A. Prior to bid, Contractor shall be listed and shall maintain participation as part of the cabling and connectivity manufacturers' certified contractor programs. Provide documentation as outlined in Submittals.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- A. Store materials in conditions endorsed by the product manufacturer.
- B. 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.
- C. Do not deliver or install product(s) in conditions that jeopardize the performance or manufacturer life expectancy and service life of the product.

### **1.6 WARRANTY**

- A. Additional requirements: Cabling and connectivity products manufacturers, including patch cords, shall have in place an agreement recognizing each other for execution of the warranty as specified. Performance and applications warranties shall be channel rated, including patch cords.
- B. The cable manufacturer and the connectivity products manufacturer shall be the same manufacturer or shall have a partnership agreement established in order to provide the required warranty.

- C. Required warranty: The TIA/EIA-568-C Category 6 – 250 MHz compliant cable system shall include a minimum 15 year extended product warranty and performance/applications assurance program to minimum of 5dB of crosstalk margin beyond the CAT 6 standard for NEXT, PSNEXT, ACR and PSACR.

## **1.7 SYSTEM DESCRIPTION**

- A. Horizontal cabling and connecting hardware provide the means of transporting signals between the communications outlet/connector and the horizontal cross-connect located in the communications room or enclosure. The cabling and associated connecting hardware are called a "permanent link," a term that is used in the testing protocols.
- B. Provide TIA/EIA-568-C compliant 4-pair twisted pair horizontal cabling system.
  - 1. Provide Category 6 compliant horizontal cabling system.
- C. Cabling
  - 1. Refer to the Drawings for types and quantities of horizontal cables.
  - 2. Provide total connectivity for complete and permanent installed communications links.
  - 3. The copper horizontal cabling system shall include provisions for voice/telephone, data/network, video surveillance, audio-visual, access control, building automation, control data and intrusion detection systems.
    - a. Cables may be color-coded by system. Reference the Drawings for requirements, and coordinate with the Owner for final verification.
- D. Unless pre-approved by the Designer, provide a single, uniform and complete connectivity solution for this Section:
  - 1. Cabling and connectivity for this Section, and related structured cabling Sections (used to form a unified Structured Cabling System), shall be provided by a single manufacturer or a two manufacturer formal relationship.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.

### **2.2 CABLING**

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

1. Berk-Tek; a Nexans company (Berk-Tek).
2. Belden CDT.
3. CommScope, Inc. (CommScope).
4. General Cable Technologies Corporation (General Cable).
5. Mohawk; a division of Belden CDT (Mohawk).
6. Superior Essex.

B. General:

1. General Performance: Comply with transmission standards in TIA/EIA-568-C when tested according to test procedures of this standard.
  - a. Twisted pair cable is required to have the appropriate Category classification as defined by TIA/EIA-568-C. Compliance with these electrical characteristics shall be third party verified by the manufacturer.
2. System cables shall be code compliant and UL/NEC rated for the location, manner, and environmental conditions in which the cables are installed.
  - a. Cables that are installed in an air handling space and not installed in a totally enclosed pathway system shall be UL plenum rated.
  - b. Cables used for below grade applications, and cables used in pathways that may reasonably end up with standing water within them, shall be manufacturer rated for continuous contact with water without performance degradation or compromise in warranty.
    - 1) Cables in conduit to a floorbox in a slab on grade application shall transition to OSP rated 4 pair cables.
  - c. Cables used for direct burial, aerial, or other applications shall be manufacturer rated for the application.
    - 1) Also see “Inter-Building Cabling” Section for cable alternate construction.
3. Cables on this Project may be color-coded. See drawings for color code.

C. Twisted Pair Cable

1. Description: 100-ohm, Indoor four-pair with a thermoplastic jacket.
  - a. Comply with ICEA S-90-661 for mechanical properties.
  - b. Comply with TIA/EIA-568-C for performance specifications.
  - c. Comply with TIA/EIA-568-C, Category 6.
    - 1) Cable shall have two individual insulated 23 AWG solid copper conductors formed into a twisted pair.
    - 2) Cable shall be constructed of one 4-pair bundle of individually insulated Unshielded Twisted Pairs (UTP).

- 3) Minimum of 5dB of crosstalk margin beyond the CAT 6 standard for NEXT, PSNEXT, ACR and PSACR.
- 4) Basis of design shall be: General Cable GenSpeed 6000

### **2.3 CABLE TERMINATION HARDWARE**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. CommScope, Inc. (CommScope).
  2. Hubbell Premise Wiring (Hubbell).
  3. Leviton Mfg. Company, Inc. (Leviton).
  4. Ortronics; a subsidiary of Legrand (Ortronics).
  5. Panduit Corp. (Panduit).
  6. 3M (Transition splices)
- B. General Requirements for Cable Connecting Hardware:
  1. Comply with TIA/EIA-568-C, IDC type, with modules designed for punch-down.
  2. Cables shall be terminated with connecting hardware of same category or higher.
  3. Provide one single manufacturer for twisted pair termination hardware used together in a permanent link and whenever a Category certification is required.
  4. Cable hardware (i.e., connectivity) shall be part of the manufacturer's enterprise solution.
  5. Cable hardware shall be component rated with third-party verification for the specified Category-rated component compliance.
- A. Patch Panels
  1. Modular panels housing multiple-numbered in-line configured IDC terminations for permanent termination of pair groups of installed cables.
    - a. Provide panels in quantities sufficient to terminate each 4 pair UTP cables as indicated on the Drawings.
    - b. Comply with TIA/EIA-568-C, Category 6.
      - 1) Flat patch panel.
      - 2) UL listed.
      - 3) Black steel with PCB connection between interfaces.
      - 4) Labeling areas on front and rear.
      - 5) Mountable in EIA standard 19-inch rack/cabinet rails.
      - 6) 24-ports in 1.75 inches of rack space (1 RU); 48-ports in 3.5 inches of rack space (2RU).
      - 7) RJ45 (8P8C) jack interface on front and 110-style IDC connections on rear.
      - 8) Tested and verified to meet TIA component, permanent link and channel requirements.

- 9) Provide accessory strain relief bars on the rear with hook and loop ties.
- 10) Basis of Design Flat: Panduit DP\*\*688TGY
- 11) .

B. Connector Jacks, Jack Assemblies

1. Connector Jacks:

- a. 100-ohm, balanced, twisted pair connector; four-pair, eight-position modular color-coded receptacle units with integral IDC-type terminals, component rated.
  - 1) Category 6 Modular Jack: Basis of Design shall be Panduit CJ688TG\*\*.
- b. Connector jacks and jack assemblies shall be color coded by system.
  - 1) Color(s): As scheduled in the Contract Documents.

## 2.4 SOURCE QUALITY CONTROL

- A. System components shall be tested and listed by one or more United States NRTL.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Review and coordinate cabling pathways prior to pathway and cabling installation.
1. Coordinate to resolve deviations, defects or other problems with pathways prior to installation. Allow adequate time for corrections so as to avoid delays to the Project completion date.
  2. Provide additional or supplemental TIA/EIA-569-C compliant pathways and cable support where required. Provide additional sleeves through walls/floors/ceilings, as necessary to route cables within buildings.
- B. Project Conditions
1. 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.
  2. Do not deliver or install product(s) in conditions that jeopardize the performance or manufacturer life expectancy and service life of the product.
  3. Delivery, Storage and Handling
    - a. Store materials in conditions endorsed by the product manufacturer.
- C. Compliance

1. Comply with NECA 1.
2. Comply with TIA/EIA-568-C, including TIA/EIA-568-C.0, Generic Telecommunications Cabling for Customer Premises; TIA/EIA-568-C.1, Commercial Building Telecommunications Cabling Standard; TIA/EIA-568-C.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard; and TIA/E7IA-568-C.3, Optical Fiber Cabling Components Standard.
3. Monitor cable pull tensions, and comply with BICSI ITSIMM, Chapter “Pulling Cable.”
4. Comply with BICSI ITSIMM, Chapter “Cable Termination Practices.”
5. Comply with requirements for raceways and boxes specified in Section 270528 “Pathways for Communications.”
  - a. Comply with TIA/EIA-569-C, or most current version, for pull-box sizing and length of conduit and number of bends between pull points.
  - b. Do not exceed the required fill capacity of raceways.
6. Install faceplates and inserts furnished under Section 271543 “Faceplates and Connectors” and/or Section 271544 “Custom Faceplates, Panels and Connectors.”
7. Provide the appropriate cable rated for the environmental conditions in which the cable is to be installed.

### **3.2 INSTALLATION OF CABLES**

- A. Prior to procurement and installation of the horizontal cabling system, coordinate and verify pathways provided and indicated on the Contract Documents.
  1. Coordinate and verify to ensure that horizontal cables will not exceed the maximum standards-based distance limitations (90 meters (295 feet)) for horizontal cabling. Any discrepancy shall be immediately brought to the attention of the Designer for direction.
  2. The maximum allowable total channel distance is 328 feet (100m) between equipment in the communications room and station equipment, including cable service loops, patch cables and station attachment cables.
  3. If proactive steps are not taken prior to procurement or installation, the Contractor shall be responsible for costs associated with providing the horizontal cabling system within industry-standard distance limitation parameters, including, but not limited to, additional required cabling, pathways, rough-in, equipment, communications rooms or enclosures, power and cooling requirements.
- B. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the communications outlet/connector.
- C. Bridged taps and splices shall not be installed as part of the horizontal cabling.
- D. Install cables within approved pathways. Install cables that are not otherwise required to be installed within raceway in such manner as to conceal them from view. Conceal conductors and cables in accessible ceilings, walls and floors.

- E. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
- F. Do not splice cable between terminations or junction points. Cable runs shall be continuous. Wiring shall be free from grounds, shorts, opens and reversals.
- G. Maintain complete protection of cabling. Cabling shall not be left hanging or coiled where it potentially obstructs the Work of other trades.
- H. Cable routing shall follow building structure lines (parallel and perpendicular).
- I. 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.
- J. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
- K. Open-Cable Installation:
  - 1. Install cabling with horizontal and vertical cable guides in communications spaces with terminating hardware and interconnection equipment.
  - 2. Suspend cable not in a raceway, a minimum of 8 inches (200 mm) above ceilings by discrete cable supports not more than 60 inches (1524 mm) apart. Bridle rings are not permitted.
  - 3. Cable shall not be run through structural members or in contact with conduits, pipes, ducts or other similar or potentially damaging items.
- L. Provide conduit sleeves for penetrations.
  - 1. Provide conduit sleeves for cables where cables pass through walls, floors and ceilings.
  - 2. Patch and firestop around sleeves.
  - 3. Firestop the interior of the sleeves after cable installation.
  - 4. Provide the appropriate bushings on each end. Split bushings shall not be used.
  - 5. Provide waterproof sealant for penetrations in humidity controlled areas.
- M. Maintain (do not violate) the minimum bend radius specified by the manufacturer of the cable.
- N. At final termination, excess cable and the service loop shall be supported and stored neatly in the cable tray or ladder rack within the communications room and above the ceiling line at an accessible point at the station end.
- O. Proper strain relief shall be applied to cables after installation to lessen the risk of physical damage and to provide proper aesthetic value.
- P. Cabling within Enclosures:

1. Bundle, lace, and train cables within enclosures.
  2. Connect to terminal points with no excess and without exceeding manufacturers' limitations on bending radii.
  3. Provide and use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
- Q. Comply with requirements in Section 270501 "Basic Materials and Methods for Communications."
1. Bundle cables within racks, ladder racks, cable trays and in discrete cable supports. Utilize reusable cable bundling hardware. Utilize plenum-rated hardware in plenum spaces.
- R. Separation from EMI Sources:
1. Outlet requirements where power and communications must be co-located, a voltage barrier shall be provided.
  2. Comply with BICSI TDMM and TIA/EIA-569-C recommendations for separating unshielded twisted pair (UTP) cable from potential EMI sources, including electrical power lines and equipment.
  3. 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 2kVA: A minimum of 5 inches (127 mm).
    - b. Electrical Equipment Rating between 2 and 5kVA: A minimum of 12 inches (300 mm).
    - c. Electrical Equipment Rating More Than 5kVA: A minimum of 24 inches (610 mm).
  4. 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 2kVA: A minimum of 2-1/2 inches (64 mm).
    - b. Electrical Equipment Rating between 2 and 5kVA: A minimum of 6 inches (150 mm).
    - c. Electrical Equipment Rating More Than 5kVA: A minimum of 12 inches (300 mm).
  5. 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 2kVA: No requirement.

- b. Electrical Equipment Rating between 2 and 5kVA: A minimum of 3 inches (76 mm).
  - c. Electrical Equipment Rating More Than 5kVA: A minimum of 6 inches (150 mm).
- 6. Separation between Communications Cables and Electrical Motors and Transformers: A minimum of 48 inches (1200 mm).
  - 7. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- S. Separate cabling by service and type (i.e., voice, data, control, coaxial, fiber) prior to terminating.
- 1. Color coding of cable and termination devices shall be coordinated and approved prior to procurement and installation.
  - 2. Terminate cabling on specified termination hardware in alpha-numerical order.
  - 3. Group connecting hardware for cables into separate logical fields.
  - 4. Neatly dress and securely attach cabling to the backboard and/or cabinet/rack.
  - 5. Provide adequate cable lengths to reach any location on the backboard or within the cabinet/rack.
  - 6. Bundle and support cables of this System separately from the cables of other systems.
  - 7. Maintain separation between cables carrying different signal types and different signal levels.
    - a. Where cables from different systems or cables with different signal types are expressly permitted by the Designer to share a common pathway, each of these cable groups shall be kept segregated to the maximum degree physically possible. Cables from different systems shall not be mixed or intertwined.
- T. Service loop:
- 1. Within communications rooms, provide a minimum service loop of 10 feet (3 m) , and spool the service loop in the ladder rack.
  - 2. At the outlet/connector, provide a minimum service loop of 2 feet (0.6096 m) , and spool and store within a discrete cable support (J-hook) above the accessible ceiling at the outlet/connector location.
- U. Cable Termination:
- 1. Terminate every conductor; no cable shall contain unterminated elements unless otherwise indicated. Make terminations only at indicated outlets, terminals, cross-connects and patch panels.
  - 2. Utilize standard positive identification color coding for multi-conductor cables.
  - 3. Provide 110-style IDC termination hardware unless otherwise indicated.

- a. Do not untwist twisted pair cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
4. Cables from the same room/space shall be terminated adjacent on termination hardware. Cables from outlets/connectors shall be terminated in alpha-numeric, sequential order, based on final room numbers.
  - a. If the communications room serves more than one floor, in addition to the requirements identified above, sequentially group the cables, by floor, on separate patch panels.

### **3.3 IDENTIFICATION**

- A. Label cables and other components in compliance with Section 270553 “Identification for Communications” for labeling requirements.
- B. Label each end of the cable.
- C. Identify system components and cabling in compliance with TIA/EIA-606-B, or most current version.

### **3.4 FIELD QUALITY CONTROL**

- A. Comply with Section 270810 “Verification Testing of Structured Cabling”.
- B. Perform tests and inspections.
  1. Twisted pair cabling shall be factory tested according to TIA/EIA-568-C.
  2. Visually inspect twisted pair jacket materials for NRTL certification marking. 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.
  3. Visually confirm the required Category-rated marking of cables, outlets, cover plates, outlets/connectors, patch panels and other termination hardware.
  4. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords and labeling of components.
  5. Test twisted pair copper cabling for DC loop resistance, shorts, opens, intermittent faults and polarity between conductors.
    - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C. 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.
  6. UTP Performance Tests:

- a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-C and 270810 “Verification Testing of Structured Cabling.”
  - b. Test cables through a Consolidation Point from workstation to patch panel.
7. Final Verification Tests: Perform verification tests for twisted pair systems after the complete communications cabling and workstation outlet/connectors are installed.
  8. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report for the cables as well as a detailed report for each cable tested.
  9. Remove and replace cabling where test results indicate they do not comply with specified requirements. Retest cabling and provide documentation.
  10. End-to-end cabling shall be considered defective if it does not pass tests and inspections.
  11. Prepare and submit test and inspection reports.
- C. The Owner reserves the right to have a representative present during testing procedures. Verification testing of copper and fiber may be performed at or near Project completion by the Consultant for quality assurance.
- D. Upon verification testing, if the Consultant finds the test results do not match the Contractor’s results, the Consultant or a third party may at the Owner’s request retest the cabling and submit those results to the Owner and deduct the verification testing costs from the Contractor’s Contract amount.

**END OF SECTION 271513**