SECTION 271300 - COMMUNICATIONS BACKBONE CABLING (INTER & INTRA-BUILDING)

Latest Update 5-7-2017 See underlined text for Edits.

(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Also turn off all "Underlines".)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cable.
3. 62.5/125 Multi-mode, and Single-mode optical fiber cabling.
4. Cable connecting hardware, patch panels, and cross-connects.
5. Cabling identification products.

B. Related Sections:

1. Division 27 Section "Communications Equipment Room Fittings".

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. EMI: Electromagnetic interference.

D. IDC: Insulation displacement connector.

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. UTP: Unshielded twisted pair.

1.4 BACKBONE CABLING DESCRIPTION

A. Backbone cabling system shall provide interconnections between buildings and between communications equipment rooms within buildings. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 PERFORMANCE REQUIREMENTS

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

1.6 SUBMITTALS

A. Product Data: For each type of product specified in this section.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
2. Cabling administration drawings and printouts.
3. Wiring diagrams to show typical wiring schematics including the following:

    a. Cross-connects.
    b. Patch panels.
    c. Patch cords.
    d. Cable path between buildings.

4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
5. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

    a. Vertical and horizontal offsets and transitions.
    b. Clearances for access above and to side of cable trays.
    c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.

d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, field inspector, and RCDD.

D. Source quality-control reports.

E. Field quality-control reports.

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

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff. RCDD, testers, and installers shall be certified by the manufacturer of the product being installed.

1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of RCDD, who shall be present at all times when Work of this Section is performed at Project site.

3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. 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.

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. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-B-2004.

E. Grounding: Comply with ANSI-J-STD-607-A-2002, and all applicable sections of NFPA 70, NEC.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable 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.
2. Test each pair of UTP cable for open and short circuits.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces (including Maintenance holes) 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. Drywall, sanding, drilling, and painting of all surfaces shall be completed before installing cable in equipment rooms and maintenance holes.

1.10 COORDINATION

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

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Patch-Panel Units: [One (1)] <Insert number> of each type.
2. Connecting Blocks: [One (1)] <Insert number> of each type.
3. Solid state digital surge protection modules (Circa 4B1S-300)

1.12 WARRANTY/GUARANTEE

A. See Division 26 Specification Section "Basic Electrical Requirements' for warranty and guarantee requirements.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-B-2004.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.
4. Velcro straps

C. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:

a. Cable Management Solutions, Inc.
b. Cooper B-Line, Inc.
c. Cope - Tyco/Allied Tube & Conduit.
d. Wiremold Spec-Mate, Catalog #CA 04 09 18.

2. Cable Tray Material: Metal, suitable for indoors and protected against corrosion by hot dipped galvanizing, complying with ASTM A 123/A 123M, Grade 055, not less than 0.002165 inch thick steel, or Aluminum.

a. Ladder Cable Trays: Nominally eighteen (18) inches wide, and a rung spacing of nine (9) inches.

D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than two (2) inches wide, four (4) inches high and two and one half (2-1/2) inches deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, three quarter (3/4) inches by forty eight (48) inches by ninety six (96) inches. Comply with requirements in Division 06 Section "Rough Carpentry" for plywood backing panels.

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
   1. Berk-Tek; a Nexans company.
   2. CommScope, Inc.
   3. Superior Essex Inc.
   4. General Cable.
   5. Mohawk
   6. Siemen
   7. Ortronics

B. OSP Description: 100 ohm twisted pair OSP cable. 24 AWG, solid copper conductors, 100-pair UTP, formed into 25-pair binder groups covered with a thermoplastic jacket and overall metallic shield, Gel filled OSP rated,
   1. Comply with ICEA S-84-608-2007 Gel Filled OSP Copper standard
   2. Comply with ANSI/TIA/EIA-758-A-2004 Standard for OSP

C. Riser Description: 24 AWG, solid copper conductors, 100-ohm, twenty five (25) pair UTP, formed into twenty five (25) pair binder groups covered with a gray thermoplastic jacket (unless this is installed in any part outside the closet riser sleeves and into the open ceiling spaces/cable trays between tele/data rooms in which case a plenum jacket will be required). Category 5e or 6e.

   1. Comply with ICEA S-90-661 for mechanical electrical and flammability requirements.
   2. Comply with TIA/EIA-568-C
   3. 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.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
   1. Siemon Co. (Data - Cat 6).
   2. AllenTel (Voice - Cat 5e).

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. Voice Connecting Blocks: 66-style IDC for Category 5e. Provide blocks for the number of cables terminated on the block, plus 25 % spare. Integral with connector bodies, including plugs and jacks where indicated. As manufactured by AllenTel, Catalog #S66M1-50 with S89B standoff brackets and 183B1 blue backboards; or approved equivalent.

1. Number of Terminals per Field: [One (1)] <Insert number> for each conductor in assigned cables.

D. Data Patch Panel: Cat 6 modular forty eight (48) port panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables. As manufactured by The Siemon Company, Ortronics, Catalog #HD-48 high density.

1. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

F. Patch Cords: Factory-made, four (4) pair cables in [thirty six (36) inch] [forty eight (48) inch] <Insert length> lengths; terminated with eight (8) 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 color-coded boots for circuit identification.

2.5 OPTICAL FIBER CABLE

A. Description: Hybrid inter-building cable shall contain both multimode and Single mode fibers under a single plenum jacket containing an armored fiber as manufactured by OCC, Catalog #DX036-090D-24WLS-12SLX-900-CST.

1. Multimode : 62.5/125-micrometer, 24-fiber, nonconductive, tight buffer with aramid yarn strength member (i.e. Kevlar™), plenum jacket, indoor/outdoor rated (-20^0C to $+85^0$C), optical fiber cable. 900 µm buffer diameter, numerical aperture 0.29 +/- 0.02, minimum bandwidth of 200 MHz at 850 nm, 500 MHz at 1300 nm, maximum attenuation 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm.

2. Single Mode: 9/125-micrometer, 12-fiber, nonconductive, tight buffer with aramid yarn strength member (i.e. Kevlar™), plenum jacket, indoor/outdoor rated (-20^0C to $+85^0$C), optical fiber cable. 8-9 µm core diameter, and 125 µm cladding

diameter, maximum attenuation 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.

3. Comply with ICEA S-83-596 for indoor cable and S-87-640 for mechanical properties on outside plant cables.
4. Comply with TIA/EIA-568-B.3 for performance specifications.
5. Comply with TIA/EIA-492AAAA-A for detailed specifications.
6. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

   a. General Purpose, Nonconductive: Type OFN or OFNG [, or OFNR, OFNP]. <Engineer to Edit for Project Requirements>
   b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
   c. Riser Rated, Nonconductive: Type OFNR [or OFNP], complying with UL 1666. <Engineer to Edit for Project Requirements>

B. Jacket:

1. Jacket Color: Orange for 62.5/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed forty (40) inches.

C. Description: Hybrid intra-building cable shall contain both multimode and Single mode fibers under a single plenum jacket, as manufactured by OCC, Catalog # GX036-090D-24WLS-12SLX-900-CST.

1. Multimode : 62.5/125-micrometer, 24-fiber, nonconductive, tight buffer with aramid yarn strength member (i.e. Kevlar™), plenum jacket, indoor/outdoor rated (-20^{0}C to +65^{0}C), optical fiber cable. 900 µm buffer diameter, numerical aperture 0.29 +/- 0.02, minimum bandwidth of 200 MHz at 850 nm, 500 MHz at 1300 nm, maximum attenuation 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm.

2. Single Mode: 9/125-micrometer, 12-fiber, nonconductive, tight buffer with aramid yarn strength member (i.e. Kevlar™), plenum jacket, indoor/outdoor rated (-20^{0}C to +65^{0}C), optical fiber cable. 8-9 µm core diameter, and 125 µm cladding diameter, maximum attenuation 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.

2.6 OPTICAL FIBER CABLE HARDWARE

A. Cross-Connects and Patch Panels: Rack mounted, modular patch panels with hinged front doors, mounting guides and designated coupler panels housing multiple-numbered SC connectors; as manufactured by Siecor/Corning, catalog #CCH-CP12-59.

1. Number of Connectors per Field: [One] <Insert number> for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

B. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths.

1. Multimode: 62.5/125um, zipcord cable with an orange jacket. Shall support all bandwidths, dual-window and low-loss. As manufactured by Lucent/Avaya (or approved equal), catalog #9191-02K5141-XXX-M; where XXX equals maximum length.

2. Single mode: 8-9/125um, zipcord cable with an yellow jacket. Shall support all bandwidths, dual-window and low-loss. As manufactured by Lucent/Avaya (or approved equal), catalog #9191-02R5131-XXX-M; where XXX equals maximum length.

C. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
2. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.75 dB, as manufactured by Siemon, catalog #CT-SC-4-02.

2.7 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

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

2.8 IDENTIFICATION PRODUCTS

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

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

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

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

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

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. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. 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 within Enclosures: Bundle, lace, and train cables within enclosures. Connect 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 PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.

3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits [3 inches] <Insert dimension> above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with ninety six (96) inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
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 un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than six (6) inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. 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.
8. 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.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a ten (10) foot- long service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than one half (1/2) inch from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
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 [sixty (60) inches] <Insert dimension> 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 [six (6) feet] <Insert size> long not less than [twelve (12) inches] <Insert size> 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/EIA-569-A recommendations 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 five (5) inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of twelve (12) inches.
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of twenty four (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 two and one half (2-1/2) inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of six (6) inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of twelve (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 three (3) inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of six (6) inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of forty eight (48) inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of five (5) inches.

3.4 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."Comply with TIA/EIA-569-A, Annex A, "Firestopping."

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

3.5 GROUNDING

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

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

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least two (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.

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

3.6 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: [1] [2] [3] [4]. <Engineer to Edit for Project Requirements>
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. Comply with requirements in Division 27 Section "Communications Horizontal Cabling" for cable and asset management software.

D. Cable Schedule: Install in a 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 cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, [backbone pathways and cables,] [entrance pathways and cables,] <Insert pathway> terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

F. Cable and Wire Identification:

1. Label each cable within four (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 fifteen (15) feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

    a. Individually number the 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 with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

5. 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.

G. 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, for the following:

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

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Visually inspect UTP and optical fiber 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-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP 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.

4. Optical Fiber Cable Tests:

    a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. 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 1,300 nm in 1 direction according to TIA/EIA-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-B.1.

D. 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 TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

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

G. Prepare test and inspection reports.

END OF SECTION 271300