

## SECTION 271010 - COMMUNICATIONS BACKBONE CABLING

## PART 1 - GENERAL

## 1.1 REFERENCES

- A. All references should be latest versions. If newer versions exist use current version.
  - 1. ANSI/NFPA-70 National Electrical Code - 2014 Edition, including local and state amendments.
  - 2. IEEE 1100 (2006) Recommended Practice for Powering and Grounding Electronic Equipment
  - 3. TIA-568.0-D (2015) Generic Telecommunications Cabling for Customer Premises
  - 4. TIA-568.1-D (2015) Commercial Building Telecommunications Cabling Standard
  - 5. TIA-568-C.2 (2009) Balanced Twisted Pair Telecommunications Cabling and Components Standard
  - 6. TIA-568-C.3 (2008) Optical Fiber Cabling Components Standard
  - 7. TIA-569 (2015) Telecommunications Pathways and Spaces.
  - 8. GSCM (2015) Georgia State Construction Manual
  - 9. GTDM (2007) Georgia Telecommunications Design Manual
  - 10. FCC Part 68 Connection of Terminal Equipment to the Telephone Network (47 CFR 68)
  - 11. ADA Americans with Disabilities Act, Title III & IV
  - 12. CFR 29 (2009) Code of Federal Regulations

## 1.2 SUMMARY

- A. Section Includes:
  - 1. 50/125 micrometer, optical fiber cabling.
  - 2. Cable connecting hardware, patch panels, and cross-connects.
  - 3. Equipment enclosures.
  - 4. Cabling identification products.
- B. Related Sections:
  - 1. Division 27 Section "Communications Horizontal Cabling".

## 1.3 BACKBONE CABLING DESCRIPTION

- A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. 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.

#### 1.4 DEFINITIONS

- A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- B. EMI: Electromagnetic interference.
- C. LAN: Local area network.
- D. RCDD: Registered Communications Distribution Designer.
- E. Basket Tray: A type of cable tray made of a rigid structure for housing and protecting cables and conductors with a welded steel wire mesh. Basket tray is not recommended for use inside telecommunications rooms.
- F. Ladder Rack: A type of cable tray made of a rigid structure for housing and protecting cables and conductors with two side rails connected by individual transverse members.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568.1-D, when tested according to test procedures of this standard.

#### 1.6 ACTION SUBMITTALS

- A. Product Data: Provide 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. 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.
  - 4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

#### 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Provide for Installer, qualified layout technician and installation supervisor.

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration 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.
  - 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: 50 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-569.
  - E. Grounding: Comply with ANSI-J-STD-607-A.
- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Test cables upon receipt at project site. Test each pair of UTP cable for open and short circuits.

## PART 2 - PRODUCTS

### 2.1 OPTICAL FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Berk-Tek; a Nexans company.
  2. Corning Cable Systems.
  3. General Cable Technologies Corporation.
  4. SYSTIMAX Solutions; a CommScope Inc. brand.
- B. Description: Multimode, 50/125-micrometer, 12-fiber, nonconductive, tight buffer, optical fiber cable.
  1. Comply with ICEA S-83-596 for mechanical properties.
  2. Comply with TIA568.1-D for performance specifications.
  3. Comply with TIA492AAAA-B for detailed specifications.
  4. 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. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
  5. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
  6. Maximum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz at 1300 nm.
- C. Jacket:
  1. Jacket Color: Aqua for 50/125-micrometer cable. Indoor/outdoor will have a black or gray jacket.
  2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.

3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

## 2.2 OPTICAL FIBER CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Corning Cable Systems
  2. Panduit
  3. Ortronics
- B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
  1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
  2. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths.
- C. Cable Connecting Hardware:
  1. Comply with Optical Fiber Connector Interchangeability Standards (FOCIS) specifications of TIA-604-2, TIA-604-3-A, TIA-604-10 and TIA-604-12. Comply with TIA/EIA-568.1-D.
  2. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.75 dB.

## 2.3 EQUIPMENT ENCLOSURES

- A. **MDF Racks:**
  1. **Basis-of-Design Product: NetShelter AR203A 4-Post Square Holes by APC division of Schneider**
  2. **Width: 24 inches.**
  3. **Depth: 29 inches.**
  4. **Height: 42U.**
  5. **Feet: Leveling.**
  6. **Color: Black.**
  7. **Number of Units: Three.**
    - 1). **Rack 1: UPS plus Cisco PoE switch and multiple Cisco layer - 2 switches to accommodate data links in cabinet 2.**
    - 2). **Rack 2: UPS plus Cisco Catalyst 3850 gigabit layer-3 switch to accommodate the two pair of fiber to each IDF and the one single-mode fiber connection to the WAN.**
    - 3). **Rack 3: Ups plus servers. Servers to be furnished and installed by Owner.**
  8. **Vertical and horizontal cable management.**
    - 1). **Horizontal: Panduit model NCMH2**
    - 2). **Vertical: Panduit model WMPV45E**
- B. **IDF Racks**
  1. **Basis-of-Design Product: NetShelter 2-Post AR201 Manufactured by APC division of Schneider**
  2. **Width: 20.2 inches.**
  3. **Depth: 14.8 inches.**
  4. **Height: 83.5in**
  5. **Feet: Leveling.**

6. Color: Black.
  7. Number of Units: Maximum of 144 data drops per rack.
  8. Each unit to contain:
    - a. Vertical and horizontal cable management.
      - 1). Horizontal: Panduit model NCMH2
      - 2). Vertical: Panduit model WMPV45E
    - b. 48-port Patch panels.
- C. Ladder Rack
1. Ladder rack shall be installed as a pathway inside the MDF/IDF rooms.
- D. Uninterrupted Power Sources:
1. Installed in MDF and each IDF
  2. APC UPS sized for the equipment that will be needed in each room
- E. Furnished and installed by cabling contractor
- 1.

#### 2.4 IDENTIFICATION PRODUCTS

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

#### 2.5 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
  1. Factory test cables on reels according to TIA-568.1-D.
- B. Cable will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

- 2.6 Warranty: Contractor shall provide a 15 year manufacturer and performance warranty. The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

### PART 3 - EXECUTION

#### 3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

#### 3.2 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."

- a. Cabling between floors shall be in 3 inch minimum diameter steel conduit. Conduit fill shall not exceed 40 percent.
  - b. Installed by the electrical contractor
- 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.

### 3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
1. Comply with TIA-568.1-D.
  2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
  3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
  6. 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.
  7. 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.
  8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  9. In the communications equipment room, install a 10-foot- long service loop on each end of cable.
  10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. Optical Fiber Cable Installation:
1. Comply with TIA-568-1.B.3.
  2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
- D. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
  3. Coil cable 6 feet long not less than 12 inches in diameter below each feed point.
  4. Group connecting hardware for cables into separate logical fields.

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

### 3.4 FIRESTOPPING

- A. Contractor must fire stop the inside of the pipes that they use. The exterior of the pipes will be fire stopped by the electrical contractor.

### 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 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.
- E. The No. 4 AWG to the communication room will be provided by the electrical contractor.
- F. The cabling contractor must provide a ground bar in each communication room.

### 3.6 IDENTIFICATION

- A. 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.
- B. 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. Label each strand in each cabinet, rack, or panel.
    - a. Individually number to 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.
  - 4. 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 606-A, for the following:
    - a. Cables use flexible vinyl or polyester that flexes as cables are bent.

### 3.7 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Optical Fiber Cable Tests:
    - a. Test each strand with a level 3 cable analyzer. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration
- B. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report. An electronic copy shall be provided to the owner.
- C. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

END OF SECTION 271010