

## SECTION 27 13 23

### COMMS OPTICAL FIBER BACKBONE CABLING

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
1. 9/125 micrometer single-mode, indoor-outdoor optical fiber cable (OS2).
  2. Optical fiber cable pre-terminated connecting hardware.
  3. Cabling identification.
  4. Firestopping within pathways.

##### 1.2 OPTICAL FIBER BACKBONE CABLING DESCRIPTION

- A. Optical fiber backbone cabling system shall provide interconnections and intraconnections (intraconnections occur within a building, interconnections occur between buildings) between communications equipment rooms and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables with high-density fiber cassettes and patch cords.
- B. Optical fiber cabling shall be used for outside plant installations where IP device installation exceeds 90 meters of permanent link from the source communications equipment location. This optical fiber cabling system shall consist of optical fiber cabling, mechanical terminations, media converters, and patch cords.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of fiber cable type.
1. Submit manufacturers' cut sheets or catalog cut sheets for:
    - a. Each of the cables specified:
      - 1) Cut sheets shall include the following information at a minimum:
      - 2) Manufacturers name and logo
      - 3) Cable outside diameter
      - 4) Number of conductors/strands in each cable and binder group
      - 5) Gauge or strand thickness
      - 6) Minimum transmission performance rating
      - 7) Cable jacket material and rating
      - 8) Maximum pulling tension
      - 9) Jacket/Sheath color
      - 10) Individual conductor or strand insulation colors
      - 11) Minimum bend radius
      - 12) During installation and post installation.
      - 13) As well as any additional information required by individual sections of this Division.

- 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. Submit for review scaled layout drawings showing the routing of all backbone cabling, with pair/strand counts, cable types, type of pathway (cable tray, j-hooks, conduit, firestopping device) and proposed cable identifiers indicated for each cable. Ideally, this information would be indicated on scaled overall plans for each floor; however, it is permissible to combine with other Structured Cabling System shop drawings for individual areas.
  - 4. Wiring diagrams to show typical wiring schematics including the following:
    - a. Telecommunications rooms plans and elevations.
    - b. Telecommunications pathways.
    - c. Telecommunications grounding system
    - d. Pre-terminated Cassette LIU elevations details.
  
- C. Optical fiber cable testing plan.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of product.
- B. Qualification Data: For RCDD, installation supervisor, and field inspector

#### 1.5 CLOSEOUT SUBMITTALS

- A. Cable performance test data.
- B. Maintenance data.
- C. As-built Drawings:
  - 1. Submit scaled layout drawings showing the routing of all backbone cabling, with pair/strand counts, cable types, type of pathway (cable tray, j-hooks, conduit, firestopping device) and final cable identifiers indicated for each cable. Ideally, this information would be indicated on scaled overall plans for each floor; however, it is permissible to combine with other Structured Cabling System Record Drawings for individual areas.

#### 1.6 WARRANTIES

- A. Provide manufacturer warranties as indicated in drawings.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field-testing program development] by an RCDD.
  - 2. All Installers must have completed the Installation & Certifications Training program on the specified systems within one-year of the installation date.

## 2.1 PERFORMANCE REQUIREMENTS

- A. Single Mode Optical Fiber Cable Requirements
1. Optical fiber cabling system shall comply with transmission standards of TIA-568-C.1, when tested according to test procedures of this standard.
  2. All cable must be listed for use and meet or exceed NEC rules for installation.
  3. Grounding: Comply with TIA-607-B.
  4. Surface-Burning Characteristics: Tested according to ASTM E84 by a qualified testing agency.
  5. Cable jacket marking: Shall be legible and shall contain the following information:
  6. Manufacturer's name and trade mark
  7. Fiber size: As indicated on drawings
  8. Fiber Grade: OS2
  9. UL listing (Shall be suitable for the application)
  10. Sequential length markings
  11. Cable jacket color shall be:
    - a. YELLOW for single-mode fiber optic cables
  12. Dispersion shifted fiber optic construction
  13. Maximum Attenuation: 0.5 dB/km at 1310 nm; 0.5 dB/km at 1550 nm.
- B. Standards:
1. Comply with TIA-492CAAA for detailed specifications.
  2. Comply with TIA-568-C.3 for performance specifications.
  3. Comply with ICEA S-104-696 for mechanical properties.
- C. Jacket:
1. Jacket Color: Yellow
  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. Standards:
1. Comply with Optical Fiber Connector Intermateability Standard specifications of the TIA-604 series.
  2. Comply with TIA-568-C.3.
- B. Terminations: All Fiber terminations shall be pre-terminated cassettes, Duplex LC style, with Pigtailed.
- C. Pre-termination Cassettes will be IEC 61753-1 | TIA-568.3-D compliant with maximum insertion loss of 0.15 dB.
- D. Patch Cords: Factory-made, dual-fiber cables as indicated on drawings.
- E. Connector Type: Type LC complying with TIA-604-10-B.

- F. Cassette Assemblies:
  - 1. Modular telecommunications connector designed for termination of multiple fiber strands in one connection.
  - 2. Insertion loss not more than 0.15 dB.

## 2.3 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with TIA-607-B.

## 2.4 IDENTIFICATION PRODUCTS

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

## 2.5 QUALITY CONTROL

- A. Factory test pre-terminated optical fiber cable assemblies according to TIA-526-14-B and TIA-568-C.3.
- B. Cable will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

## 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 wire-mesh cable trays per drawings.
  - 1. Comply with requirements for pathways specified in Section 270528 "Pathways for Communications Systems."

### 3.3 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

- A. Comply with NECA 1, NECA 301, and NECA/BICSI/ TIA 568.
- B. General Requirements for Optical Fiber Cabling Installation:
  - 1. Comply with TIA-568-C.1 and TIA-568-C.3.
  - 2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
  - 3. In the communications equipment room, provide a 10-foot- (3-m-) long service loop on each end of cable.

- C. Group connecting hardware for cables into separate logical fields.

### 3.4 CABLE INSTALLATION

#### A. General:

1. Place all backbone cabling in accordance with these specifications, on the Drawings and as indicated on any cable schedules.
2. Install each cable as an uninterrupted conductor section between the designated termination points, unless otherwise directed by the cable installation specifications.
  - a. There shall be no splices or mechanical couplers installed between the cable points of origin and termination except as shown on the Drawings and/or specified herein.
  - b. There shall be no Bridged taps (multiple appearances of the same cable pairs at several distribution points) installed.
3. Unless otherwise noted, all cables shall be routed through the building cable tray/conduit/cable ladder system. Refer to the Telecommunications floor plan and detail drawings for the layout of the conduits, cable tray and cable ladder.
  - a. Backbone cables in which no portion of the cable jacket will be exposed when routed in a plenum or other air handling space, shall be riser rated (CMR, MPR, OFNR, or OFCR). Cables suitable for use in air plenums or other air handling spaces, and which meet the electrical/transmission specifications, are also acceptable for riser applications.
  - b. Backbone cables in which any portion of the cable jacket will be exposed when routed in an air plenum or other air handling space shall be plenum (CMP, MPP, OFNP, or OFCP) rated.
  - c. Backbone cables installed in “wet” locations as defined by the NEC or in these construction documents shall be suitable for installation in such environments and follow the installation requirements for outside plant cables as specified herein.
  - d. Backbone cables routed vertically within a Telecommunications Room shall be supported by velcro-attachment every 18” to vertically-mounted ladder rack or D- rings.
4. Cables shall remain unattached to pathways or other cables and shall simply lay at rest on the supports provided by its pathway (including cable trays, wire basket, j-hooks, conduit, etc.). Wire ties, velcro straps, electrical tape or any other method shall not be used to attach cables to cable supports or to create cable bundles.
  - a. Except when supported by ladder racking or D-rings within each Telecommunications room, UON.
5. All backbone cables running on ladder racking within all Telecommunications rooms throughout the building shall be neatly placed and secured to the horizontal and vertical ladder racking with cable lacing twine or nylon wire ties at intervals not to exceed every third rung plus all locations where the cable changes direction.
6. At the same time backbone cables are pulled into a conduit also install a pull cord to facilitate future cable pulls along those. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull cord.

7. Do not install 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. Where distance allows all backbone cables shall be provided with slack/service loops at each end of the cable. Each slack/service loop shall be:
  - a. A minimum of (10) feet in length, UNO
  - b. Configured in a loosely formed figure eight configuration (ie. not coiled)
9. Prior to using any cable pulling lubricants provide the Design Consultant with written documentation from the cable manufacturer supporting the cable manufacturers' acceptance of its use in compliance with all required warranties as part of these contract documents. The use of non-water based lubricants shall be provided when pulling PVC jacketed and all cables not suitable for contact with water.
10. Comply with all referenced standards and guidelines
11. Cables shall be masked, covered, or otherwise protected from being painted or coming in contact with any other substance that may degrade the performance or physical characteristics of the cable jacket or insulation over time.
12. Where backbone cabling has a shield or metallic member, the shield or metallic member shall be bonded to the TMGB/TGB in accordance with ANSI/TIA-607 and BICSI/NECA 607-2011.

B. Outside plant cable installation: for cables placed in "wet locations". These locations include but are not limited to; pathways that extend outside the envelope of the building such as aerial entrances, direct buried cables, underground conduits, conduits embedded in, or routed below a ground floor slab, etc.

1. Unlisted cables shall transition to an indoor rated cable within 50' of the entrance point as required the NEC.
  - a. This 50' allowed by code is only to allow termination as close as practicable to the entrance point. Terminate all outdoor only (unlisted) cables at the closest point of entrance and transition to an indoor rated cable to extend to additional Telecommunications rooms (spaces)
  - b. No portion of outdoor only (unlisted) cables may be installed with the cable jacket exposed in any plenum or other air handling spaces nor shall they be allowed to transition between different levels of the building.
2. Where specifically allowed by these construction documents cable jackets rated for dual use by a NRTL, such as an indoor/outdoor rated cable may be used.
  - a. These cables may be installed in locations within the building in which the cable jacket is appropriately rated to meet all applicable building codes.
3. Rigid metallic conduit shall be used to route outdoor (unlisted) cabling to within 50' of the transition point to indoor rated cabling in accordance with the NEC.
4. Cables which extend beyond the envelope/footprint of the building shall be installed with entrance protectors in accordance with Division 27 Section "Communications Equipment Room Fittings".

### 3.5 FIRESTOPPING

- A. Comply with TIA-569-D, Annex A, "Firestopping."
- B. Comply with BICSI ITSIMM, "Firestopping" Chapter.

### 3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."
- B. Cable and Wire Identification:
  - 1. Label each cable within 4 inches of each termination, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
  - 3. Label each unit and field within distribution racks and frames.
  - 4. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- C. 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-B.

### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. Tests and Inspections:
  - 1. Visually inspect 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-568-C.1.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment, and patch cords, and labeling of all components.
  - 3. Optical Fiber Cable Tests:
    - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.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 1300 nm in one direction according to TIA-526-14-B, Method B, One Reference Jumper.
      - 2) Attenuation test results for backbone links shall be less than 1.0 dB. Attenuation test results shall be less than those calculated according to equation in TIA-568-C.1.
- 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 TDMM, 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 it does not comply with specified requirements.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

### 3.8 ACCEPTANCE

- A. The Owner and Design Consultant reserves the right to observe the conduct of any or all portions of the testing process.
- B. All cables that fail testing are to be corrected prior to substantial completion and acceptance by owner. Replace entire cable if bad pair or strand is found.

END OF SECTION 27 13 23