

SECTION 27 13 10
COMMUNICATIONS BACKBONE ISP CABLING
Construction Specification

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Backbone ISP (indoor) twisted pair cabling and fiber optic cabling.
- B. Related Sections
 - 1. Comply with the Related Sections paragraph of **Section 27 00 00** Telecommunications Basic Requirements.
 - 2. **27 05 28 Telecommunications Building Pathways.**
 - 3. **27 08 00 Telecommunications Testing.**

1.2 REFERENCES

- A. Comply with **Section 27 00 00** References requirements.

1.3 DEFINITIONS

- A. Refer to **Section 27 00 00** for Definitions.
- B. In addition, the following list of terms as used in this specification shall be defined as follows:
 - 1. "CMP": Communications Media Plenum [NEC plenum rating]
 - 2. "CMR": Communications Media Riser [NEC riser/non-plenum rating]
 - 3. "ISP": Inside Plant [cabling]
 - 4. "MM": Multimode [fiber type]
 - 5. "PIC": Plastic Insulated Conductor
 - 6. "OFNP": Optical Fiber Non-conductive Plenum, plenum rating
 - 7. "OFNR": Optical Fiber Non-conductive Riser, non-plenum riser rating
 - 8. "OFN": Optical Fiber Non-conductive, general purpose indoor rating
 - 9. "PE": Polyethylene
 - 10. "PVC": Polyvinyl Chloride
 - 11. "SM": Singlemode [fiber type]

1.4 SYSTEM DESCRIPTION

- A. Refer to **Section 27 00 00** for description of the project and building.
- B. Work Provided Under Other Sections
 - 1. Telecommunications Pathways (Cable Basket, Conduits, Riser Sleeves, etc.). Refer to the Drawings for size/capacity and route information.
 - 2. Buildout of the telecommunications rooms (e.g., backboards, overhead and vertical cable runway, etc.). Refer to the Drawings for buildout information.
- C. Base Bid Work

1. Provide engineering, labor, materials, apparatus, tools, equipment, and transportation required to make a complete working telecommunications backbone twisted pair and fiber optic cabling system installation described in these specifications.
2. Consider backbone cabling shown on the Drawings as base bid work, unless otherwise noted. This includes terminations at both ends, unless otherwise noted.
3. In general, the base bid work includes:
 - a. Preconstruction Submittals.
 - b. Backbone ISP (riser) twisted pair (copper) cables and terminations.
 - c. Backbone ISP fiber optic cables and terminations.
 - d. Cable management.
 - e. Crossconnects.
 - f. Cable identification tags and system labeling.
 - g. Record Documents.
 - h. Warranty.

1.5 SUBMITTALS

- A. Comply with Submittal procedural, quantity, and format requirements of **Section 27 00 00**.
- B. Preconstruction Submittal Requirements:
 1. Product Data Submittal, indicating conformance with NEC, UL, TIA/EIA listings, certifications, and specifications.
 2. Labeling Submittal, consisting of proposed labeling scheme for backbone cables and backbone terminations.
 3. Schedule Submittal, consisting of proposed schedule of work. This schedule may be combined with the schedule developed for 27 XX XX series Sections.
 4. Shop Drawings Submittal, consisting of proposed changes to cable routing, or termination locations/configurations.
- C. Submittal Requirements at Closeout:
 1. As-Built Drawings.
 2. Crossconnection records/cut sheets.
 3. O & M Manuals.

1.6 QUALITY ASSURANCE

- A. Comply with Quality Assurance requirements of **Section 27 00 00**
- B. Contractor Qualifications:

In addition to the Contractor Qualifications requirements of **Section 27 00 00**, the Contractor shall be manufacturer certified to install the proposed and submitted cabling system and to provide an extended warranty. Provide satisfactory evidence of certification in the form of a current letter or certificate from the manufacturer as part of the bid submission.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Comply with Delivery, Storage and Handling requirements of **Section 27 00 00**.

1.8 WARRANTY

- A. Telecommunications cabling system, as specified in this section, shall carry a 15 year (minimum) extended system warranty. This extended warranty shall cover parts and labor for the duration of the extended warranty. This extended warranty shall also cover electrical performance of the twisted pair cabling system to the specific category per ANSI/TIA/EIA-568-B performance criteria for backbone cabling.

PART 2 PRODUCTS

2.1 SHIELDED TWISTED PAIR CABLES – NON-PLENUM

A. Application:

1. Cable shall be suitable for indoor installation, between floors in vertical riser system, under access flooring, and through overhead ceiling space (in cable tray, conduit, & hangers).
2. Each and every cable run shall be a continuous single cable, homogenous in nature. Splices are not permitted anywhere.
3. Cable shall be twisted pair PIC type cable, air core, with an "ALVYN" sheath. Cable shall be compatible with Bell System type "ARMM".

B. Conductors:

1. Conductors shall be 24 AWG annealed solid copper.
2. Conductors shall be fully insulated. Insulation shall consist of an inner layer of expanded polyolefin, covered with an outer layer (skin) of solid PVC.
3. Conductors shall be twisted into pairs. Twisted pairs are stranded into 25-pair bundles and into units (and super units, if required by pair count).
4. Color Coding: Twisted pairs and units (supper units, if necessary) shall be individually color coded to industry standards (ANSI/ICEA Publication S-80-576, and EIA-230).

C. Core & Sheath:

1. Cable core (twisted pairs) shall have a tape applied longitudinally (wrapped around its entirety). Tape Material: non-hydroscopic polypropylene film, or equivalent.
2. Sheath Type: "ALVYN". Sheath shall consist of an inner shield and an outer jacket.
 - a. Shield: Aluminum, 0.008", corrugated tape applied longitudinally, with an overlap.
 - b. Jacket: Flame-retardant PVC, adhesively bonded to shield.
3. Cable shall be NEC rated as CMR, and UL listed as such.

D. Performance:

Electrical performance of the twisted pairs and overall cable shall comply with TIA/EIA-568-B Part 2 requirements for Category 3 UTP cabling.

E. Manufacturers:

1. General Cable Air Core Cables "Foam Skin ALVYN Riser Cable" series cables.
2. SYSTIMAX ARMM series cables.

2.2 FIBER OPTIC CABLES – NON-PLENUM

A. Application:

1. Cable shall be suitable for indoor installation, between floors in vertical riser system, under access flooring, and through overhead ceiling space (in cable tray, conduit, & hangers).
2. Cable shall exhibit stable performance in a building environment. The optical transmission performance of the fiber shall not be significantly affected by environmental fluctuations, installation, or aging.
3. Materials used in the cable shall not emit hydrogen in quantities that will increase attenuation.

B. 50/125 μm Multimode fiber strands shall meet or exceed the following geometry criteria:

1. Core diameter = 50 μm , $\pm 3.0 \mu\text{m}$.
2. Cladding diameter = 125 μm , $\pm 1.0 \mu\text{m}$.
3. Core/Cladding Concentricity = $\leq 3 \mu\text{m}$.
4. Minimum Tensile Strength = 100,000 psi.

C. 50/125 μm Multimode fiber strands shall meet or exceed the following performance criteria:

1. Attenuation = 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm wavelengths, maximum.
2. Overfilled Bandwidth = 500 MHz•km at 850 nm and 500 MHz•km at 1300 nm wavelengths, minimum.
3. Laser Bandwidth = 2,000 MHz•km at 850 nm and 500 MHz•km at 1300 nm wavelengths, minimum.

D. Singlemode fiber strands shall meet or exceed the following geometry criteria:

1. Core diameter = 8.3 μm .
2. Mode field diameter = 8.8 μm , $\pm 0.5 \mu\text{m}$.
3. Cladding diameter = 125 μm , $\pm 1.0 \mu\text{m}$.
4. Core/Cladding Concentricity = $\leq 0.8 \mu\text{m}$.
5. Minimum Tensile Strength = 100,000 psi.

E. Singlemode fiber strands shall meet or exceed the following performance criteria:

1. Attenuation = 0.4 dB/km at 1310 nm and 0.3 dB/km at 1550 nm wavelengths, maximum.
2. Cutoff wavelength = 1260 nm.
3. Dispersion = 3.5 ps/nm•km at 1285-1330 nm.

F. Buffering:

1. Each fiber shall be completely covered with a “primary coating” (acrylate material). This shall constitute the “fiber strand”.
2. Each fiber strand shall be fully covered with a flame retardant thermoplastic material (material = PVC, or equivalent thermoplastic). This shall constitute the “buffered strand” (tight buffer type), and shall have a diameter of 0.9 mm.

3. **Buffered Strands:** Buffered strands shall be individually color coded to meet the requirements of ANSI/TIA/EIA-598-A-1995. (Also, ref. ANSI/ICEA S-87-640-1992).

G. **Cable Sheath:**

1. **Strength Element:** The cable shall have an internal strength element such as aramid yarn (e.g., Kevlar).
2. **Tensile Strength:** The cable shall have a 150-lb, minimum, rated load.
3. **Outer Jacket:** The cable shall have a seamless outer jacket (material = PVC, or equivalent) applied to and completely covering the internal components (fiber strands, strength element, other).
4. **Flame Rating:** The cable shall be NEC (Article 770) rated as OFNR, and UL listed as such. H. **Manufacturer:** Corning "MIC" series cables, or equal.

2.3 TERMINATION EQUIPMENT

A. **Twisted Pair Cabling Patch Panel**

1. Refer to Section 27 15 13 for product requirements.

B. **Fiber Optic Patch Panels**

1. Passive fiber optic physical equipment and apparatus used in interconnecting and cross-connecting fiber optic cables shall possess a minimum fire resistant rating of UL94V-1.
2. The equipment, apparatus, and material for fiber optic equipment an apparatus shall conform to existing OSHA Health and Safety Laws. The equipment and apparatus shall have provision for the application of safety labels such as laser identification or warning labels as required by system considerations.
3. Fiber optic patch panel shall be a fully assembled rack-mounted fiber optic enclosed housing for protecting, storing and organizing the termination of the fiber cable and all fiber strands at each end of the cable. The patch panel shall include an integrated patching facility.
4. "Fully assembled" shall include all required installation & mounting components, and include accessories such as connector panels, coupling adapters, etc. for a complete installation.
5. The fiber patch panel must:
 - a. Provide means of strain relief and support of the specified cables.
 - b. Contain slack storage facilities for fiber slack.
 - c. Provide patch cord management.
6. **Manufacturer:** Corning
 - a. #CCH-01U; 1U fiber shelf, accepts 4 adapter plates
 - b. #CCH-CP24-A9; Connector Housing Panel, LC adapters, Single Mode
 - c. #CCH-CP24-E4 Connector Housing Panel, LC adapters, Multi Mode

A. **Multimode Fiber Optic Connectors – LC Type**

1. **Materials:**
 - a. Ferrule: ceramic (zirconia or alumina) with pre-radiused finish/face.
 - b. Connector housing: plastic.

2. Connector shall have an integral strain relief feature, including a bend limiting rear boot.
3. Connectors shall be aqua.
4. Connectors shall be installable via either epoxy or anaerobic method.
5. Manufacturer: Corning Cable Systems, or equal.
 - a. #95-051-98-SP-X; LC connector, multimode OM4

B. Singlemode Fiber Optic Connectors – LC Type

1. **Materials:**
 - a. Ferrule: ceramic (zirconia or alumina) with pre-radiused finish/face.
 - b. Connector housing: plastic.
2. Connector shall have an integral strain relief feature, including a bend limiting rear boot.
3. Connectors shall be blue.
4. Connectors shall be installable via either epoxy or anaerobic method.
5. Manufacturer: Corning Cable Systems, or equal.
 - a. # 95-200-99; LC connector, Single Mode.

2.5 LABELS

A. Labels for Backbone ISP Cables

1. General: Labels shall be machine printable with a laser printer, ink jet printer, thermal transfer printer, or hand-held printer. Labels shall be adhesive backed and have a self-laminating feature.
2. Printable Area: 2" x 0.5", minimum.
3. Color: White.
4. Manufacturer: Panduit, or equal.
 - a. #LJSL7-Y3-1; laser/ink jet labels for cable diameters 0.16"-0.32", white
 - b. #LJSL8-Y3-1; laser/ink jet labels for cable diameters 0.31"-0.69", white
 - c. #LJSL19-Y3-1; laser/ink jet labels for cable diameters 0.31"-1.42", white

PART 3 EXECUTION

3.1 GENERAL

- A. Comply General Execution requirements of Section 27 00 00.

3.2 EXAMINATION

- A. Pathways: Prior to installation, verify pathways (cable trays, conduits, etc.) exist and are 'ready' to accept backbone cables.
- B. Telecommunications Rooms: Prior to installation, verify equipment rooms are 'ready' to accept the backbone cables and terminations.

3.3 PREPARATION

- A. The Contractor is solely responsible to verify that twisted pair cables and fiber optic cables are fully operational – both cable sheath and conductors (twisted pair and optical) – prior to installation.
- B. Documentation of pre-installation testing is not a close out requirement, and shall be the responsibility of the Contractor.

3.4 INSTALLATION – TWISTED PAIR CABLING

A. Backbone Cables

1. General

- a. Cable runs shall have continuous sheath continuity, homogenous in nature. Splices are not permitted anywhere.

2. Placement

- a. Maintain a minimum bend radius of 6 times the cable diameter during and after installation.
- b. Maintain pulling tension within manufacturer's limits.
- c. Protect cable during installation. Replace cable if damaged during installation.
- d. Place cables with no kinks, twists, or impact damage to the sheath.
- e. Place a pull rope along with cables where run in conduit and spare capacity still exists in the conduit. Tie off ends of the pull rope.

3. Routing

- a. Maximum cable length from the termination within the Entrance Facility to the termination in Telecommunications Room shall be 500 meters.
- b. Install cables within designated pathways.
- c. When routing horizontally within telecommunications rooms, utilize the overhead cable support. When routing vertically within telecommunications rooms, utilize the wall mounted vertical cable runway and support every 24 inches on center using cable ties.
- d. Place and suspend cables in a manner to protect them from physical interference or damage.
- e. Route cables a minimum of 6" away from power sources to reduce interference from EMI.
- f. Provide a 10 feet (minimum) sheathed cable slack loop at each end of the run. Place the slack in the overhead cable support.

4. Termination

- a. Properly strain relieve cables at termination points per manufacturer's instructions.
- b. Perform terminations in accordance with manufacturer's instructions and TIA/EIA-568-B standard installation practices.
- c. Perform post-installation testing as described in the Telecommunication Testing specification.

B. Termination Apparatus

1. Provide accessories required for a complete installation.
2. Terminate twisted pair backbone cables to modular patch panels, terminating one pair to positions 4 and 5.

3. Install the patch panels as shown on the drawing. If not is shown, install patch panels at the top of the rack.

3.5 INSTALLATION – FIBER OPTIC CABLING

A. Backbone Cable

1. General
 - a. Cable runs shall have continuous sheath continuity, homogenous in nature. Splices are not permitted anywhere.
 - b. Protect fibers during installation & termination. Fibers damaged beyond repair during installation or termination shall result in replacement of the affected cable at no additional cost.
 - c. Place cables within innerduct the entire route.
2. Placement
 - a. Bend Radius: Maintain a minimum bend radius of 20 times the cable diameter during installation, and a minimum bend radius of 10 times the cable diameter after installation.
 - b. Pulling: Maintain pulling tension within manufacturer's limits.
 - c. Protection: Place and suspend cables in a manner to protect them from physical interference or damage. Replace cable if damaged during installation.
 - d. Place cables with no kinks, twists, or impact damage to the sheath.
 - e. Do not use cable-pulling compounds for indoor installations.
 - f. Provide 30 feet (minimum) sheathed cable slack loop at each end of the run within the Telecommunications Rooms; place the slack in the overhead cable support.
 - g. Place a pull rope along with cables where run in conduit and spare capacity still exists in the conduit. Tie off ends of the pull rope.
3. Routing
 - a. Maximum cable length from the termination within the Entrance Facility to the termination in Telecommunications Room shall be 500 meters.
 - b. Route cables in innerduct between points of termination throughout entire length (except at the fiber take up reel).
 - c. Install cables within designated pathways.
 - d. Neatly dress and organize cables using designated cable routing facilities, and fasten to support devices via tie wraps or Velcro-type straps.
 - e. When routing horizontally within telecom rooms, utilize the overhead cable support. When routing vertically within telecommunications rooms, utilize the wall mounted vertical cable runway and properly fasten. "Properly fasten" shall consist of cable ties in a 'crossed' configuration per cable or cable bundle (up to three cables or innerducts) every 24 inches on center.
 - f. Place and suspend cables in a manner to protect them from physical interference or damage.
 - g. Provide a 10 feet (minimum) sheathed cable slack loop at each end of the run. Store slack in slack storage ring mounted on the wall.
4. Termination
 - a. Properly strain relieve cables at termination points (at/within the fiber optic termination panels) per manufacturer's instructions.

- b. Terminate/connectorize fiber strands at both ends using the specified fiber optic connectors appropriate for the mode type of the fiber. Perform terminations in accordance with manufacturer's instructions.
 - c. Provide required accessories and consumables for the complete termination of fiber strands.
 - d. Provide 3 feet of tight buffered fiber (unsheathed) slack at each end of the run within the patch panel/termination enclosure. Properly store fiber slack in rear of patch panel into the 'routing rings', per manufacturer's instructions.
- B. Fiber Optic Cable Termination Panel
1. Provide the termination panel in designated equipment rack; locate per drawings (if not shown, locate at the top).
 2. Provide accessories required for proper installation of each termination panel, including connector panels and adapters.

3.6 LABELING

- A. General Requirements
1. Labeling and identifier assignment shall conform to the TIA/EIA-606 Administration Standard and as approved by Owner's Representative before installation. Label colors shall conform to the TIA/EIA-606 Administration Standard.
 2. Provide permanent and machine-generated labels; hand written labels will not be accepted.
- B. Label Formats
1. Cable Labels
 - a. Text Attributes: Black, 1/8" high, minimum, or #12 font size.
 - b. Provide labels on both ends of cables. Install labels no more than 4" from the edge of the cable jacket. Fully wrap label around the cable jacket. Install labels such that they are visible by a technician from a normal stance.
 2. Termination Apparatus Labels
 - a. Use labels included in the product packaging. Request approval by the Engineer for substitutions.
 - b. Provide white label respective field type, per TIA/EIA-606.
 - c. Text Attributes: Black, 3/32" high, minimum, or #10 font size.
- C. Identifier Assignment
1. General: Separate label fields of the identifier with a hyphen.
 2. Backbone ISP Twisted Pair Cables
 - a. First field shall identify the originating termination room identifier as shown on the plans; for example, "B01-TDA".
 - b. Second field shall identify the ending termination room identifier as shown on the plans; for example, "B01-TDB".
 - c. Third field of the identifier shall be the campus pair count range; for example, "0401-0600"
 - d. Example: "B01-TDA-B01-TDB-0401-0600"
 3. Termination Positions at the Patch Panels
 - a. Each port shall be labeled with the pair count of the campus infrastructure.

4. Backbone ISP Fiber Optic Cables
 - a. First field shall identify the originating termination room identifier as shown on the plans; for example, "B01-TDA".
 - b. Second field shall identify the ending termination room identifier as shown on the plans; for example, "B01-TDB".
 - c. Third field shall identify the type and number of strands; for example, "Mxxx" where "M" stands for multimode or "S" for singlemode and xxx stands for the ending fiber strand sequential count.
 - d. Example: "B01-TDA– B01-TDB–M025-M036"
5. Termination Positions at the Termination Panels
 - a. First field of the identifier shall be the destination room; for example, "TO B01-TDB".
 - b. Second field of the identifier shall be the strand count range; for example, "M025-M036"
 - c. Identifier Example: "TO B01-TDB M025-M048".

3.7 FINAL INSPECTION

- A. Inspect installed products and work in conjunction with the District or District's Representative. Develop a punchlist for items needing correction.
- B. Issue punchlist to Engineer for review prior to performing punchlist with the Engineer.
- C. Repair defects prior to system acceptance.
- D. Inspect installed products and work in conjunction with the Engineer for sign off.

END OF SECTION