

SECTION 27 10 00

COMMUNICATIONS GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes general cabling requirements for the Communications Cabling System.

1.02 RELATED SECTIONS

- A. Division 27 Specification Section *Common Work - Sleeves, Penetrations and Firestopping*. Provide sleeves, penetrations, and firestopping as required to support the work of this Section.
- B. Division 27 Specification Section *Common Work – Hangers and Supports*. Provide hangers and supports as required to support the work of this Section.
- C. Division 28 Specification Section *Security – General Requirements*. Review the specifications to determine if there is any cabling scope of work related to the cabling described in the specification below.

1.03 SUBMITTALS

- A. Provide the following per the criteria set forth in Submittals in Division 27 Specification Section *Basic Communications Requirements*:
1. Product Data
 2. Shop Drawings:
 - a. Cable Routing: Provide a cable routing plan if communications cable routing has not been shown on the Drawings, or if the Contractor is proposing a deviation from that shown.
 - 1) If a routing plan is not required, submit written documentation stating that the routing will be provided as shown on the Drawings, that the Contractor has reviewed the routing shown on the Drawings with the other applicable trades and that all have agreed that it does not create conflicts between the trades, and the routing meets applicable codes, regulations and standards.
 - 2) If a routing plan is required, submit complete floor plans or detail drawings showing the proposed routing, raceway sizes and locations, and cabling in a manner equal to that of the Drawings. Ensure that any routing changes are coordinated with comparable changes to the raceway routing. Specifically note each location where the proposed routing is different from the Drawings. Where deviations are proposed, submit written documentation detailing the reason for each. Each deviation must be approved in writing by the Engineer prior to proceeding with installation.
 - b. Termination Block Wall Field Terminations and Elevations: All wall field locations will be coordinated with DoTs Project Manager.
 - 1) Where changes to the wall field termination diagrams and elevation drawings are proposed, submit wall field termination diagrams and elevation drawings in a manner equal to that of the Drawings. Specifically note areas where deviations are proposed, and submit written documentation detailing the reason for each. Each deviation must be approved in writing by the Engineer prior to proceeding with installation.

PART 2 - MATERIALS

2.01 GENERAL

- A. Manufacturer: Communications cabling system components shall be sourced by a single Manufacturer. Products shall not be intermixed between different manufacturers unless the Manufacturer of the chosen communications cabling system has listed (in writing) another manufacturer's component as an "approved alternative product" (or equivalent wording) and will warrant the "approved alternative product" as part of the Manufacturer's extended Warranty, or if the product has been specifically called out as a special

- requirement in the Specifications. Additionally, for a given Manufacturer, all products shall be part of a single product line and the product line shall be specifically engineered “end-to-end” (e.g. the system and all of its components shall have been engineered to function together as a single, continuous transmission path). The structured cabling system shall be:
1. Panduit/General Cable “PanGen” Solution
- B. Plenum Rating:
1. Cable shall be plenum (CMP, OFNP) rated unless otherwise indicated. Cable shall bear plenum markings.
- C. Color: All cables of the same type (i.e. Copper Backbone, Copper Horizontal, Fiber Horizontal, Coaxial CATV Trunk, 62.5µm MM, 50µm MM, SM, etc.) shall be of the same color. Multiple colors of the same cable type are not acceptable.
- D. Part Numbers: Refer to the Equipment Schedule(s) in the Communications Construction Specifications for specific manufacturers and part numbers.

2.02 PERFORMANCE

- A. Protocols/Services:
1. At a minimum, the communications cabling system shall support data network protocols/services at rates up to 1 Gbps or 10 Gbps for transmission on copper and 10 Gbps for transmission on fiber. It shall support Ethernet, ATM and other network protocols. The communications cabling system shall additionally support RS-232 and other dedicated point-to-point protocols.
 2. The communications cabling system shall support PBX telephone services. It shall support analog, digital, and ISDN services, and shall be compatible with direct trunk lines (POTS).
- B. Category Rating: Copper components (cable, connectors, etc.) shall meet or exceed the TIA/EIA transmission requirements for the Category for which they are rated.
1. Horizontal Cable shall be rated Category 6 (Enhanced)
 2. Backbone Cable shall be rated Category 5E.
- C. Performance Rating: All components (copper and fiber) shall meet or exceed TIA/EIA transmission requirements for their component type.
- D. Fiber Performance:
1. Backbone Cable:
 - a. 50/125 µm Laser Optimized Multimode (<OM3 or OM4>): Provide cable with a maximum attenuation of 3.0 dB/km at 850 nm and 1.0 dB/km at 1300 nm. The minimum cable bandwidth shall be 2000 MHz-km at 850 nm and 500 MHz-km at 1300 nm. Color shall be aqua.
 - b. Singlemode (OS1): Provide cable with a maximum attenuation of 1.0 dB/km @ 1310 nm and 1.0 dB/km at 1550 nm. Color shall be yellow.

PART 3 - EXECUTION

3.01 GENERAL

- A. Work shall comply with the Governing Requirements as defined in Division 27 Specification Section *Basic Communications Requirements*. Governing Requirements of particular relevance to this Section include, but are not limited to:
1. TIA/EIA - 568: Commercial Building Telecommunications Cabling Standard
 2. TIA/EIA 569: Commercial Building Standard for Telecommunication Pathways and Spaces
 3. ANSI/EIA 310-D: Cabinets, Racks, Panels and Associated Equipment

4. TIA/EIA 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
5. ANSI/NECA/BICSI 607: Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
6. ANSI J-STD-607: Commercial Building Grounding and Bonding Requirements for Telecommunications
7. TIA/EIA - 758: Customer-owned Outside Plant Telecommunications Cabling Standard
8. ANSI/TIA 942: Telecommunications Infrastructure Standard for Data Centers
9. IEEE 802.3 (series): Local Area Network Ethernet Standards
10. BICSI: Customer Owned Outside Plant Design Manual
11. BICSI: Information Transport Systems Installation Manual
12. BICSI: Telecommunications Distribution Methods Manual
13. BICSI: Telecommunications Cabling Installation Manual
14. BICSI: Wireless Design Manual
15. National Electric Code (NFPA 70)

3.02 GENERAL INSTALLATION

- A. Maintain separation from other conductors (power, fire alarm, etc.) per NEC requirements and TIA/EIA standards.
- B. The bending radius and pull strength requirements of all cable as detailed in the Governing Requirements and Manufacturers recommendations shall be strictly observed during handling and installation.
- C. Pull cables simultaneously where more than one cable is being installed in the same raceway.
- D. Use pulling compound or lubricant where necessary. Use compounds that will not damage conductor or insulation.
- E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cable or raceway.
- F. Cable jackets shall not be twisted during installation. Cables showing evidence of twisting shall be replaced at no additional cost to the Owner, regardless of the outcome of cable testing.
- G. Cable shall be installed in a continuous (non-spliced) manner.
- H. Provide strain relief to ensure durable connections at all cable termination locations.
- I. Pathway/Raceway Validation: The Contractor is responsible for validating pathway/raceway sizing against the amount of cable it is to support for compliance with NEC and TIA/EIA 569 cable capacity standards. The Contractor shall notify the Engineer of all raceways the Contractor determines to be insufficient in size and shall await the Engineer's direction prior to procurement and installation.
- J. Copper Cables:
 1. Backbone Cable: All pairs shall be terminated. Unless otherwise noted on the Drawings, the installation of un-terminated cable pairs is not acceptable. For shielded cable, bond both ends of the metallic shield (or metallic strength member) to the nearest TGB.
 2. Horizontal Cable: Thoroughly clean and remove foreign material from outlet boxes prior to installation of cable.
- K. Fiber Cables:
 1. All fiber strands shall be terminated. Unless otherwise noted on the Drawings, the installation of unterminated (i.e. "dark fiber") is not acceptable.

2. Fiber splices shall be fusion. Mechanical splices are not acceptable. Each fusion splice shall be protected in a splice tray or similar protective device that is designed to mount within the enclosure. Bare/stripped optical fiber strands shall be protected with a buffer tube, heat shrink or silicon adhesive to prevent exposure to moisture.
- L. Provide Sleeves and Penetrations as necessary where cable must pass through building barriers such as walls, floors or foundations. Firestop all through and membrane penetrations of fire-rated barriers. Sleeves, Penetrations and Firestopping shall be per the requirements of Division 27 Specification Section *Common Work - Sleeves Penetrations and Firestopping*.

3.03 CABLE INSTALLED IN RACEWAY

- A. In Conduit or Ducts:
1. Fill ratios shall not exceed NEC requirements.
 2. Cable shall not be pulled into conduit/ducts until the conduit/duct ends have been prepared for cable installation (i.e. ducts cleaned and swabbed, reamed to eliminate sharp edges, bushings installed (insulated throat for metallic conduits, PVC for PVC conduits), etc.). Cables pulled into conduit/ducts prior to conduit/duct end preparation shall be removed and replaced (after the conduit/duct ends are prepared) at no additional cost to the Owner.
 3. Backbone (riser) cables shall not share conduits/ducts with horizontal cables.
 4. Reinstate pull-wires in conduits and ducts after use to facilitate future addition of cables.
- B. In Cable Tray:
1. Cable shall not be attached to the cable tray (i.e. cable shall be left “loose”).
 2. Cable shall be laid in tray in such a way as to present a neat and professional appearance. However, cable shall not be combed (for performance reasons).
 3. For cable tray serving both backbone (riser) and horizontal cabling, install cable in cable tray in such a manner that backbone cabling does not overlap with horizontal cabling – reserve approximately 25 percent of the space in the tray for backbone cabling and the remaining 75 percent for horizontal cabling.
 4. Where cables in cable trays are required to maintain specific distances between each other they shall be firmly secured to maintain this distance at fire rated penetrations.

3.04 CABLE NOT INSTALLED IN RACEWAY (E.G. “EXPOSED”):

- A. Cables shall be strapped, fastened or tie-wrapped for support. Staples are not acceptable.
1. Straps, fasteners, and tie-wraps shall not be over-tightened. Cables showing evidence of over-tightening shall be replaced at no additional cost to the Owner, regardless of the outcome of cable testing.
 2. Straps, fasteners, and tie-wraps shall be plenum or non-plenum rated to match that of associated cable.
 3. Cables shall be loosely grouped by application (horizontal or backbone) and by cable type (Cat 3, Cat 5E, Cat 5, Cat 6, MM Fiber, SM Fiber, etc.). Cable applications and types shall not be intermixed within a grouping.
- B. Cables in suspended cable runs shall be supported at varying intervals. Cable spans shall be limited to 5 feet or less, and the length of spans shall vary along the cable path (i.e. a given span should not be exactly the same length as the span preceding or following it – “exact” spans can degrade cable performance).
- C. Cable installed on exposed surfaces or structural members shall be installed parallel and perpendicular to the surfaces. Surface contours shall be followed wherever possible. Cables shall be attached to surfaces at intervals not to exceed 3 feet, and the length of spans shall vary along the cable path (i.e. a given span should not be exactly the same length as the span preceding or following it – “exact” spans can degrade cable performance).

- D. Attaching cables to pipes, electrical conduit, mechanical items, existing cables, or the ceiling support system (grids, hanger wires, etc. – with the exception of ceiling support anchors) is not acceptable.
- E. Cables exiting floor or wall penetrations and running exposed into furniture or casework shall be bundled and wrapped in spiral wrap or split-loom tubing for protection.
- F. The quantity of cables installed in j-hooks, straps, and other similar fasteners shall not exceed manufacturer maximum loads for the fastener. Provide additional fasteners as required to meet load and future capacity requirements.
- G. Route cable to comply with the Governing Requirements standards and rules for avoiding potential EMI sources of interference and as follows:
 - 1. Provide clearances of:
 - a. 18 inches from light fixtures
 - b. 12 inches from electrical power distribution (including conduits and cables)
 - c. 4 feet from motors and transformers
 - 2. Cable pathway shall cross perpendicular to potential EMI sources of interference.

3.05 CABLE IN COMMUNICATIONS ROOMS AND SPACES

- A. Cable on backboards:
 - 1. Lay and dress all cables to allow other cables to enter raceway (conduit or otherwise) without difficulty at a later time by maintaining a working distance from these openings.
 - 2. Cable shall be routed as close as possible to the ceiling, floor, sides, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations.
 - 3. Lay cables via the shortest route directly to the nearest edge of the backboard from mounted equipment or blocks. Secure all similarly routed and similar cables together and attach to D-rings vertically or horizontally, then route over a path that will offer minimum obstruction to future installations of equipment, backboards or other cables.
- B. Cable Bundles:
 - 1. Cables shall be bundled by application (horizontal or backbone) and by cable type (Cat 3, Cat 5E, Cat 5, Cat 6, MM Fiber, SM Fiber, etc.). Cable applications and types shall not be intermixed within a bundle.
 - 2. Cable bundles shall be combed to present a neat and professional appearance. For performance reasons, combing shall occur from the cable end to a maximum of 35 feet back (or per the Manufacturer’s recommendations, whichever is more stringent). For the portion of a cable bundle within the communications room exceeding this requirement (if any), the exterior cables in the cable bundle shall be combed straight. Interior cables shall not be combed (i.e. they shall be left “mixed”).
- C. Cable in ladder rack on walls: Place larger cable bundles against wall, smaller cable bundles to the inside.
- D. Cable straps: Install cable straps to secure cable bundles to cable runway and other supporting equipment. The use of plastic tie wraps for this purpose is not acceptable. Comply with Division 27 Specification Section *Communications - Equipment Room Fittings*.

3.06 CABLE SLACK

- A. Cable slack in communications rooms and spaces:
 - 1. Provide Slack length as follows:
 - a. Inside Plant Cable: 10 feet minimum for all backbone cable.
 - b. Outside Plant Cable: 10 feet minimum for all backbone cable.

- 1) At termination ends:
 - a) Copper Backbone Cable: 10 feet minimum
 - b) Fiber Backbone Cable: 10 feet minimum
 - 2) In UCV's
 - a) See OUTSIDE PLANT CABLE INSTALLATION below
2. Where Cable Runway does not exist or where slack storage is not called out on the Drawings, slack shall be stored as follows:
- a. Copper Cable:
 - 1) No slack in closets.
 - 2) Backbone: Slack shall be stored in drip loop in vertical wire manager
 - b. Fiber Cable: Slack shall be stored in drip loop in vertical wire manager.
- B. Cable slack at the work area outlet: Provide 1 foot of slack, 7" in box and 5" at top of conduit.
- C. Cable slack at Wireless Access Point enclosures ceiling: shall be ten feet of slack in neat coil.
- D. In cases of extreme congestion, notify the Engineer and await the Engineer's direction prior to installation.

END OF SECTION 27 10 00