

SECTION 28 05 13.01
CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 REFERENCE STANDARDS

- A. BICSI TDMM - Telecommunications Distribution Methods Manual, 14th Edition; 2020.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.
- F. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- G. UL 1581 - Reference Standard for Electrical Wires, Cables, and Flexible Cords; Current Edition, Including All Revisions.

1.02 DESCRIPTION

- A. This section describes:
 - 1. Coaxial cabling.
 - 2. RS-232 cabling.
 - a. RS-485 cabling.
 - b. Low-voltage control cabling.
 - c. Control-circuit conductors.
 - d. Fire alarm wire and cable.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 07 84 13, Firestopping
- B. Section 26 05 26, Grounding and Bonding for Electrical Systems
- C. Section 26 05 33, Raceway and Boxes for Electrical Systems
- D. Section 26 05 53, Identification for Electrical Systems
- E. Section 28 13 00, Fire Detection and Alarm

1.04 REFERENCES

- A. BICSI: Building Industry Consulting Service International
 - a. BICSI ITSIM Ch. 4: Pulling Cable
 - b. BICSI ITSIM Ch. 6: Cable Termination Practices
- B. NECA: National Electrical Contractors Association
 - a. NECA 1: Standard Practice of Good Workmanship in Electrical Construction
- C. NEMA: National Electrical Manufacturers Association
 - a. NEMA EN 10250: Enclosures for Electrical Equipment (1000 Volts Max)
- D. NFPA: National Fire Protection Association
 - a. NFPA 70: National Electric Code
 - b. NFPA 72: National Fire Alarm and Signaling Code
 - c. NFPA 262: Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
- E. TIA: Telecommunications Industry Association

- a. TIA 568-B.1: Minimum 4-Pair Sc-TP Patch Cable Bend Radius
- F. UL: Underwriters Laboratories:
 - a. UL 83: Thermoplastic-Insulated Wires and Cables
 - b. UL 1581: Reference Standard for Electrical Wires, Cables, and Flexible Cords
 - c. UL 1655: Standard for Community-Antenna Television Cables
 - d. UL 1666: Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

1.05 SUBMITTALS

- A. Submit the following materials:
 - a. Product Data: Submit for each type of product indicated.
 - b. For coaxial cable, submit the following installation data for each type used:
 - 1) Nominal OD.
 - 2) Minimum bending radius.
 - 3) Maximum pulling tension.
 - c. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
 - d. Maintenance Data: For wire and cable to include in maintenance manuals.
 - e. Cable test data per testing requirements of Part 3.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces 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.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable manufacturers:
 - a. Belden CDT Inc., Electronics Division.
 - b. West Penn Wire/CDT, a division of Cable Design Technologies.
 - c. Or equal.

2.02 COAXIAL CABLE

- A. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- B. RG-11/U: NFPA 70, Type CATV.
 - a. No. 14 AWG, solid, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.
 - c. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 - d. Jacketed with sunlight-resistant, black PVC or PE.
 - e. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85°C.
- C. RG59/U: NFPA 70, Type CATVR.
 - a. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
 - b. Gas-injected, foam-PE insulation.

- c. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
 - d. Color-coded PVC jacket.
- D. RG-6/U: NFPA 70, Type CATV or CM.
- a. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 - c. Jacketed with black PVC or PE.
 - d. Suitable for indoor installations.
- E. RG59/U: NFPA 70, Type CATV.
- a. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - b. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
 - c. PVC jacket.
- F. RG59/U (Plenum Rated): NFPA 70, Type CMP.
- a. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
 - b. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
 - c. Copolymer jacket.
- G. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655, and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
- a. CATV Cable: Type CATV.
 - b. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
 - c. CATV Riser Rated: Type CATVR, complying with UL 1666.
 - d. CATV Limited Rating: Type CATVX.

2.03 COAXIAL CABLE HARDWARE

- A. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.04 RS-232 CABLE

- A. Standard Cable: NFPA 70, Type CM.
 - a. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. Polypropylene insulation.
 - c. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - d. PVC jacket.
 - e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - f. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
 - a. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. Plastic insulation.
 - c. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
 - d. Plastic jacket.

- e. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
- f. Flame Resistance: Comply with NFPA 262.

2.05 RS-485 CABLE

- A. Standard Cable: NFPA 70, Type CM.
 - a. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
 - a. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
 - b. Fluorinated ethylene propylene insulation.
 - c. Unshielded.
 - d. Fluorinated ethylene propylene jacket.
 - e. Flame Resistance: NFPA 262, Flame Test.

2.06 LOW-VOLTAGE CONTROL CABLE

- A. Paired Cable: NFPA 70, Type CMG.
 - a. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - a. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with NFPA 262.
- C. Paired Cable: NFPA 70, Type CMG.
 - a. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1581.

PART 3 - EXECUTION

3.01 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - a. Comply with TIA-568-B.1.
 - b. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - c. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated terminals.
 - d. 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.

- e. 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. Install lacing bars and distribution spools.
 - f. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
 - g. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - h. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. Pulling wire and cable into conduit or trays shall be completed without damaging or putting undue stress on the cable insulation. UL listed pulling compounds are acceptable lubricants for pulling wire and cable. Grease is not acceptable. Raceway construction shall be complete, cleaned, and protected from the weather before cable is placed.
- D. Outdoor Coaxial Cable Installation:
- a. Install outdoor connections in enclosures complying with NEMA EN 10250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
 - b. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches.
- E. Separation from EMI Sources:
- a. Separation between cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
 - b. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - 1) Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
 - c. 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:
 - 1) Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - 2) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - 3) Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
 - d. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
 - e. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.02 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal raceway according to Section 260533, Raceway and Boxes for Electrical Systems.
 - a. Install plenum cable in environmental air spaces, including plenum ceilings.
 - b. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess.

1. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

3.03 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
- a. Class 1 remote-control and signal circuits, No. 14 AWG.
 - b. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
 - c. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.04 CONNECTIONS

- A. Comply with requirements in Section 28 31 00, Fire Detection and Alarm for connecting, terminating, and identifying wires and cables.

3.5		POWDER-ACTUATED FASTENERS
	A.	POWDER-ACTUATED FASTENERS ARE NOT ALLOWED.
3.6		FIRESTOPPING
3.7		GROUNDING FOR LOW-VOLTAGE WIRING AND CABLING, COMPLY WITH REQUIREMENTS IN SECTION 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
3.8	A.!	IDENTIFICATION COMPLY WITH REQUIREMENTS FOR IDENTIFICATION SPECIFIED IN SECTION 26!05!53, IDENTIFICATION FOR ELECTRICAL SYSTEMS.

3.01 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- a. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding.
 - b. Visually inspect cable placement, cable termination, grounding and bonding, equipment, and labeling of all components.
 - c. Test 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.
 - 1) Instruments used for continuity measurements shall have a resolution of 0.1 ohms and an accuracy of better than 0.1 percent of reading plus 0.3 ohms. A 500-volt megohmmeter shall be used for insulation resistance measurements.
 - d. Coaxial Cable Tests: Comply with requirements of TIA testing practices and procedures.
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 inch BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
 - C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
 - D. Prepare test and inspection reports.

3.02 EXISTING CIRCUITS

- A. Confirm the destination and purpose of each existing circuit before connecting to new equipment and new wiring. Connections shown on the one-line diagram drawing are the preferred connections. In any cases where drawings conflict, the conflict will be resolved by the Port.
- B. Remove existing terminations with as much existing cable as possible. Existing cable length may require different routings within manhole vaults than are shown on the drawings. Do not unnecessarily cut off any existing cable length.

END OF SECTION 28 05 13.01