

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

Latest Update: 5.6.2017 See Underlined Text.

(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Also turn off "Underlines".)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section and all other sections of Division 26.

1.2 SUMMARY

A. Section Includes:

1. UTP cabling.
2. 62.5/125-micrometer, multimode optical fiber cabling.
3. RS-232 cabling.
4. RS-485 cabling.
5. Low-voltage control cabling.
6. Control-circuit conductors.
7. Identification products.

1.3 DEFINITIONS

- A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- B. Channel Cable Tray: A fabricated structure consisting of a one (1) piece, ventilated-bottom or solid-bottom channel section.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- F. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

- G. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- H. RCDD: Registered Communications Distribution Designer.
- I. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.
- J. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.
- K. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
 - 1. Vertical and horizontal offsets and transitions.
 - 2. Clearances for access above and to side of cable trays.
 - 3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
 - 4. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
- C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Maintenance Data: For wire and cable to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

- 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: 450 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
 - 2. Test each pair of UTP cable for open and short circuits.
- B. PROJECT CONDITIONS
- C. Environmental Limitations: Do not deliver or install UTP and optical fiber 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.

1.7 WARRANTY/GUARANTEE

- A. See Division 26 Specification Section “Basic Electrical Requirements” for warranty and guarantee requirements.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Velcro straps.
 - 2. J-hooks.
- B. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cable Management Solutions, Inc.
 - b. Chatsworth Products Inc.
 - c. Cablofil Inc.
 - d. Cooper B-Line, Inc.
 - e. Cope - Tyco/Allied Tube & Conduit.
 2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inch thick steel, steel wire mesh or aluminum.
 - a. Basket Cable Trays: [six (6) inches wide and two (2) inches deep] <Insert dimensions>. Wire mesh spacing shall not exceed two (2) by four (4) inches.
 - b. Trough or Ventilated Cable Trays: <Insert dimension> wide.
 - c. Ladder Cable Trays: <Insert dimension> wide, and a rung spacing of <Insert dimension>.
- C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
1. Outlet boxes shall be no smaller than two (2) inches wide, three (3) inches high and two and one quarter (2-1/2) inches deep.

2.2 BACKBOARDS

- A. Description: Plywood, fire-retardant treated, three quarters (3/4) inches by forty eight (48) inches by ninety six (96) inches. Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry."

2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
 1. Belden CDT Inc.; Electronics Division.
 2. Berk- Tek; a Nexans company.
 3. CommScope, Inc.
 4. Mohawk; a division of Belden CDT.
 5. Superior Essex Inc.
 6. General Cable Company.
 7. Simon

- B. Description: 22-24 AWG, solid copper conductors, 100- ohm, four (4) pair UTP, nominal impedance +/- 15%, green CMP Plenum jacket and complies with EIA/TIA 568-C Cat 6 standard
1. Comply with ICEA S-90-661 for mechanical properties.
 2. Comply with TIA/EIA-568-C, Category 6.
 3. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
1. Ortronics Corporation
 2. Simon Co. (The).
- B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same manufacturer and the same category or higher.
- C. Connecting Blocks: 110 style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25% spare; integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
1. Corning
 2. SYSTIMAX Solutions; a CommScope, Inc. brand.
 3. Optical Cable Corporation Lucent/Abaya
- B. Description: Multimode, 62.5/125-micrometer, 12-fiber, nonconductive, tight buffer, OM1, optical fiber cable. Single mode, 9/125-micrometer, 12-fiber, plenum-rated, optical fiber cable.
1. Comply with ICEA S-83-596 for mechanical properties.
 2. Comply with TIA/EIA-568-C for performance specifications.
 3. Comply with TIA/EIA-492AAAA-A 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: 3.50dB/km at 850 nm; 1.0dB/km at 1300 nm for OM1 multimode, 1.0 dB/km at 1310 nm; 1.0 dB/km at 1550 nm for single mode.
6. Minimum Modal Bandwidth: 200 MHz-km at 850 nm; 500 MHz-km at 1300 nm for OM1 multimode.

C. Jacket:

1. Jacket Color: Orange for multimode and yellow for single mode.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-C.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed forty (40) inches.

2.6 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Berk-Tek; a Nexans company.
2. Corning Cable Systems.
3. Siemon Co. (The).

B. Cable Connecting Hardware:

1. Comply with the Fiber Optic Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
2. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.5 dB.

2.7 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100% shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.

6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100% shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned-copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.8 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM.

1. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.

1. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.9 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.

2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.10 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.11 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with requirements of NFPA 70, NEC, National Electrical Code.

2.12 IDENTIFICATION PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Brady Corporation.
 2. HellermannTyton.
 3. Kroy LLC.
 4. Panduit Corp.
- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.13 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
- E. Cable will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports, including all deficiencies and corrective measures.

PART 3 - EXECUTION

3.1 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."
- B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools to comply with manufacturer's recommendations.

3.2 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-B-2006.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-B-2004 for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wire ways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.

2. Install vertical and horizontal cable trays to route cables if conduits cannot be located in these positions.
 3. Secure conduits to backboard when entering room from overhead.
 4. Extend conduits three (3) inches above finished floor.
 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with ninety six (96) inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1-2010.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-C.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated. Terminate conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced.
5. Secure and support cables at intervals not exceeding thirty (30) inches and not more than six (6) inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
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. Install distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Do not allow un-terminated cable to lay on floor, prior to installation. Remove and discard cable if damaged prior to and/or during installation and replace it in its entirety with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating. In the communications equipment room, install a ten (10) foot long service loop in the cable tray, on the backboard or on each end of cable.
9. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, and "Pulling Cable." Monitor cable pull tensions and ensure manufacturer's specified tension limits are not exceeded.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.

2. Install 110-style IDC termination hardware unless otherwise indicated.
 3. Do not untwist UTP cables more than one half (1/2) inch from the point of termination to maintain cable geometry.
- D. Installation of Control-Circuit Conductors:
1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- E. Optical Fiber Cable Installation:
1. Comply with TIA/EIA-568-B.3.
 2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
- F. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend copper cable not in a wireway or pathway a minimum of eight (8) inches above ceilings by cable supports not more than sixty (60) inches apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- G. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Coil cable seventy two (72) inches long shall be neatly coiled not less than twelve (12) inches in diameter below each feed point.
- H. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-A 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 five (5) inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of twelve (12) inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of twenty four (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 two and one half (2-1/2) inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of six (6) inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of twelve (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 three (3) inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of six (6) inches.
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of forty eight (48) inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of five (5) inches.

3.4 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables.

3.5 CONTROL-CIRCUIT CONDUCTORS

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

3.6 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.7 GROUNDING

- A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.8 IDENTIFICATION

- A. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - 3. Test UTP 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 but not after cross connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 4. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.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) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, one Reference Jumper.
 - 2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

- D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

- F. Prepare test and inspection reports.

END OF SECTION 260523