

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESIGN REQUIREMENTS

- A. Provide complete wire and cable system to meet the requirements of the project. Provide wire sizes in accordance with NEC.

1.2 SUBMITTALS

- A. Product data shall be submitted for in accordance with the requirements of Section 26 05 00 each of the following:
 - 1. Wires
 - 2. Cables
 - 3. Connectors

1.3 QUALITY ASSURANCE

- A. Wire and cable shall be provided and installed in accordance with the requirements of Section 26 05 00.
- B. Installer Qualifications and Certifications: Firms with at least 3 years of successful installation experience with projects utilizing electrical wiring cabling work similar to that required for this project.
- C. Regulatory Requirements: Conform to applicable code relations regarding toxicity of combustion products of insulating materials
- D. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Wire and cable shall be delivered, stored and handled in accordance with the requirements of Section 26 05 00.
- B. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA-specified type wire and cable reels.
- C. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- D. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

1.5 WARRANTY

- A. Wire and cable warranties shall be provided in accordance with the requirements of Section 26 05 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by the following (for each type of wire, cable, and connector):
1. Wire and cable:
 - a. Triangle - PWC
 - b. American Wire and Cable Co.
 - c. Anaconda-Ericsson Inc; Wire and Cable Div.
 - d. Belden Div; Cooper Industries
 - e. General Cable Corporation
 - f. General Electric
 - g. Okonite
 2. Connectors:
 - a. O-Z/Gedney Co.
 - b. AMP, Inc.
 - c. Burndy Corporation
 - d. Ideal Industries, Inc.
 - e. 3M Company
 - f. Thomas and Betts Corp.

2.2 MATERIALS, GENERAL

- A. Wires and Cables:
1. Provide new wire and cable suitable for the temperature, conditions, and location where installed. All cable shall be new and shall conform to or exceed IPCEA requirements. Building wire shall be insulated with THHN/THWN/THW or XHHW insulation, rated 600 volt.
 2. Conductors: Provide solid conductors for power and lighting circuits 12 AWG and smaller. Provide stranded conductors for 10 AWG THHN/THWN and larger. In sizes 250 MCM and larger use type THW or THWN. In sizes #1 AWG and smaller all conductors shall have heat/moisture resistant thermoplastic insulation type THW or THWN (75 degree C), except as follows:
 - a. Where conduit temperature will exceed 100 degree F, use type THHN (90 degree C). Type XHHW (90 degree C) permissible in dry locations.
 - b. In 120-volt incandescent fixtures, type AF (150 degree C).
 - c. In wire ways of fluorescent lighting fixtures types THW-MTW, THHN (90 degree C).
 3. Conductor Material: Provide copper for all wires and cables.
 4. Metal Clad cable is acceptable.
 5. Use colors of wires as specified in paragraph 3.5 of this section.
 6. For general applications, other than special use, use THHN insulated wire.
 7. Type NM, NMC, NMS cable are not acceptable for any application.
 8. Use copper wire only.
 9. No wire splices shall be allowed in the conduit or conduit fittings. All splices shall be done in an approved box.
 10. Grounding conductors shall be copper type THHN with green integrally-colored insulation, sized to meet NEC.
 11. Plenum rated cable when required by Plenum conditions.
- B. Connectors:
1. Provide UL type factory-fabricated, solder less metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperatures equal to or greater than those of the wires upon which used.
- C. Wiring to Light Fixtures:
1. Type THHN to fluorescent light fixtures, 12-gauge minimum.
 2. Type THHN to incandescent fixtures, 12-gauge minimum.
- D. Wire Connectors:
1. For wires size #8 AWG and smaller, insulated pressure type (with live spring) rated 105 degree C, 600 volt, for building wiring and 1000 volt in signs or fixtures. 3M or Ideal.

2. For wires size #6 AWG and larger, T & B or equivalent compression type with 3M #33 or #88 tape insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that mechanical work likely to damage cable has been completed.

3.2 INSTALLATION, GENERAL

- A. Install electrical cables, wires and connectors in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Coordinate wire/cable installation work, including electrical raceway and equipment connection work, with other work. Pull no wire into any portion of conduit system until all construction work, which might damage the wire, has been completed.
- C. BAS Conductor installation: (see Section 23 09 13)
- D. Wires and Cables:
 1. On systems greater than 600V thoroughly swab raceway before installing wire. Pull conductors simultaneously where more than one is being installed in same raceway. Use pulling compound or lubricant on all cable installations. compound used shall not deteriorate conductor or insulation.
 2. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway. Do not use rope hitches for pulling attachment to wire or cable. Do not exceed manufacturer's tension requirements.
 3. Keep conductor splices to minimum. Install all wire continuous from outlet to outlet or terminal to terminal. Splices in cables when required shall be made in hand holes, pull boxes, or junction boxes and shall be in strict accordance with cable manufacturer's recommendations utilizing solder less connectors NEMA/UL approved for the use. Splice only in accessible junction boxes. Use splices and tap connectors which are compatible with conductor material.
 4. Install splices and tapes, which possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
 5. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486 for copper.
 6. Support cables above accessible ceilings, do not rest on ceiling tiles. Use spring clips and hanger rods, bridle rings or 'J' hooks, independent from the ceiling suspension system to support cables from structure.
 7. Provide adequate length of conductors within electrical enclosures and form the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than 10 AWG cables to individual circuits. Make terminations so there is no bare conductor at the terminal.
 8. Make up splices in outlet boxes with 8-inch minimum of correctly color-coded tails left in box. Splices in wires size #8 AWG and smaller shall be made with insulated spring type wire connectors, "Scotchlok" or equivalent. Splices in larger wire and cables shall be made with indent connectors NEMA/UL approved for the purpose.
 9. Use split bolt connectors for copper wire splices and taps, 6 AWG through 1 AWG. Tape un-insulated conductors and connectors with electrical tape to 150% of the insulation value of conductor. Rubber, friction and 3M-33 or 88 or better. Two (2) layers minimum each.
 10. Use copper compression connectors for copper wire splices and taps, 1/O AWG and larger. Tape un-insulated conductors and connectors with electrical tape to 150% of the insulation value of the conductor. Rubber, friction and 3M-33 or 88.

11. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
12. Thoroughly tape the ends of spare conductors in boxes and cabinets.
13. Install exposed cable, parallel and perpendicular to surfaces, or exposed structural member, and follow surface contours, where possible.
14. Make all ground, neutral and line connections to receptacle and wiring device terminals as recommended by manufacturer. Provide ground jumper from outlet box to individual ground terminal of devices.
15. Parallel conductors shall be cut to the same length and be the same type of wire.
16. All splices in control panels, terminal junction boxes, low voltage control circuits and fire alarm conductors shall be on numbered terminal strip.
17. When routed in a wall, install all thermostat wire, fire alarm, computer cable, low voltage cable, and other communication cable in conduit.
18. All junction boxes shall be fully accessible.
19. All wiring shall be routed through an acceptable raceway regardless of voltage application, unless specified otherwise under other sections of these standards.

3.3 TESTING, CLEANING AND CERTIFICATION

- A. Refer to Section 26 05 00 for testing, cleaning, and certification requirements.
- B. Prior to energizing circuitry, check installed wires and cables with megaohm meter to determine insulation resistance levels to ensure requirements are fulfilled. Test shall be made on all feeders regardless of size and on all branch circuits with No. 4 AWG and larger conductors.
- C. Prior to energizing, test wires and cables for electrical continuity and for short-circuits.
- D. Subsequent to wire and cable hook-up, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

3.4 COMMISSIONING (DEMONSTRATION)

3.5 SCHEDULES

- A. Color code secondary service, feeder, and branch circuit conductors as follows:

120/208 Volts	Phase	277/480 Volts
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray
Green	Ground	Green
Switch leg - Pink		
3 & 4 way travelers - Purple		

- B. Conductors shall be solid color for entire length.
- C. EXCEPTION:
 1. Conductors 8 AWG and larger may be black and shall be with color-coded at each termination and in each box or enclosure. For a distance of 6 inches use half-lapped 3/4 inch plastic tape in the specified color. Do not cover cable identification markings. Adjust tape locations to prevent covering of markings.

END OF SECTION 26 05 19