

**SECTION 26 05 19**  
**ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS OR LESS)**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This section includes the following:
  - 1. Conductors and Cables
  - 2. Connectors and Splices
- B. Meet the following performance requirements:
  - 1. Where not indicated size branch circuit wiring per the Energy Code not to exceed 3 percent voltage drop and feeders not to exceed 2% voltage drop. Do not reduce conductor sizes indicated.
  - 2. Aluminum conductor substitution
    - a. Not Allowed

**1.2 RELATED WORK**

- A. Section 26 00 10 – Basic Electrical Requirements, is an integral part of this section. Requirements and work indicated in 26 00 10 are not repeated in this Section.

**1.3 COORDINATION**

- A. Coordinate work under provisions indicated in Section 26 00 10.
- B. Field verify measurements.

**1.4 QUALIFICATIONS / QUALITY ASSURANCE**

- A. Conform to requirements indicated in Section 26 00 10.
- B. Provide written test results after installation. Indicated procedures and values obtained.
- C. Toxicity: Materials shall comply with applicable codes and regulations regarding toxicity of combustions products.
- D. NRTL Compliance: Comply with applicable requirements of UL Standard 910 (or NRTL equivalent) "Test Method for Fire and Smoke Characteristics of Cables Used in Air Handling Spaces." Provide products that are NRTL listed and labeled for such use.

**1.5 REGULATORY REQUIREMENTS AND STANDARDS**

- A. Conform to requirements indicated in Section 26 00 10.

**1.6 SUBMITTALS**

- A. Submit as required here in and under Section 26 00 10.

**1.7 EXTRA MATERIALS**

- A. Furnish under provisions indicated in Section 26 00 10.

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**1.8 PROJECT RECORD DOCUMENTS**

- A. Submit under provisions indicated in Section 26 00 10.
- B. Record actual locations of concealed cable assemblies and branch circuit arrangements and branch circuit numbering.

**1.9 OPERATION AND MAINTENANCE DATA**

- A. Submit under provisions indicated in Section 26 00 10.

**1.10 WARRANTY**

- A. Provide under provisions indicated in Section 26 00 10.

**PART 2 - PRODUCTS**

**2.1 BUILDING WIRE AND CABLE – INTERIOR DRY AREAS ABOVE GROUND**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Southwire Company.
  - 2. American Insulated Wire Corporation.
  - 3. The Okonite Company.
  - 4. Cerror Wire & Cable Company
  - 5. Cobra Wire and Cable Inc.
  - 6. Substitutions: or equal under provisions of Section 26 00 10.
- B. Building Wire and Cable – above ground in raceways. Southwire SimPull or equal.
  - 1. Description: Single conductor insulated wire.
  - 2. Conductor: Copper
  - 3. Insulation Voltage Rating: 600 volts.
  - 4. Insulation: ANSI/NFPA 70; Type THWN-2, XHHW-2 (No. 6 AWG or larger) insulation for feeders and branch circuits. 90 degree C rated wet or dry, Southwire SimPull or equal.
- C. Control Circuits: ANSI/NFPA 70; Type THHN/THWN insulation.
- D. Conductors in Cable Tray (#4/0 awg and larger):
  - 1. Description: Single conductor insulated wire.
  - 2. Conductor: Copper
  - 3. Insulation Voltage Rating: 600 volts.
  - 4. Insulation: ANSI/NFPA 70: Type DLO/RHW-2, THW, or RHH, 90 degree C rated for cable tray use. For DC circuits provide extra flexible construction using a maximum strand size of 24AWG (0.0020 inch diameter).

**2.2 BUILDING WIRE AND CABLE – UNDERGROUND OR WET AREAS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Southwire Company.
  - 2. American Insulated Wire Corporation.
  - 3. The Okonite Company.
  - 4. Cerro Wire & Cable Company.
  - 5. Cobra Wire and Cable Inc.
  - 6. Substitutions: or equal under provisions of Section 26 00 10.

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- B. Service entrance, feeder or branch circuit conductors in raceways: Type USE-2/RHW-2 or SimPull THHN/THWN-2 or XHHW-2 by Southwire.
  - 1. Conductor: Copper.
  - 2. Insulation Voltage Rating: 600 volts.
  - 3. Insulation Temperature Rating: 90 degrees C. wet

**2.3 NONMETALLIC SHEATHED-CABLE – INTERIOR**

- A. Not Used

**2.4 OVERHEAD MANUFACTURERS – SERVICE-ENTRANCE CABLE**

- A. Not Used

**2.5 ARMORED CABLE**

- A. Not Allowed.

**2.6 METAL CLAD CABLE**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Southwire Company.
  - 3. Cobra Wire and Cable
  - 4. Substitutions: Under provisions of Section 26 00 10.
- B. Metal Clad Cable
  - 1. Description: ANSI/NFPA 70, Type MC.
  - 2. Conductor: Copper.
  - 3. Insulation Voltage Rating: 600 volts.
  - 4. Insulation Temperature Rating: 90 degrees C. Used at 60 degree C ampacity rating.
  - 5. Insulation Material: Thermoplastic or Thermosetting.
  - 6. Armor Material: Steel (for EMI protection)
  - 7. Armor Design: Interlocked metal tape.
  - 8. Jacket: None, except PVC in non plenum areas, for connections to vibrating equipment or in wet or damp locations or in mechanical or generator rooms.
  - 9. Provide grounding conductor.

**2.7 CORDS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
  - 1. American Insulated Wire Corp.
  - 2. Cerro Wire & Cable Company.
  - 3. Southwire Company.
  - 4. Substitutions: Under provisions of Section 26 00 10.
- B. Oil-resistant thermoset, insulated multi-conductor flexible cord with identified equipment grounding conductor, suitable for extra hard usage in damp locations.

**2.8 MANUFACTURED (MODULAR) WIRING SYSTEM - OPTIONAL WIRING METHOD**

- A. Not Used

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**2.9 WIRING CONNECTORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Split Bolt Connectors:
    - a. Appleton Electric Company.
    - b. Crouse Hinds Company.
    - c. Teledyne - Penn - Union Electric.
    - d. Substitutions: Under provisions of Section 26 00 10.
  - 2. Solderless Pressure Connectors:
    - a. Burndy Electrical Connectors.
    - b. Thomas and Betts.
    - c. AMP Special Industries.
    - d. Substitutions: Under provisions of Section 26 00 10.
  - 3. Spring Wire Connectors:
    - a. Burndy Electrical Connectors.
    - b. Thomas and Betts.
    - c. AMP Special Industries.
    - d. Substitutions: Under provisions of Section 26 00 10.
  - 4. Compression Connectors:
    - a. Burndy Electrical Connectors.
    - b. Teledyne - Penn - Union Electric
    - c. Crouse Hinds Company

**2.10 CONNECTORS AND SPLICES**

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
  - 1. 3M; Electrical Products Division.
  - 2. Hubbell Power Systems, Inc.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.
  - 4. AFC Cable Systems, Inc.
  - 5. Tyco Electronics Corp.
  - 6. Substitutions: Under provisions of Section 26 00 10.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- C. For damp or wet areas provide connectors pre-filled with waterproofing sealant.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.

**3.2 PREPARATION**

- A. Completely and thoroughly swab raceway before installing wire. Repeat until no foreign material or water is evident.

**3.3 COLOR CODING**

- A. Wiring and cable systems shall be color-coded to denote polarity to match existing building system coding or color-coded as follows:

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208/120 Volt Systems

Phase A      Black  
Phase B      Red  
Phase C      Blue  
Neutral      White  
Grounding Conductor: Green  
Isolated Grounding Conductor: Green with Yellow Stripe

480/277 Volt Systems

Phase A      Brown  
Phase B      Orange  
Phase C      Yellow  
Neutral      Gray

- B. Neutral (Grounded Conductor): Grounded conductors for each voltage system shall be uniquely color-coded. For voltage systems not identified above, provide white insulation with colored stripes other than green or black.
- C. Conductors larger than No. 6 AWG that do not have colored insulation provide wrap of two full turns of 1-inch wide (25 mm) wide colored tape at two locations (12 inches (300 mm) apart) at each location where conductor is accessible.
- D. Provide engraved nameplate indicating color-coding system at each panelboard or switchboard on the interior of the door if so equipped; otherwise, install on the front trim. Refer to specification 26 05 53. "Identification for Electrical Systems" for nameplates requirement.

**3.4 GENERAL**

- A. Generally, the Drawings do not show point-to-point wiring. Provide complete wiring and raceway systems to suit project.
- B. Do not group circuits into multi-wire branch circuits unless specifically indicated. Protect multi-wire circuits with multi-pole or adjacent single-pole over-current devices with handle ties.
- C. Provide separate neutrals where indicated and for the following:
  - 1. Single phase circuits protected by ground fault circuit interrupters.
  - 2. Single phase circuits protected by arc fault circuit interrupters.
  - 3. Circuits to convenience outlets in office or work areas.
- D. Do not reduce the number of home runs indicated on the Drawings without written acknowledgement from the Architect.
- E. Neatly train and secure wiring inside of boxes and equipment enclosures.
- F. Wiring and cable routing indicated on Drawings is approximate unless dimensioned. Route wire and cable as require to meet Project Conditions. Include wire and cable lengths within 10 feet (3 m) of lengths required.
- G. Provide required separation between cable and other work.
- H. Determine cable routing to avoid interference with other work.

**3.5 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Control Circuits: Copper. Stranded.

**3.6 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS WHERE ALLOWED BY THE ELECTRICAL CODE**

- A. Service Entrance:

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1. Type Southwire SimPull THHN/THWN-2, single conductors in raceway
  2. Type Southwire SimPull XHHW-2, single conductors in raceway
  3. Mineral-insulated, metal-sheathed cable, Type MI
  4. Type USE-2/THW-2 cable.
- B. Exposed Feeders:
1. Type THHN/THWN-2, or XHHW-2 single conductors in raceway
  2. Metal-clad cable, Type MC
  3. Mineral-insulated, metal-sheathed cable, Type MI.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawl spaces:
1. Type THHN/THWN-2, or XHHW-2, single conductors in raceway
  2. Metal-clad cable, Type MC
  3. Mineral-insulated, metal-sheathed cable, Type MI.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground:
1. Type Southwire SimPull THHN/THWN-2 single conductors in raceway
  2. Type Southwire SimPull XHHW-2 single conductors in raceway.
  3. Type USE-2/THW-2, single conductors in raceway
- E. Feeders Installed below Raised Flooring:
1. Type THHN/THWN-2, or XHHW-2 single conductors in raceway
  2. Metal-clad cable, Type MC with PVC jacket if installation follows the electrical code NEC 70 article 645.
  3. Mineral-insulated, metal-sheathed cable, Type MI.
- F. Feeders in Cable Tray:
1. Metal-clad cable, Type MC
  2. Mineral-insulated, metal-sheathed cable, Type MI
  3. Type DLO/RHW-2 or RHH 90°C rated for cable tray use, single or multi conductor.
- G. Exposed Branch Circuits, Including in Crawlspace:
1. Type THHN/THWN-2, or XHHW-2 single conductors in raceway
  2. Metal-clad cable, Type MC
  3. Mineral-insulated, metal-sheathed cable, Type MI.
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions:
1. Type THHN/THWN-2, or XHHW-2 single conductors in raceway
  2. Metal-clad cable, Type MC
  3. Mineral-insulated, metal-sheathed cable, Type MI.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground:
1. Type Southwire SimPull THHN/THWN-2, single conductors in raceway
  2. Type Southwire SimPull XHHW-2, single conductors in raceway
  3. Type USE-2/THW-2 single conductors in raceway
- J. Branch Circuits Installed below Raised Flooring:
1. Type THHN/THWN-2, or XHHW-2 single conductors in raceway
  2. Metal-clad cable, Type MC with PVC jacket if installation follows the electrical code NEC 70 article 645
  3. Mineral-insulated, metal-sheathed cable, Type MI.
- K. Branch Circuits in Cable Tray:
1. Type THHN/THWN-2, or XHHW-2 single conductors in raceway
  2. Metal-clad cable, Type MC
  3. Mineral-insulated, metal-sheathed cable, Type MI
  4. Type DLO/RHW-2 – or RHH-2 90 deg C rated for cable tray use, extra flexible cable.

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- L. Cord Drops and Portable Appliance Connections:
  - 1. Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- M. Class 1 Control Circuits: Type THHN/THWN, in raceway.
- N. Class 2 Control Circuits: Type THHN/THWN, in raceway; power-limited cable, in raceway; power-limited tray cable, in cable tray.
- O. Fire rated feeders, as indicated in the documents or required by code, shall be installed underground or in mineral insulated (MI) cable or in a NRTL listed circuit protective system.

**3.7 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation and shall remain slippery when dry. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, swivel grips, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables including cables behind removable surfaces such as ceilings, access floors, etc., parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- G. Install conductors of each wiring system such as 480/277 volt, 208/120 volt, emergency, sound, fire alarm, security, etc. in separate raceway systems unless otherwise indicated.
- H. Install conductors in conduit where exposed to abuse or below 8 feet above finished floor unless indicated otherwise.
- I. Exposed wiring and wiring in mechanical and electrical rooms and homeruns to panelboards shall be in conduit. Homeruns start within 20 feet of the last outlet served.
- J. Type MC cable may be used in concealed areas where properly supported with listed devices, and installed parallel and perpendicular to the structure. Tie wire or wraps shall not be used to support cable(s). Maintain proper spacing between cables so as not to require derating. Support cable from structure using listed support means equal to Caddy systems. Do not support from ceiling tie wires except cables going from fixture to fixture in non-fire rated ceilings. Do not rest cables on ceiling tiles. Maintain one cable width spacing between cables.
- K. The following areas are air plenums: Provide wiring as required herein and allowed by the Electric Code. 1. Under raised floors 2. above suspended ceilings.
- L. Do not reduce the size or number of homeruns or conduits indicated without written permission of the Architect indicating specific exceptions and locations.
- M. Cords may be used to connect chain or pendant hung industrial-type fixtures as allowed by the Electric Code.

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- N. Install products in accordance with manufacturers instructions.
- O. Use solid conductor for power circuits #10 AWG and smaller.
- P. Use stranded conductors for control circuits.
- Q. Use conductor not smaller than #12 AWG for power and lighting circuits.
- R. Use conductor not smaller than #14 AWG for control circuits unless specifically indicated otherwise.
- S. Use #10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet (23 m) or larger as indicated on the drawings for voltage drop.
- T. Use #10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 175 feet (53 m) or larger as indicated on the drawings for voltage drop.
- U. Pull all conductors into raceway at same time.
- V. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- W. Protect exposed cable from damage.
- X. Support cables not in raceways above accessible ceiling, using spring metal clips to support cables from structure. Do not rest cable on ceiling panels.
- Y. Use suitable cable fittings and connectors.
- Z. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- AA. Clean conductor surfaces before installing lugs and connectors.
- BB. Terminate connections to switchgear, switchboards, panels, transformers, generators, UPS, ATS and distribution equipment with two hole bolt type compression fittings with inspection windows.
- CC. Feeders and branch circuits shall be installed in independent raceways and boxes, unless otherwise indicated.
- DD. Redundant circuits to equipment shall be installed in independent raceways utilizing diverse pathways, unless otherwise indicated.
- EE. Feeders and branch circuit conductors 100A or larger shall be installed as one continuous piece. Install conductor splices only where specifically indicated. Location and reason for proposing a splice shall be submitted to the Architect for approval prior to installation. Splices shall be compression type, fully insulated and accessible for future infrared inspections.
- FF. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- GG. Terminate aluminum conductors with tin-plated aluminum-bodied compression connectors only. Fill with anti-oxidant compound before installing conductor.
- HH. Use suitable reducing connectors or mechanical connector adapters for connecting aluminum conductors to copper conductors.
- II. Use insulated, compression type connectors for copper conductor splices and taps, 4 AWG and larger



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- JJ. Use split bolt connectors for copper splices and taps for 6 & 8 AWG conductors. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- KK. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- LL. Grounding Conductors: Exothermic welding and irreversible compression-type connections allowed above and below ground. Provide exothermic welding connections for all lightning protection components.
- MM. Terminations of Control Wiring: Screw or pressure type insulated terminal blocks using spade or ring connectors or wago connectors.
- NN. Fire Alarm, Control, Security, Sound and other Low Voltage Systems: Screw or pressure type insulated terminal blocks using spade or ring connectors. Mount in cabinets or junction boxes, otherwise conductors are to be continuous and unspliced. Wiring is to be permanently labeled at each termination with mylar ring labels or heat shrink type labels.
- OO. Cables or conductors in common manholes, hand holes or pits under equipment shall be protected by arc fireproofing tape. Tape shall be a flexible fabric tape of an organic composition coated with a flame retardant material. Tape shall be two half lapped or two layers butt-lapped (staggered) over the entire length of exposed conductors. Tape shall be held in place with a glass cloth adhesive tape. Extend one inch into raceway.

**3.8 MANUFACTURED (MODULAR) WIRING SYSTEMS**

- A. Not Applicable.

**3.9 CONNECTIONS**

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

**3.10 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Provide and coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping" and Section 26 05 00 "Common Work Results for Electrical".

**3.11 ARC/FIRE PROOFING**

- A. Cables or conductors of multiple feeders in common hand holes, manholes or pits under equipment shall be protected by arc fireproofing tape. Tape shall be flexible fabric tape of an organic composition coated with a flame retardant material. Tape shall be two half lapped or two layers butt-lapped (staggered) over the entire length of exposed conductors. Tape shall be held in place with a glass cloth adhesive tape. Extend tape 1 inch (25mm) into duct.

**3.12 IDENTIFICATION**

- A. Identify wire and cable under provisions of Section 26 05 53.

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- B. Identify each conductor with its circuit number or other designation indicated on Drawings.

**3.13 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping" and Section 26 05 00 "Common Work Results for Electrical".

**3.14 FIELD QUALITY CONTROL**

- A. After installing conductors and cables and before electrical circuitry has been energized, test conductors and cables for conformance with requirements.
- B. Perform field inspection and testing under provisions of Section 260010 and 260813.
- C. Test feeders and branch circuit conductors rated over 100 amps, with 500 volt megger. Replace conductor with less than 250,000 ohms resistance.
- D. Test and verify proper phasing connections at distribution equipment and motor-operated equipment.
- E. Test polarity and grounding at each receptacle device.
- F. Inspect wire and cable for physical damage and proper connection. Replace conductors with cable damage including nylon jacket.
- G. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values with permanent marker, mark bolt location for correct torque. Correct those bolted connections not meeting manufacturer's or NRTL's recommendations.
- H. Verify proper conductor supports for short circuit withstand requirements and to keep stress off terminations as recommended by NEMA, NRTL and manufacturer.

**END OF SECTION**