

## **SECTION 26 05 19 – LOW-VOLTAGE POWER CONDUCTORS AND CABLES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Copper building wire rated 600V or less.
  - 2. Aluminum building wire rated 600V or less.
  - 3. Metal-clad cable, Type MC, rated 600V or less.
  - 4. Connectors, splices, and terminations rated 600V and less.

#### **1.3 DEFINITIONS**

- A. RoHS: Restriction of Hazardous Substances.
- B. VFC: Variable-frequency controller.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

### **PART 2 - PRODUCTS**

#### **2.1 COPPER BUILDING WIRE**

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with overall insulation layer or jacket, or both, rated 600V or less.
- B. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by qualified testing agency, and marked for intended location and use.

2. RoHS compliant.
  3. Conductor and Cable Marking: Comply with wire and cable marking per UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- D. Conductor Insulation:
1. Type THHN and Type THWN-2: Comply with UL 83.
  2. Type XHHW-2: Comply with UL 44.

## **2.2 ALUMINUM BUILDING WIRE**

- A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with overall insulation layer or jacket, or both, rated 600V or less.
- B. Standards:
1. Listed and labeled as defined in NFPA 70, by qualified testing agency, and marked for intended location and use.
  2. RoHS compliant.
  3. Conductor and Cable Marking: Comply with wire and cable marking per UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Aluminum, complying with ASTM B800 and ASTM B801.
- D. Conductor Insulation: Type THHN and Type THWN-2: Comply with UL 83.

## **2.3 METAL-CLAD CABLE, TYPE MC**

- A. Description: Factory assembly of one or more current-carrying insulated conductors in overall metallic sheath.
- B. Standards:
1. Listed and labeled as defined in NFPA 70, by qualified testing agency, and marked for intended location and use.
  2. Comply with UL 1569.
  3. RoHS compliant.
  4. Conductor and Cable Marking: Comply with wire and cable marking per UL's "Wire and Cable Marking and Application Guide."
- C. Circuits:
1. Single circuit.
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

- E. Ground Conductor: Insulated.
- F. Conductor Insulation:
  - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
- G. Armor: Steel, interlocked.
- H. Jacket: PVC applied over armor.

## **2.4 CONNECTORS AND SPLICES**

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by qualified testing agency, and marked for intended location and use.
- B. Connectors and splices shall be manufactured by Hubbell, Service Wire Company, Burndy, or approved equal.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
  - 1. Material: Copper or Aluminum.
  - 2. Type: Two hole with long barrels.
  - 3. Termination: Compression.

## **PART 3 - EXECUTION**

### **3.1 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper for feeders smaller than 1/0 AWG; copper or aluminum for feeders 1/0 AWG and larger. Conductors shall be solid for 10 AWG and smaller; stranded for 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for 10 AWG and smaller; stranded for 8 AWG and larger.
- C. VFC Output Circuits Cable: Extra-flexible stranded.

### **3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.

- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway or metal-clad cable, Type MC.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- H. VFC Output Circuits: Type XHHW-2 in metal conduit.

### **3.3 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points per Section 260533 "Raceways and Boxes" before pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- F. Support cables per Section 260529 "Hangers and Supports."

### **3.4 CONNECTIONS**

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

### **3.5 IDENTIFICATION**

- A. Identify and color-code conductors and cables per Section 260553 "Identification."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### **3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Raceways and Cabling."

### **3.7 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly per Section 078413 "Penetration Firestopping."

### **3.8 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  - 2. Perform each of following visual and electrical tests:
    - a. Inspect exposed sections of conductor and cable for physical damage and correct connection per single-line diagram.
    - b. Test bolted connections for high resistance using one of following:
      - 1) Low-resistance ohmmeter.
      - 2) Calibrated torque wrench.
      - 3) Thermographic survey.
    - c. Inspect compression-applied connectors for correct cable match and indentation.
    - d. Inspect for correct identification.
    - e. Inspect cable jacket and condition.
    - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply potential of 500V dc for 300V rated cable and 1000V dc for 600V rated cable for one-minute duration.
    - g. Continuity test on each conductor and cable.
    - h. Uniform resistance of parallel conductors.
  - 3. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform infrared scan of each splice in conductors 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during scan.
    - a. Instrument: Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - b. Record of Infrared Scanning: Prepare certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
  - 4. Follow-up Infrared Scanning: Perform additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record following:
  - 1. Procedures used.
  - 2. Results that comply with requirements.
  - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

**END OF SECTION**