

## **SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

### **PART 1 - GENERAL**

#### **1.1 SUBMITTAL REQUIREMENTS**

- A. Product Data
  - 1. For each type of conductor and cable.

### **PART 2 - PRODUCTS**

#### **2.1 CONDUCTORS AND CABLES**

- A. Acceptable Manufacturers: Subject to being equivalent and subject to compliance with requirements, provide product by one of the manufacturers listed below, or by an NRTL listed equivalent manufacturer.
  - 1. Alcan Products Corporation; Alcan Cable Division.
  - 2. Alpha Wire.
  - 3. Belden Inc.
  - 4. Encore Wire Corporation.
  - 5. General Cable Technologies Corporation.
  - 6. Southwire Incorporated.
  - 7. American Insulated Wire Corp
  - 8. Republic Wire
- B. Conductor Insulation and Multiconductor Cables: Comply with NEMA WC 70/ICEA S-95-658. Refer to Part 3 of this section for allowable types specific to this project.
- C. MC Cable (Metal-Clad):
  - 1. Provide Type MC Cables that are minimum 90 degrees C rated, with components and fittings listed for grounding, compliant with NEC Articles 250 and 330.
  - 2. Provide cable formed from continuous length of spirally wound, interlocked zinc coated or galvanized (inside and outside) strip steel or aluminum jacket. Provide cables with full parity insulated equipment ground conductor.
  - 3. Provide compatible steel fittings with integral red plastic insulated throat bushings, compliant with NEC 330.
- D. Variable Frequency Controller / Variable Frequency Drive Cable (VFC/VFD): Comply with UL, UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable. Provide type TC-ER with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85

percent coverage braided shields and insulated full-size ground wire, and sunlight- and oil-resistant outer PVC jacket.

## **2.2 CONNECTORS AND SPLICES**

- A. Acceptable Manufacturers: Subject to being equivalent and subject to compliance with requirements, provide products by one of the manufacturers listed below, or by an NRTL listed equivalent manufacturer.
1. AFC Cable Systems, Inc.
  2. Gardner Bender.
  3. Hubbell Power Systems, Inc.
  4. Ideal Industries, Inc.
  5. IlSCO; a branch of Bardes Corporation.
  6. NSi Industries LLC.
  7. O-Z/Gedney; a brand of the EGS Electrical Group.
  8. 3M; Electrical Markets Division.
  9. Tyco Electronics.
  10. Square D, a Schnieder Electric Company
  11. Thomas & Betts
  12. Arrow-Hart Div, Crouse-Hinds Co
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

## **PART 3 - EXECUTION**

### **3.1 APPLICATIONS AND INSTALLATION**

- A. Feeders: Refer to Feeder Schedule on drawings.
- B. Branch Circuits: Stranded copper conductors.
- C. Where applicable for electrical equipment connections for aluminum wiring, provide the following supplemental requirements and work regardless of who furnishes the equipment or what type of equipment is affected.
1. Review equipment submittals, installation documents and nameplates to determine if there are any warranty or UL limitations regarding copper versus aluminum wiring connections at equipment.
  2. If there are any limitations, provide local non-fused disconnect at or near equipment (external to the equipment) and terminate aluminum conductors to the line side terminals of the disconnect switch. Provide copper conductors from load side terminals of the disconnect switch to the respective equipment factory disconnect or terminals as applicable.

3. Provide UL-Listed AA-8000 series compact-stranded conductors with insulation type compliant with specifications, prevailing codes and end-use equipment manufacturer requirements. Provide appropriately UL-Listed connectors as recommended by conductor manufacturer. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- D. Provide conductor insulation rated at 600VAC and 90 degrees C. Provide wire, cable and connectors suitable for the temperature, conditions and location where installed. Provide THHN/THWN insulation for conductors 500 kcmil and larger, and for conductors # 8 AWG and smaller. Provide THW or THHN/THWN insulation for other sizes as appropriate for the locations where installed. Provide XHHW-2 insulation for wiring below grade and for wiring subject to moisture conditions.
- E. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application. Provide with full parity sized insulated equipment ground conductor. Only use Portable Cord for flexible pendant leads to outlets, equipment where indicated, and only where permitted by NEC, by local authority having jurisdiction. Confirm application and color, case by case, with Design Professional.
- F. Grounded (“Neutral”) Conductors: Provide dedicated parity sized grounded (“neutral”) conductor for each branch circuit phase conductor fed from 15-ampere and 20-ampere branch circuit breakers. Provide grounded (“neutral”) conductor in all lighting control device (switch, dimmer, occupancy sensor, etc.) wall outlet boxes, even if not immediately used. Provide grounded (“neutral”) conductor for all multi-pole feeders. Provide grounded (“neutral”) conductor(s) for all multi-pole feeders and branch circuits unless this contractor determines in field that the affected load(s) will never have need for a grounded (“neutral”) conductor and NEC does not mandate otherwise.
- G. Complete raceway installation between conductor and cable termination points prior to pulling conductors and cables. Use manufacturer UL 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. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- H. Install wire in raceway unless specifically permitted otherwise in this specification section, under other Division 26 sections, or on electrical drawings. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- I. Do not pull wire until raceways are complete, plastering is complete, and raceways are free of moisture. Install joints and splices only at NEC approved panels, accessible junction boxes, or accessible outlet boxes. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or

lubricant, where necessary to prevent damage to conductors. Use pulling means, including fish tape, cable, rope, and basket weave wire/cable grips that will not damage cables and raceways. Do not use rope hitches for pulling attachment to wire or cable. Conceal work in finished spaces.

- J. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems." Use of synthetic or plastic "tie-wraps", "zip ties", "wire ties" and similar products are not permitted as a permanent means of anchoring, securing, supporting or otherwise installing any cables, conductors, conduits, raceways, devices, equipment or other electrical work.
- K. Neatly dress work. Install work parallel and perpendicular to surfaces and exposed structural members, and follow surface contours where possible. Keep conductor splices to minimum. Install splice and tap connectors that possess equivalent, or better, mechanical strength and insulation rating than conductors being spliced. Use splice and tap connectors that are compatible with conductor material. Install wires continuous from outlet to outlet. Provide insulation value of joints at least 100 percent more than that of the wire insulation. Provide adequate length of conductors within electrical enclosures, and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than #10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.
- L. De-rate cables per NFPA 70 where bundled, where passing through insulation, and where otherwise required to be compliant with NFPA 70 based on field conditions and/or means and methods that will be used. De-rate conductors per NFPA 70 where required based on quantities of conductors within raceways, and where otherwise required to be compliant with NFPA 70 based on field conditions and/or means and methods that will be used.

### **3.2 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-486B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors. Install conductor at each outlet with at least 8 inches of slack.
- B. Provide complete assembly of materials for each type of required electrical connection, including but not limited to, pressure connectors, terminal (lugs), electrical insulating tape, heat shrinkable insulating tubing, cable ties, solderless wire-nuts, and other items and accessories as needed to complete splices and terminations of types indicated.
- C. Unless otherwise indicated, provide wires/cables (conductors) for electrical connections that match, including sizes and ratings, of wires/cables that are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 90 degrees. Provide factory splice kits (U.L. approved for submersion in water and direct

burial) for wire splicing in outdoor grade, or slab on grade, junction boxes and for all other wet locations.

- D. Provide electrical connectors and terminals that mate and match, including sizes and ratings, with equipment terminals, and that are recommended by equipment manufacturer for intended applications. Connect wires #6 AWG and larger to panels and apparatus by means of approved lugs or connectors large enough to enclose all strands of the conductors. Provide solderless type connectors
- E. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment. Cover splices with electrical insulating material to achieve insulation at least 100 percent in excess of electrical insulation rating of those conductors being spliced. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Do not "ring" copper conductors while skinning wire.
- F. There may be cases where circuit or feeder conductor sizes are too large or too small to fit into the lugs normally supplied with the power distribution equipment or end-use equipment, due to circumstances such as increasing conductor sizes to offset voltage drop, unusual breaker frame sizes, type of conductors used, etc. In such cases provide appropriate factory lug kits for affected equipment if recommended by manufacturer; elsewhere provide insulated butt-splices with tails sized to fit respective lugs.
- G. Ground metal frames of portable and stationary direct-wired electrically operated equipment by connecting frames to the circuit equipment grounding conductor and to grounded metal raceway. Provide necessary electrical connections between the specified equipment and junction boxes, disconnect switches, and starters near equipment with flexible metallic conduit and matched connectors. Do not expose flexible conduit in finished areas.

### **3.3 CONDUCTOR SIZING**

- A. Conductor sizes indicated in Division 26 documents are based on copper unless specifically indicated otherwise on single-line diagram on drawings.
- B. Provide minimum #12 AWG conductor size, unless specifically indicated otherwise on drawings.
- C. Unless specifically indicated otherwise on drawings, provide grounded ("neutral") conductors that are at least parity-sized with corresponding phase/line conductors for all applications.

**END OF SECTION 260519**