

SECTION 26 05 19 – WIRES AND CABLES – 600V AND BELOW

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The extent of the wire and cable work is indicated by Drawings and by requirements or other sections of the Specifications for cables used for power, lighting, signal, control and related system rated 600 volts or less. See below article "CABLES" for permitted use of Type MC Cables on this project.

1.2 CODES AND STANDARDS

- A. NEC Compliance: Comply with applicable requirements of NEC for construction and installation of wires/cables and connectors.
- B. UL Compliance: Comply with UL Stds 44, 83 and 486A, B and C. Provide wiring/cabling and connector products which are UL-listed and labeled consistent with their uses.
- C. ICEA Compliance: Insulated Cable Engineers Association Inc., Standard WC-5-86.
- D. IEEE Compliance: Institute of Electrical and Electronic Engineers, Standard 82-83.
- E. ANSI Compliance: American National Standard Institute, Standard C119.4

1.3 SUBMITTALS

- A. Provide submittals for compression lugs only; wire does not require submittal.
- B. Comply with Division 1 requirements.
- C. Compression Lug Product Data:
 - 1. Submit manufacturer's descriptive literature and produce specifications for each product.
 - 2. Manufacturer's product drawings.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide all wires and cables of sizes indicated on the Drawings and suitable for the temperature, conditions and location where installed. Install all wire in raceway.

2.2 CONDUCTOR MATERIAL

- A. Use copper conductors of 98% conductivity and rated at 600V for all wires and cables, unless otherwise noted.

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- B. Provide aluminum switchboard, transformer and panelboard feeders for 50amps and larger where permitted in these specifications and/or as indicated on the drawings. Where aluminum switchboard, transformer and panelboard feeders are used, they shall be sized according to NEC Article 310. Feeder sizes on the drawings are for copper conductors, unless otherwise noted.

- 1. All device and equipment feeds shall be copper unless specifically noted otherwise.

2.3 INSULATION

- A. No conductors smaller than No. 12 AWG shall be used unless noted elsewhere. All wires No. 8 AWG or larger shall be stranded. Wire sizes No. 12 and No. 10 AWG. shall be solid (stranded wire used for No. 12 AND 10 will not be permitted unless otherwise noted).
- B. Where permitted, aluminum wire shall be provided with compact strands.
- C. All conductors shall be provided with type THHN/THWN insulation, unless noted otherwise.
- D. All switchboard, transformer and panelboard feeder insulation shall be type XHHW-2.
- E. Each circuit shall be provided with a dedicated neutral wire. Sharing of neutral wire for multiple circuits shall not be permitted, unless otherwise noted.

2.4 CABLES

- A. Provide the following in NEC approved locations and project applications where indicated.
- B. Type MC Cable: Provide Metal Clad Cable wiring using two No. 12 or 10 AWG with separate insulated copper ground wire (unless noted otherwise). Where AC (armored cable without separate neutral) is installed, Contractor will be required to remove cable and reinstall with approved cable type at no additional cost to the owner. Metal Clad cable may be used on this project only as follows:
 - 1. For lighting and receptacle branch circuits from panel to device(s) or light fixture(s).
 - 2. Connection to motors (2 feet maximum).
 - 3. Fishing existing walls.
 - 4. Branch circuits in stud walls.
 - 5. Mechanical equipment/miscellaneous branch circuits inside of the building (less than 50amps) where condition warrants.
- C. Where MC cables are run in parallel (i.e., down corridors), the Contractor shall bundle the cables and zip tie them together.
- D. The Contractor shall bear all costs related for removing MC cable not pre-approved. Support and secure type MC cable at intervals not exceeding 6'-0". In addition, type MC cable must be supported within 12" of every fitting, junction box or outlet box that the cable enters.
- E. All other wiring shall be installed in conduit as specified in Division 26 "Raceways," unless approved otherwise by the Engineer prior to installation.
- F. All switchboard, transformer and panelboard feeder wiring shall be run in conduit.

2.5 CONNECTORS FOR CONDUCTORS

- A. Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

2.6 ALUMINUM AND COPPER COMPRESSION LUGS

- A. All aluminum cables shall have compression lugs at both ends of the cable. Under no circumstances shall the contractor attach aluminum cables directly to mechanical lugs.
- B. Contractor may use copper compression lugs with copper cables at their discretion.
- C. Manufacturer: Compression Lugs shall be Blackburn as manufactured by Thomas & Betts, or equal.
- D. Aluminum NEMA Lugs
 - 1. Lugs, splices and tees shall meet or exceed ANSI C119.4 requirements for Aluminum lugs and splices.
 - 2. Lugs, splices and tees shall be dual-rated for use with both aluminum and copper conductors.
 - 3. Lugs, splices and tees shall be made from high strength, high conductive aluminum alloy.
 - 4. Lugs, splices and tees shall be prefilled with oxide inhibitor to prevent oxidation and keep out moisture.
 - 5. Splices and tees shall have solid center stops to insure proper cable insertion depth.
 - 6. Lugs, splices and tees shall be marked with conductor sizes and die references for easy identification.
 - 7. Lugs shall be provided for all aluminum wire connections. Where aluminum wire is to terminate at mechanical lugs, provide bi-metal pin terminal compression lug to allow the mechanical lug to clamp on a copper pin.

PART 3 - EXECUTION

3.1 WIRES AND CABLES

- A. General: Install electrical cables, wires, and connectors in compliance with NEC. Coordinate cable installation with other work. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.
- B. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.
- C. **While installing cables, care shall be taken to protect outer coating. If outer coating is damaged, contractor shall remove and reinstall cables.**
- D. Conceal all cable in finished spaces. Install exposed cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours, where possible. Keep conductor splices to minimum.
- E. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced. Use splice and tap connectors which are compatible with conductor material.

- F. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Make terminations so there is no bare conductor at the terminal. Provide wire ties and neatly train and rack wires in all boxes, panels, and other areas as required.
- G. 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 486A and UL 486B.
- H. Each branch circuit shall be provided with a dedicated neutral wire, unless noted otherwise.
- I. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.2 FIELD QUALITY CONTROL

- A. Prior to energizing, provide the following tests to all cables, 600 Volt or less and size no. 3 AWG or larger:
 - 1. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - 2. Test bolted connections for high resistance using one of the following:
 - a. A low-resistance ohmmeter.
 - b. Calibrated torque wrench.
 - c. Thermographic survey.
 - 3. Inspect compression-applied connectors for correct cable match and indentation.
 - 4. Inspect for correct identification.
 - 5. Inspect cable jacket and condition.
 - 6. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration. Use an industry approved meter for all tests.
 - 7. Continuity test on each conductor and cable.
 - 8. Uniform resistance of parallel conductors.
 - 9. All inspection, cleaning and testing procedures shall be in compliance with the recommendations and standards outlined in the "maintenance testing specifications for electrical power distribution equipment and systems", latest edition, published by International Electrical Testing Association (NETA).
- B. Prepare test and inspection reports and locate in the O&M manuals at the completion of the project. Test and inspection reports shall be provided to record the following:
 - 1. Procedures used.
 - 2. Results of above tests that comply with requirements.
 - 3. Results that do not apply, corrective action taken, and retesting showing that they comply with the above requirements.
- C. Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.

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D. Color-Coding for Phase Identification:

1. Color-code secondary service, feeder, and branch circuit conductors with factory-applied color as follows:
- | Phase | 120/208 Volts | 120/240 Volts | 277/480 Volts |
|----------|---------------|-------------------|------------------------|
| A | Black | Black | Brown |
| B | Red | Orange (High-Leg) | Orange |
| C | Blue | Blue | Yellow |
| Traveler | Yellow | Yellow | Yellow w/ "T" tag |
| Neutral | White | White | Gray |
| Ground | Green | Green | Green w/ Yellow stripe |
2. Switch legs shall include an additional "S" tag.
3. Provide visible colored taped as listed above at all termination points for No. 8 and larger wires.

END OF SECTION 26 05 19