

SECTION 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SCOPE OF WORK:

- A. Requirements of Section 260100 shall apply.
- B. This Section applies to secondary power and signaling conductors for systems rated 600 volts and below.
- C. A complete system of conductors shall be installed in the raceway systems as specified here and shown on drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section 260553 – Identification for Electrical Systems

1.3 APPLICABLE SPECIFICATIONS AND STANDARDS:

- A. Compliance: The materials specified here shall meet the following specifications and standards in their current edition.
- B. UL Standards:
 - 1. Insulation tape
 - 2. Wire Connectors and Soldering lugs
- C. NEMA Standards:
 - 1. Thermoplastic - Insulated WC 5 (IPCEA S-61-402)
- D. General:
 - 1. All wire and cable shall be listed by an “approved” third party testing agency by the North Carolina Building Code Council.
 - 2. Prior to energizing, power circuits shall be tested for electrical continuity and short circuits. A copy of these tests shall be sent to the Engineer prior to energizing cables.
 - 3. All wire and cable shall be run in raceway, unless otherwise specifically noted.

PART 2 - PRODUCTS

2.1 CONDUCTORS:

- A. All conductors shall be made of copper, except as otherwise noted. All wire shall be new, manufactured within 12 months of project award. If requested, contractor shall provide manufacturer's certification giving date of manufacture.
- B. Conductors, unless otherwise noted, shall be heat and moisture resistant grade, thermoplastic insulated. Conductors No. 8 AWG and larger shall be stranded Class B copper conductors, dual rated, Type THHN-THWN or XHHW. Conductors No. 10 and smaller shall be solid copper, Type THHN-THWN (dual rated), or XHHN, except otherwise required below.
- C. The minimum branch circuit conductor size shall be No. 12 AWG and the maximum conductor size allowed shall be 500 KCM.
- D. Conductors for branch circuits whose length from panel to the first outlet in the circuit exceeds 50 feet for the 280/120 volt system shall not be smaller than No. 10 AWG, but not smaller than what is scheduled on panelboard schedule. Conductors for branch circuits whose length from the panel to the first outlet box in the circuit exceeds 125 feet for the 480/277 volt system shall not be smaller than No. 10 AWG, but not smaller than what is scheduled on panelboard schedule.
- E. Branch circuit conductors for all other lighting fixtures shall have a temperature rating of not less than what is required by the UL listing of the fixture with a minimum rating of 90 degrees C.
- F. Except as otherwise noted on technical specification sections, conductors for signal and control circuits above 50 volts AC shall be stranded type, THWN-THHN as permitted by NEC, No. 14 AWG. Conductors for signal and control circuits below 50 volts AC or DC may be 300-volt, PVC insulated, stranded No. 14 AWG, except as otherwise noted on corresponding technical section of this specification.
- G. Conductors being connected to transformers and other equipment shall have a temperature rating as required by the transformer or equipment manufacturer.

2.2 COLOR CODING:

- A. Conductors, feeders, and branch circuits shall be color coded by phases as follows:
 - 1. 480/277 volts systems: Phase A-Brown; Phase B-Orange; Phase C-Yellow; Neutral-Natural Gray; Grounding Wire-Green
 - 2. 208/120 volts systems: Phase A-black; Phase B-red; Phase C-blue; neutral-white; Grounding wire-green.
 - 3. Insulating tape of proper color shall be used to identify the phase conductors No. 4 AWG and larger conductors. Conductors #6 AWG and smaller shall be factory color coded.

PART 3 - EXECUTION:

3.1 SPLICES:

A. Solid Conductor Splices:

1. Solid conductors namely those sized #10, #12, and #14 AWG copper, shall be spliced by twisting securely and by means of Ideal 'wing nuts', 3M Company's 'Scotchlok' or twist on wire connectors in junction boxes and light fixtures.
2. "Sta-Kon" or other permanent type crimp connectors shall not be used.

B. Stranded Conductor Splices:

1. Namely #6 AWG and larger, shall be spliced by approved mechanical pressure type connectors or lugs plus gum rubber tape or friction tape. Solderless mechanical connectors, for splices and taps provided with U.L. approval insulating covers, may be used instead of mechanical connectors plus tape. Circuit joints shall not be made with terminal screws of wiring devices.

3.2 SPLICES IN WET LOCATIONS

- A. Splices in wet locations like within handholes or outdoor junction boxes shall be made as specified above except that splice shall be insulated utilizing UL listed, heat-shrink waterproof insulation kit suitable for wet locations. Submit proposed kit information along with manufacturer's installation requirements for approval by Engineer.

3.3 INSTALLATION OF CONDUCTORS:

- A. Conductors shall be continuous from outlet to outlet, and no splices shall be made except within outlet or junction boxes, troughs and gutters. Pull boxes may be utilized where required. If other than long radius bends are required, pull boxes sized in accordance with the NEC shall be used. Location of feeder pull boxes shall be subject to approval by Engineer and shall be included with installation drawing submittal specified under Section 260100 - General Provisions - Electrical.
- B. Conductors in vertical runs shall be supported as required by NEC utilizing listed and approved support fittings.
- C. Conductors shall be labeled within all junction boxes, etc. using plastic "punch" tape identifying the conductors according to circuit numbers.
- D. Where connected under screw or bolt heads, stranded wire shall be fitted with a lug of proper size. Make solid conductor loops clockwise so as to be forced closed as screw is tightened. Only one solid wire loop may be held under a single screw.
- E. Make all connections tight. Torque-tighten all connections to lugs per manufacturers' and UL requirements.

- F. Wires within panel boards, terminal cabinets and similar equipment shall be neatly squared and “bunched” together and held with plastic ties.
- G. Provide a dedicated, separate neutral conductor for each circuit requiring a neutral. The neutral carrying all or any part of the current of any specific load or run shall be contained in the same raceway or enclosure with the phase wire or wires also carrying that current. No split neutrals permitted. For lighting, motor, appliance, circuits and receptacle circuits where two or more circuits are run in the same conduit, provide a separate neutral for each circuit.
- H. Provide oversized conductors to compensate for voltage drop as needed to compensate for the voltage drop limitations specified above or as indicated on drawings. The more stringent sizing shall apply.
- I. Under the above requirements and with required color coding system, no feeder or branch circuit raceway will contain more than one wire of the same color, except for switch legs and control circuits. The only exception is as otherwise noted for 208, 240 or 480 volts, single phase branch circuits.
- J. Insulation on conductors #6 AWG and smaller shall be suitable colored in manufacturing.
- K. Unless noted otherwise, or another arrangement is approved by the Engineer, busses in panels and switchgear shall be considered “A”, “B”, and “C” from left to right, top to bottom, or front to back when facing equipment.
- L. Control and signal wiring shall not use the above named colors except green for grounding. Any other colors or striping may be used but the coding shall provide same color or striping between any two terminals being jointed.
- M. Group and tie conductors per circuits as required by NEC.

3.4 CONDUCTOR SEQUENCE AND ROTATION:

- A. All feeders, sub-feeds to panels, motors, etc., shall be completely phased out as to sequence and rotation. Phase sequence shall be A-B-C from front to rear, top to bottom, left to right when facing equipment.

3.5 CONNECTION OF OVERSIZED CONDUCTORS TO CIRCUIT BREAKERS AND SWITCHES:

- A. When oversized branch circuit conductors are scheduled to be connected to circuit breakers, or switches, not having the capability to accept the larger conductor, provide splice in suitable junction box as close as possible to circuit breaker, but not further than 10 feet from circuit breaker, equipment or device being connected, as approved by the A/E, and connect to circuit breaker with the largest conductor that fit the circuit breaker.

3.6 CIRCUIT IDENTIFICATION:

- A. Identify circuits by origin, circuit number and voltage at each handhole, junction box and light fixture utilizing methods as specified in Section 260553 – Identification for Electrical Systems

3.7 CONDUCTOR INSULATION RESISTANCE TEST:

- A. All new current carrying phase conductors and neutrals shall be tested as installed, before connections are made, for insulation resistance and accidental grounds. Where new conductors are spliced to existing conductors, the entire length of cable shall be tested. This shall be done with 500-volt megger. The procedures listed below shall be as follows:
1. Minimum reading shall be one million or more ohms for #6 AWG wire and smaller, 250,000 ohms or more for #4 AWG wire or larger, between conductors and between conductor and the grounding conductor.
 2. The contractor shall submit to the Engineer certified circuit insulation test results. The test certifications shall identify the circuit, when the test was accomplished, the name of the electrician that conducted the test and the name of the person responsible for the test, test values and signature of person responsible for the test. SUBMITTALS INDICATING "PASS/NOT PASS" TESTING RESULTS THAT DO NOT INCLUDE SPECIFIC OHMIC READINGS FOR EACH TEST ARE NOT ACCEPTABLE AND SHALL BE REJECTED BY ENGINEER.

END OF SECTION 260519