SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the 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.
2. Metal-clad cable, Type MC.
3. Luminary cable.
4. Connectors, splices, and terminations.

B. Related Requirements:

1. Section 27 15 13 "Communications Copper Horizontal Cabling" for twisted pair cabling used for data circuits.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.4 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 an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company.
2. Belden Inc.
3. Cerro Wire LLC.

4. General Cable Technologies Corporation.
5. Okonite Company (The).
6. Prysmian Group.
7. Southwire Company.
8. WESCO.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type XHHW: Comply with UL 44.
2. Type XHHW-2: Comply with UL 44.

F. Aluminum conductors will not be permitted on this project.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems; a part of Atkore International.
2. Alpha Wire Company.
3. Belden Inc.
4. General Cable Technologies Corporation.
5. Okonite Company (The).
6. Prysmian Group.
7. Southwire Company.
8. WESCO.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:

1. Type XHHW: Comply with UL 44.
2. Type XHHW-2: Comply with UL 44.

H. Armor: Aluminum, interlocked.

2.3 LUMINARY CABLE

A. Description: A factory assembly of insulated current-carrying conductors, including two phase conductors, one equipment ground, and two low-voltage control conductors, in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems; a part of Atkore International.
2. Encore Wire Corporation.
3. Southwire Company.

C. Standards:

1. Underwriters Laboratories Standards: UL-66, UL-83, UL-1479, UL-1569, UL-1581, UL-2556.
2. Federal Specification A-A-59544.
3. ASTM-B3 and B8.
4. NFPA 70 Article 250.118(10)(a), 300.22(C)(1), 330, 392, 396, 501, 502, 503, 504, 505, 518, 520, 530, 645, 725.
5. ARRA 2009 Section 1605 "Buy American• " Compliant.
6. UL CRD Type MC-PCS - 12/19/2014 (Effective 2/1/2015).
7. L Listing #E-301130.

D. Circuits:

1. Single LED or Fluorescent dimmable lighting circuit.

E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation: Color-coded PVC compound meeting the required thickness of Type THHN/THWN-2 with a heat-stabilized Nylon rated for 90ºC for use in dry or wet locations.

H. Armor: Aluminum, interlocked.

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 a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. 3M Electrical Products.
2. ABB (Electrification Products Division).
3. Atkore International (AFC Cable Systems).
4. Emerson Electric Co. (Automation Solutions - Appleton - O-Z/Gedney).
5. Gardner Bender.
6. Hubbell Incorporated (Hubbell Power Systems).
7. Ideal Industries, Inc.
8. ILSCO.
9. NSi Industries LLC.
10. Service Wire Co.
11. TE Connectivity Ltd.

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. Listed for use with applicable conductor types.
2. Type: One or two hole as required, standard barrels.
3. Termination: Compression or crimp.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

1. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Lighting Circuits: Copper. Solid for phase and ground conductors; stranded for control conductors.

D. ASD Output Circuits Cable: Extra-flexible stranded for all sizes #8 or larger.

E. Minimum Wire Size, All Power and Lighting Applications: No. 12 AWG.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exterior:

1. Service Entrance: Type XHHW-2, single conductors in raceway.
2. Feeders: Type XHHW-2, single conductors in raceway.
3. Branch Circuits: Type XHHW-2, single conductors in raceway.

B. Interior:

1. Feeders: Type XHHW, single conductors in raceway.
2. Branch Circuits: Type XHHW, single conductors in raceway, unless noted otherwise.

    a. All conductors No. 8 AWG and larger shall be Type XHHW-2.

C. Lighting Circuits, LED and Fluorescent Dimmable: Luminary cable.

1. Luminary cable may be fished in the voids of existing masonry walls for wiring to luminaires or devices in lieu of cutting, patching and refinishing.

D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

E. Metal-clad Cable, Type MC may be used in the following applications:

1. In rooms in lieu of conduit and wire for branch circuits No. 10 AWG and smaller from the first junction box or outlet box after the branch circuit home run wiring enters the room.

    a. Install conduit and wire for branch circuit homerun wiring from the panelboard to the first junction or outlet box within the room, as well as between rooms on the same circuit. The first junction box or outlet box shall be located within the room where the utilization equipment and wiring devices, etc., are located.
2. Fished in the voids of existing masonry walls for wiring to wiring devices in lieu of cutting, patching and refinishing.
3. Final connection to lighting fixtures in lengths not exceeding 6 feet. Do not wire directly from fixture to fixture, each recessed light fixture shall be wired from a junction box.
4. Final connection to chain hung industrial-style fixtures in mechanical, electrical, and unfinished support spaces.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. General Installation

1. Install conductor and cable types only where specifically permitted for use by NFPA 70.
2. Provide separate neutral conductor for every interior branch circuit. Shared neutral conductors will not be permitted.
3. Install conductors continuous between outlets without splicing except in approved junction boxes.
4. Conceal cables in raceway within finished walls, ceilings, and floors unless otherwise indicated.

5. All conductors shall be installed in raceways unless noted otherwise. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
6. Exact location, material, and thickness of all walls to be chased or cut for installation of wiring shall be verified with Architect and General Contractor before commencing work.
7. Install detectable warning tape above all underground cable, 12 inches below finished grade.
8. 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.
9. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
10. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
11. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."
12. Inspect exposed sections of existing cable and conductors for physical damage, condition of insulation or jacket, compression connectors with proper cable match and indentation, and correct identification.

B. Metal-clad Cable, Type MC

1. Install only where explicitly permitted by NFPA 70.
2. Do not install exposed, in areas without ceilings, or in new masonry walls.
3. MC cable may be run concealed above ceilings or where concealed in wood or metal stud walls or where concealed in furred out walls.
4. Installation of MC cable shall meet latest NEC and NECA 120 installation requirements.

C. Luminary Cable

1. Install only where explicitly permitted by NFPA 70.
2. Do not install exposed, in areas without ceilings, or in new masonry walls.
3. Luminary cable may be run concealed above ceilings or where concealed in wood or metal stud walls or where concealed in furred out walls.
4. Installation of Luminary Cable shall meet latest NEC and NECA 120 installation requirements.
5. When furnished with a PVC jacket, Luminary Cable may be surface mounted, fished, or embedded in plaster in wet, damp, or dry locations, interior or exterior. PVC-jacketed Luminary Cable may also be installed in corrosive conditions, directly buried in earth, or embedded in concrete.

D. ASD Output Circuits

1. Type TC-ER cable shall be used for all ASD-controlled motors rated at or above 10Hp, 480 V or 208 V, three phase.
2. Provide standard branch circuit conductors from the equipment disconnect switch to the ASD and make final connections.
3. Provide ASD cabling from the ASD to the motor and make final connections.
4. Provide all cabling with approved termination fittings.

3.4 CONNECTIONS

A. Splice connectors, No. 8 AWG and smaller: Wing-nut, compression solderless connector.

B. Splice connectors, No. 6 AWG and larger: Split bolt pressure connector or compression connector, short-sleeve.

C. Lug connectors, connection to motor leads: Compression or crimp connector, standard or short-sleeve.

D. Lug connectors, stranded wire under binding screw or bolt: Compression or crimp connector, standard or short-sleeve.

E. Lug connectors, connection to bus or terminal: Compression or crimp connector, standard or short-sleeve, or bolted pressure connector.

F. 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.

G. 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.

H. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

I. Fasten lugs on motor leads with brass machine bolds, lock washers, and nuts.

J. Do not terminate stranded wire under a binding screw or bolt unless connector is explicitly listed for use with stranded wire.

K. Tighten all screws and terminal bolts using torque wrench to manufacturer or code required tightness.

L. Cap all spare conductors with UL listed end caps.

M. Terminate only one conductor per terminal or lug unless connector is listed for use with more than one conductor.

N. All connections made below grade shall be made with UL listed waterproof connectors.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."

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 26 05 44 "Sleeves and Sleeve Seals for Electrical 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 according to Section 26 84 13 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. 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 the following visual and electrical tests:

a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
b. Test bolted connections for high resistance using one of the following:

1) A 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 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.
g. Continuity test on each conductor and cable.
h. Uniform resistance of parallel conductors.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the 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