

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - Building wire and cable
 - Remote control and signal circuits
 - Splices, connectors, and terminations
 - Armored cable type AC and metal clad cable type MC
- B. Substitutions: Substitute products will be considered only under the terms and conditions of Section 26 05 00 - Common Work Results For Electrical.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. National Electrical Manufacturers Association (NEMA).
- C. Underwriter's Laboratories, Inc. (UL).

1.3 DEFINITIONS

- A. VFC: Variable frequency controller.

1.4 SUBMITTALS

- A. Make submittals in accordance with Section 26 05 00 - Common Work Results for Electrical.
- B. Submit product data for type AC and MC cables, connectors and manufacturer's recommended sheath cutting procedure including special tools.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 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.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THW-2, Type THHN-THWN, Type XHHW-2, and Type SO.

- D. Multi-conductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for armored cable, Type AC, metal-clad cable, Type MC, mineral-insulated, metal-sheathed cable, Type MI, and Type SO with ground wire.
- E. Fire Rated Cable: Compliant with application, rated for **[90][120]** minutes.
 - 1. Underwriter's Laboratories Circuit Integrity Systems (FHIT). Type RHW in compatible raceway (horizontal runs only)
 - 2. Underwriter's Laboratories Fire Resistive Cable (FHJR). Mineral Insulated Cable.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 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.
- B. Description: UL listed, factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- C. For #14 through #10 AWG wire sizes, provide insulated spring wire connectors or insulated compression connectors.
- D. For #8 AWG wire, use solderless pressure connectors with insulating sleeves.
- E. For #6 AWG and through #2, optional use split bolt connectors with manufactured insulation covers or tape sufficient to provide 150% insulation level.
- F. For #6 and larger: Compression connectors using compression dies designed for the exact connector being terminated. Provide insulating sleeves manufactured specifically for the connector being used. Mechanical termination integral to overcurrent protective devices are also acceptable.

2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

2.4 ARMORED CABLE (TYPE AC)

- A. Manufacturer: AFC Cable Systems, Interflex, Okonite, Rockbestos, AFC.

- B. Multi Conductor: Type AC with 2, 3, or 4 insulated copper conductors in sizes #12 AWG or #10 AWG.
 - 1. Fibrous Covering: Individual for each conductor.
 - 2. Bonding Strip: Minimum #16 AWG applied between the conductor assembly and the armor for the entire length of the cable.
 - 3. Armor: Interlocking galvanized steel or aluminum.
 - 4. Ground Conductors: Each cable shall contain a green insulated ground conductor.
 - 5. UL listed in accordance with UL4.

- C. Connectors
 - 1. UL listed for use with the type of cable installed.
 - 2. Manufacturer: AFC Cable Systems, Crouse-Hinds, Regal, Thomas and Betts.

2.5 METAL CLAD CABLE (TYPE MC)

- A. Manufacturer: AFC Cable Systems, Interflex, Okonite, Rockbestos, AFC.

- B. Multi Conductor: Type MC with 2, 3, or 4 insulated copper conductors in sizes #12 AWG or #10 AWG.
 - 1. Armor: Interlocking galvanized steel or aluminum or continuous aluminum corrugated sheath.
 - 2. Ground Conductors: Each cable shall contain a green insulated ground conductor.
 - 3. UL listed in accordance with UL 1569.

- C. Connectors
 - 1. UL listed for use with the type of cable installed.
 - 2. Manufacturer: AFC Cable Systems, Crouse-Hinds, Regal, Thomas and Betts.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

- B. Branch Circuits: Copper. Solid or stranded for No. 10 and No. 12 AWG at the contractor's option; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders and Branch Circuits: Type THHN-THWN, single conductors in raceway.

- B. Feeders and Branch Circuits Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.

- C. Feeders and Branch Circuits Concealed in below grade concrete walls, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

- D. Feeder and Branch Circuits exposed above roofing: XHHW-2.
- E. Fire Rated Feeders: Mineral-insulated, metal-sheathed cable, Type MI. Installed within the limitations of the product listing and in accordance with manufacturer's instruction. Routing shall provide access for maintenance. Rigidly secure manufacturer's cable supports to structure.
- F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- G. VFC Output Circuits: Type XHHW in metal conduit.
- H. Oversize neutral conductors for receptacle circuits using common neutrals, including those to power poles and powered furniture partitions for possible non-linear loads. See drawings for sizing criteria.
- I. Color Coding
 - 1. Color code wire in accordance with the coding shown below:

3.3

	<u>208Y/120V</u>	<u>480Y/277V</u>
A Phase (Left bus in panel):	Black	Brown
B Phase (Center bus in panel)	Red	Orange
C Phase (Right bus in panel)	Blue	Yellow
Neutral	White	Gray
Equipment Ground	Green	Green
Isolated Ground	Grn/Yel*	Grn/Yel*

- 2. If large conductors cannot be purchased with the correct insulation color, color code the conductors with wire and cable markers of the appropriate color. Completely encircle the conductor with color coding tape for a minimum length of 6 inches at all accessible locations.
- 3. In the event that separate neutrals are specified with each phase conductor, provide a white neutral conductor with a tracer of the same color as the corresponding phase conductor.

3.4 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 according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to 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 according to Section 26 05 29 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 26 05 36 "Cable Trays for Electrical Systems" prior to installing conductors and cables.
- H. Utilize type THHN/THWN wire for all power, lighting circuits except where the ambient temperature is below 0°C, use Type XHHW installation. Refer to Section 26 24 21 for cabling for Isolated Power Systems.
- I. Install all wiring in a raceway system unless otherwise specified.
- J. Install wire only after building interior has been protected from the weather.
- K. Install wire only after mechanical work likely to damage wire has been completed.
- L. Completely and thoroughly swab exterior raceways before installing wire.
- M. Pull all conductors into a common raceway simultaneously.
- N. Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- O. Neatly train and lace wiring inside boxes, equipment and panelboards.
- P. Provide conductor vertical supporting device as required by NEC 300-19.
- Q. Conductors from one system shall not be intermixed in the same raceway as another system unless shown otherwise. Examples of circuits not to be intermixed are 480Y/277 with 208Y/120 volt circuits, emergency power, line voltage circuits with low voltage wiring, etc.
- R. Provide separate neutrals for all single phase circuits.

3.5 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.
- B. 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.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.6 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.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.8 PENETRATIONS

- A. Penetrate fire barriers, smoke barriers, vapor barriers, roofing materials and other rated architectural elements in a manner that preserves the rating of the architectural element.
- B. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 84 13 "Penetration Firestopping."

3.9 REMOTE CONTROL & SIGNAL CIRCUITS

- A. Sizing - #16 AWG minimum.
- B. Installation:
 - 1. Install cables in cable tray and cable rings.
 - 2. Provide protection for exposed cables where subject to damage.
 - 3. Support cables above accessible ceilings; do not rest on ceiling tiles.
 - 4. Use suitable cable fittings and connectors.

3.10 ARMORED CABLE (TYPE AC) and METAL CLAD CABLE (TYPE MC)

- A. Uses Permitted
 - 1. At the contractor's option, type AC and/or MC cable may be used in a concealed, dry, interior locations for conductor sizes #10 and smaller.
 - 2. AC and MC cable may only be used for branch circuits serving devices.
- B. Uses Not Permitted
 - 1. Exposed, wet, damp or exterior locations.
 - 2. In hazardous (classified) locations except as permitted in NEC articles 501, 502, 503, 504 and 505.
 - 3. Type AC and MC cables may not be used for circuit homeruns.
 - 4. Type AC and MC cable may not be used for low voltage or communications systems, including fire alarm system.
 - 5. Type AC and MC cable may not be used for emergency system circuits (per NEC).
- C. Sizing
 - 1. Minimum #12 AWG for power and lighting circuits.
 - 2. Oversize neutral conductors for receptacle circuits using common neutrals, including those to power poles and powered furniture partitions for possible non-linear loads. See drawings for sizing criteria.
- D. Color Coding

1. Color code wire in accordance with Section 26 05 19 - 3.1 B.

E. Installation

1. Install cable in accordance with the manufacturers recommended procedures. Cut cables only with the special tools provided by the cable manufacturer; the use of wire cutters or hacksaws for armor cutting is not permitted.
2. Install cables only after building interior has been protected from the weather.
3. Install wire only after mechanical work likely to damage wire has been completed.
4. Maintain 12" minimum clearance to high temperature (greater than 90° C) surfaces.

END OF SECTION