

## SECTION 26 05 13.10

### MEDIUM VOLTAGE CABLE (15 KV DISTRIBUTION FEEDER - VERTICAL SHAFT)

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Material and installation requirements for:
    - a. Medium voltage cable (601 V and above).
    - b. Cable terminations and splices.
- B. Related Specification Sections include but are not necessarily limited to:
  - 1. **Section 26 08 13** – Medium Voltage Equipment Acceptance Testing.

##### 1.2 QUALITY ASSURANCE

- A. Referenced Standards:
  - 1. Association of Edison Illuminating Companies (AEIC).
    - a. CS8, Specification for Extruded Dielectric Shielded Power Cables Rated 5 Through 46 kV.
  - 2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    - a. 48, Standard for Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV.
    - b. 386, Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV.
    - c. 404, Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2.5 kV to 500 kV.
  - 3. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
    - a. WC 74/S-93-639, 5 - 46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.
  - 4. National Fire Protection Association (NFPA):
    - a. 70, National Electrical Code (NEC).
    - b. 70E, Standard for Electrical Safety in the Workplace.
  - 5. National Institute for Certification in Engineering Technologies (NICET).
  - 6. National Institute of Standards and Technology (NIST).
  - 7. Occupational Safety and Health Administration (OSHA).
  - 8. Underwriters Laboratories, Inc. (UL):
    - a. 1072, Standard for Medium-Voltage Power Cables.
  - 9. **Build America, Buy America Act (BABA).**

##### 1.3 SUBMITTALS

- A. Shop Drawings:
  - 1. Product data:
    - a. **Provide submittal data for all products specified in PART 2** of this Specification Section.
- B. Informational Submittals:
  - 1. Product data sheets.
  - 2. Pulling Tension, installation instructions.

3. Accessories data sheets (breakout boots, cable glands, special tools, etc).
4. Manufacturer cable test reports.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Ship cable with removable watertight end seals, and store in dry place.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
  1. Wire and cable:
    - a. Prysmian Group.
    - b. United Wire & Cable.
    - c. Approved Equal.
  2. Lugs, connectors and terminations:
    - a. 3M.
    - b. Elastimold by Thomas & Betts.
    - c. Joslyn.
    - d. TE Connectivity Raychem.
    - e. Eaton Cooper Power Systems.

#### **2.2 MEDIUM VOLTAGE CABLES**

- A. Ratings:
  1. 15 kV class.
- B. Application:
  1. Vertical mine shaft.
  2. Three conductor cable and grounding conductor.
  3. High tensile strength capabilities for vertical installations greater than 1,000'.
- C. Standards:
  1. NEMA/ICEA WC 74/S-93-639: 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.
  2. ICEA S-75-381: Portable and Power Feeder Cables for Use in Mines.
  3. AEIC CS8: Specification for Extruded Dielectric Shielded Power Cables Rated 5 through 46 kV.
  4. UL 1072: Type MV-105, For CT USE Direct Buried/Sunlight Resistant.
- D. Conductor Material:
  1. Regular or compressed concentric stranded copper.
- E. Insulation:
  1. Temperature rating: Type MV-105 per NFPA 70.
  2. Ethylene-propylene-rubber (No-Lead EPR).
  3. 133% (220-mil) insulation level.
- F. Shielding:
  1. Shielding on cables rated above 2 kV consists of:
    - a. Free stripping, semiconducting conductor shield.
    - b. Free stripping, semiconducting insulation shield.
    - c. Non-magnetic, 5 mil copper tape over insulation shield with 25% overlap.

2. Color coded polyester ribbon phase identifiers:

VOLTAGE	PHASE A	PHASE B	PHASE C	NEUTRAL	GROUND
12.47 KV	RED	ORANGE	BLACK	N/A	BARE CU
4.16 KV	RED	BLACK	BLUE	N/A	BARE CU
480Y/277 V	BROWN	ORANGE	YELLOW	GREY	GREEN
208Y/120 V	BLACK	RED	BLUE	WHITE	GREEN

G. Grounds:

1. Bare uncoated copper.
2. Size as specified in Bid Documents.

H. Sheath

1. Continuously corrugated & welded armored OR interlocked armored OR polymeric armored cable.

I. Jackets:

1. Waterproof, oil resistant, sunlight resistant outer jacket.
2. Jacket Color Codes:

<b>1000 V OR LESS CABLES</b>	BLACK
<b>5 KV CABLES</b>	YELLOW
<b>15 KV CABLES</b>	RED

**2.3 CABLE ACCESSORIES**

A. Lugs and Connectors:

1. Lugs:
  - a. Compression type.
  - b. Standard: UL 486A for copper cables.
  - c. Voltage rating: Up to 35 kV.
  - d. Current rating: Continuous operation at the rating of the cable.
  - e. Material: Tin-plated copper.
  - f. Number of holes: Two, except one on motor leads.
2. Splice connectors:
  - a. Standard: UL 486A for copper cables
  - b. Current rating: Continuous operation at the rating of the cable.
  - c. Material: Tin-plated copper.

B. Terminations:

1. End caps:
  - a. Cold or hot shrink.
  - b. Used to environmentally seal and mechanically protect exposed cable ends.
2. Cold shrink kits:

- a. Standard: IEEE 48, Class 1 termination.
  - b. Voltage rating: Same as the cable rating.
  - c. Current rating: Continuous operation at the rating of the cable.
  - d. One-piece design, where high-dielectric constant stress control is integrated within an insulator made of silicone rubber.
  - e. Suitable for contaminated indoor and outdoor locations.
3. Molded rubber kit:
- a. Standard: IEEE 48.
  - b. Voltage rating: Same as the cable rating.
  - c. Current rating: Continuous operation at the rating of the cable.
  - d. One-piece design or modular with stress cone, where high-dielectric constant stress control is integrated within an insulator made of EPDM rubber.
  - e. Suitable for contaminated indoor and outdoor locations.
4. Elbow connectors:
- a. Standard: IEEE 386.
  - b. Voltage rating: Same as the cable rating.
  - c. Current rating: 200A (deadfront, loadbreak) or 600A (deadfront, deadbreak).
  - d. One-piece design, comprised of an insulation shield, insulation layer and an outer shield constructed of EPDM rubber.
  - e. Deadfront, loadbreak or deadbreak type with:
    - 1) Hot stick pulling eye.
    - 2) Grounding tab.
    - 3) Test point.
  - f. Accessories to be constructed in a similar manner as the elbow connector:
    - 1) Bushing inserts.
    - 2) Bushing well plugs.
    - 3) Feed thru inserts.
    - 4) Protective caps.
- C. Splices:
1. Cold shrink kits:
- a. Standard: IEEE 404.
  - b. Voltage rating: Same as the cable rating.
  - c. Current rating: Continuous operation at the rating of the cable.
  - d. One-piece design, comprised of an insulation shield, insulation layer and a silicone rubber body.
  - e. Suitable for indoor, direct burial or submersible applications.
2. Molded rubber kit:
- a. Standard: IEEE 386 or IEEE 404.
  - b. Voltage rating: Same as the cable rating.
  - c. Current rating: Continuous operation at the rating of the cable.
  - d. One- or multi-piece design, comprised of an insulation shield, insulation layer and an outer shield constructed of EPDM rubber.
  - e. Suitable for indoor, direct burial or submersible applications.
3. Modular separable molded rubber:
- a. Standard: IEEE 386.
  - b. Voltage rating: Same as the cable rating.
  - c. Current rating: 600A.

- d. One-piece design, comprised of an insulation shield, insulation layer and an outer shield constructed of EPDM rubber.
  - e. Deadfront, deadbreak type.
  - f. Components: T-body, insulating plug with cap, insulating plug with cap and stud, and connecting plug.
  - g. Suitable for submersible applications.
4. Motor lead kits:
- a. Voltage rating: Same as the cable rating.
  - b. Current rating: Continuous operation at the rating of the cable.
  - c. Material: EPDM rubber boot with nylon pin.
  - d. On shielded cables provide an additional EPDM rubber cold shrink sleeve.
- D. Cable Shield Grounding Adapters:
- 1. Type: Molded rubber with constant force spring and solder-blocked tinned copper braid pigtail.
  - 2. Waterproof, providing a positive seal for the cable jacket.
  - 3. May be integral with termination of splice device with Engineer's approval.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Do not install cable during wet conditions.
- 1. Prior to pulling cables, drain or pump out manholes and other low points if standing water is present.
  - 2. Blow out conduits with dried compressed air if moisture is present in conduits.
  - 3. Install end caps immediately on all cut ends of cable prior to pulling, and maintain end caps while pulling in cable.
    - a. If end caps are damaged, remove and install new end caps.
    - b. Do not remove end caps until ready to terminate or splice cable.
- B. Cable Installation in Shaft:
- 1. Secure vertical shaft cables per NEC Table 300.19 (A) requirements.
  - 2. Follow cable manufacturer guidance on vertical tension limits on supporting members.
- C. Do not install conductors when ambient temperature is near minimum as recommended by manufacturer for installation of the type of conductor insulation.
- D. Provide components in kit form, complete with instructions, supplied by a single approved manufacturer and suitable for each shielded cable termination.
- 1. Select correct termination to match cable diameter and construction.
  - 2. Form and install terminations in strict accordance with instructions of cable manufacturer and termination manufacturer.
- E. Splices:
- 1. Provide components in kit form, complete with instructions, supplied by a single approved manufacturer and suitable for the type of cable being used.
  - 2. Prepare cable ends, provide materials and follow all application steps in accordance with manufacturer's instructions.
    - a. As a minimum requirement:
      - 1) The cable ends shall be cut squarely.
      - 2) The insulation shall be free from nicks or burrs after removal of jacket.
      - 3) The conductors shall be cleaned and an oxide inhibitor applied.

- 4) For splices, connector indents shall be filled with insulating putty to eliminate voids or prepared per manufacturer's instructions.
- 5) Attach grounding lead to system ground.
3. Splices shall be avoided whenever possible.
  - a. No more than one splice is permitted between termination points without Engineer's approval.
  - b. No splices are permitted in runs less than 100 feet long.
  - c. Splices will be made only at manholes or other accessible locations.
  - d. Do not pull splices into ductbanks or conduits or leave them under tension.
- F. The ground shield grounding adaptors shall be grounded:
  1. Shired and elbow terminators: Grounded to ground bar or cable loop in equipment.
  2. Splices: Grounded to ground bar or rod in manhole.
  3. Connect with insulated, stranded #6 AWG wire.

### 3.2 QUALITY CONTROL

- A. Cable manufacturer date must be no more than two years from the ship date.
- B. See Specification Section 26 08 13 for acceptance testing requirements.

**END OF SECTION**