

SECTION 26 0513 - MEDIUM-VOLTAGE 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. This Section includes medium voltage shielded power cables, sizes 1/0 through 2000 kcmil, related splices, terminations, and accessories for medium-voltage electrical distribution systems, nominal 2.4 kV through 15 kV services.

1.3 DEFINITIONS

- A. NETA ATS: National Electrical Testing Association Acceptance Testing Specification.
- B. AIA: Aluminum Interlocked Armor.

1.4 ACTION SUBMITTALS

- A. Product Data: For each size and type of cable indicated.
- B. Samples: 16-inch (400-mm) lengths of each type of cable indicated.
- C. Include data sheets for the following additional items:
 - 1. Splices and terminations.
 - 2. Separable connectors.
 - 3. Cable accessories.
 - 4. Pulling compounds.
 - 5. Strand dynamometer.

1.5 INFORMATIONAL SUBMITTALS

- A. Resumes of cable splicer(s).
- B. Material Certificates: For each cable and accessory type, signed by manufacturers.
- C. Cable pulling tension calculations and recorded values.
- D. Source quality-control test reports.
- E. Field quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Installer: Engage a cable splicer, trained and certified by splice material manufacturer, to install, splice, and terminate medium-voltage cable. Cable splicer shall have a minimum of 2000 hours experience with terminating and installing medium voltage cable. Furnish satisfactory proof of such experience for each employee who splices or terminates the cables prior to any work. Submit names and service dates of proposed employees. Persons listed by the Contractor may be required to perform a dummy or practice splice and termination in the presence of the Electrical Shop representative and Engineer before being approved as a qualified installer of medium-voltage cables.
- B. Source Limitations: Obtain cables and accessories through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C2 and NFPA 70.
- E. Comply with ASTM B3 and B8.
- F. NRTL (Nationally Recognized Testing Laboratory) Listing: Products shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for electrical and fire safety.
- G. Comply with most current edition of the Northwestern University Design Standards.

1.7 PROJECT CONDITIONS (*Delete If Not Required*)

- A. **[Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by the University or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:**
 - 1. **Notify the University's Chief Electrician no fewer than [two] calendar weeks in advance of proposed interruption of electric service.**
 - 2. **Do not proceed with interruption of electrical service without the University's Chief Electrician's written permission.**
 - 3. **University Lock-out/Tag-out procedures shall be used with Contractor controlled locks and tags.**
 - 4. **Comply with NFPA 70E.]**

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cables:

- a. General Cable Technologies Corporation.
- b. Okonite Company (The).
- c. Southwire Company.

2. Cable Splicing and Terminating Products and Accessories:

- a. 3M; Electrical Products Division.

2.2 CABLES

- A. Cable Type: [**Single conductor**] [**Three conductor (AIA only)**], UL type MV105 approved for N.E.C. applications.
- B. Comply with UL 1072, AEIC CS 8, ICEA S-93-639/NEMA WC74, and ICEA S-97-682.
- C. Conductor: Annealed, soft drawn Copper.
- D. Conductor Stranding: Compact round, concentric lay, Class B.
- E. Conductor Insulation: discharge free, no lead, Ethylene-Propylene Rubber (EPR), color contrasted with strand and insulation shields.
 1. Voltage Rating: [**15**] kV.
 2. Insulation Thickness: 133 percent insulation level.
- F. Strand Shielding: Black extruded semi-conducting thermoset copolymer applied directly over the conductor.
- G. Insulation Shield: Black extruded semiconducting thermoset copolymer applied directly over the insulation.
- H. Shielding: [**Copper tape, 5 mils thick, helically applied with 25% overlap, over semiconducting insulation shield,**] or [**six solid copper corrugated drain wires embedded longitudinally in composite layers of semi conducting thermoset copolymer and CPE**].
- I. Cable Jacket: Chlorinated Polyethylene, CPE per ICEA and UL 1072.
- J. Identification: The following minimum legend shall be printed on the jacket and repeated at not more than two foot intervals.
 1. Manufacturer/plant no.
 2. Conductor size (awg or kcmil).
 3. CU.
 4. EPR.
 5. SHLD.
 6. Voltage (kV).
 7. Insulation level (133%).
 8. Insulation thickness (mils), MV-105.

2.3 SPLICE KITS

- A. Connectors and Splice Kits: Comply with IEEE 404; type as recommended by cable or splicing kit manufacturer for the application.

- B. Manufacturers: Subject to compliance with requirements, provide products by the following: 3M
- C. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.
 - 1. Heat-shrink splicing kit of uniform, cross-section, polymeric construction with outer heat-shrink jacket.
 - 2. Pre-molded, cold-shrink-rubber, in-line splicing kit.

2.4 SOLID TERMINATIONS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following: 3M
- B. Multi-conductor Cable Sheath Seals: Type recommended by seal manufacturer for type of cable and installation conditions, including orientation.
 - 1. Compound-filled, cast-metal body, metal-clad cable terminator for metal-clad cable with external plastic jacket.
 - 2. Cold-shrink sheath seal kit with preformed sleeve openings sized for cable and insulated conductors.
 - 3. Heat-shrink sheath seal kit with phase- and ground-conductor re-jacketing tubes, cable-end sealing boot, and sealing plugs for unused ground-wire openings in boot.
- C. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class is equivalent to that of cable. Include shield ground strap for shielded cable terminations.
 - 1. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone rubber, insulator modules; shield ground strap; and compression-type connector.
 - 2. Class 1 Terminations: Heat-shrink type with heat-shrink inner stress control and outer non-tracking tubes; multiple, molded, non-tracking skirt modules; and compression-type connector.
 - 3. Class 2 Terminations, Indoors: Kit with stress-relief tube, non-tracking insulator tube, shield ground strap, and compression-type connector. Include silicone-rubber tape, cold-shrink-rubber sleeve, or heat-shrink plastic-sleeve moisture seal for end of insulation whether or not supplied with kits.
 - 4. Medium voltage cable terminations and splices: long barrel, 2-hole hydraulic crimp lugs.

2.5 SEPARABLE INSULATED CONNECTORS

- A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.
- B. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.
- C. Load-Break Cable Terminators: Elbow-type units with 200-A load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.

- D. Dead-Break Cable Terminators: Elbow-type unit with 600-A continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
- E. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless-steel mounting brackets, and attaching hardware.
 - 1. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
 - 2. Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
 - 3. Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.
 - 4. Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.
- F. Tool Set: Shotgun hot stick with energized terminal indicator, and carrying case.
- G. Ground Bails: Heavy duty grounding bails shall be provided to accommodate portable grounding equipment.

2.6 ARC-PROOFING MATERIALS

- A. Tape for First Course on Metal Objects: Scotch 88, 10-mil- (250-micrometer-) thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.
- B. Arc-Proofing Tape: Scotch 77, fireproof tape, flexible, conformable, and intumescent to 0.3 inch (8 mm) thick, compatible with cable jacket.
- C. Self-fusing Silicon Tape: Scotch 70, high temperature, arc and track resistant tape composed of self-fusing, inorganic silicone rubber.
- D. Glass-Cloth Tape: Scotch 69, Pressure-sensitive adhesive type, 1/2 inch (13 mm) wide.

2.7 SOURCE QUALITY CONTROL

- A. Test and inspect cables according to ICEA S-97-682 before shipping.
- B. Test strand-filled cables for water-penetration resistance according to ICEA T-31-610, using a test pressure of 5 psig (35 kPa).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Minimum cable size shall be #1/0 awg.

- B. Cables for all circuits shall be 15 kV rated.
- C. Install cables according to IEEE 576.
- D. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values for single or multi-conductor cables.
 - 1. A strand dynamometer/tension meter shall be used during the cable installation, readings shall be recorded and a report submitted for each cable pull and witnessed by a representative of the NU Electric Shop.
 - 2. Where necessary, use manufacturer-approved pulling compound or lubricant that will not deteriorate conductor or insulation.
 - 3. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips that will not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.
 - 4. Provide cable lengths with liberal allowances of slack for terminations.
 - 5. Cable shall not be pulled with the ends open, cable ends shall be moisture proofed at all times until terminations are installed.
- E. Install underground cables in Sch. 40 PVC conduits in concrete encased ductbanks, comply with Section 26 0543.
- F. In buildings and at road crossings, install cables in concrete encased Rigid Galvanized Conduit (Heavy-wall).
- G. Provide a 1" PVC conduit centered in the top of the ductbank containing a green-jacketed #12 awg copper "tracer" wire.
- H. Medium voltage cables shall not be direct buried.
- I. Install permanent markers at ends of cable runs, changes in direction, and splices.
- J. Install "buried-cable" warning tape above ductbanks. Comply with Division 26 Sections "Underground Ducts and Raceways" and "Identification for Electrical Systems". Tape damaged during construction shall be completely replaced.
- K. In manholes, hand holes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit and support cables with suitable UL listed non-metallic racks, located at intervals adequate to prevent sag.
- L. Pull all cables in continuous lengths, splices in feeder circuits shall be avoided unless necessitated by the length of the run more than 500 feet. Locations of all splices shall be approved by the University's Chief Electrician or his representative in writing.
- M. Outdoor splices and terminations shall be performed in dry conditions only.
- N. Three -Way splices are not permitted.
- O. Install separable insulated-connector components as follows:
 - 1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
 - 2. Portable Feed-Through Accessory: Three.
 - 3. Standoff Insulator: Three.

- P. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, or termination materials such as transformers, switchgear, and manholes. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:
1. Clean cable sheath.
 2. Wrap metallic cable components with 10-mil (250-micrometer) pipe-wrapping tape.
 3. Smooth surface contours with electrical insulation putty.
 4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
 5. Band arc-proofing tape with 1-inch- (25-mm-) wide bands of half-lapped, adhesive, glass-cloth tape 2 inches (50 mm) O.C.
- Q. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Sections and University Fire Protection Group.
1. All penetrations shall be under constant visual surveillance until firestopping is applied.
 2. Products: Cooper B –Line, 3M, Hilti, Specified Technologies, Inc.
- R. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.
- S. Identify cables according to Division 26 Section 26 0553 "Identification for Electrical Systems."
1. Identify individual phases at termination points.
 2. In manholes, cables shall be identified where cables enter and leave the manhole. Identify circuit number and voltage.
 3. Use embossed brass tags tie wrapped to cable.

3.2 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
 2. After installing medium-voltage cables and terminations but before electrical circuitry has been connected to busses or switchgear and energized, test for compliance with requirements, including but not limited to DC high potential testing according to IEEE 400 and insulation resistance testing.
 3. Submit all reports to the NU Electric Shop prior to permanently energizing any cables.
- B. Remove and replace non-compliant cable or terminations and retest as specified above.

END OF SECTION 26 0513

NORTHWESTERN UNIVERSITY
PROJECT NAME _____
JOB # _____

FOR: _____
ISSUED: 03/29/2017

THIS PAGE IS INTENTIONALLY BLANK