

## **SECTION 260513 - MEDIUM-VOLTAGE CABLES**

Latest Update: 5.6.17 See Underlined Text for Edits

(Engineer shall edit specifications and blue text in header to meet project requirements. This includes but is not limited to updating Equipment and/or Material Model Numbers indicated in the specifications and adding any additional specifications that may be required by the project. Also turn off "Underlines".)

### **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 and all other sections of Division 26.

#### **1.2 SUMMARY**

- A. This Section includes cables and related splices, terminations, accessories and acceptance testing for (15,000) or (5,000) volt electrical distribution system(s).

#### **1.3 DEFINITIONS**

- A. NETA ATS: Acceptance Testing Specification.

#### **1.4 SUBMITTALS**

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data: For each type of cable indicated. Include splices and terminations for cables and cable accessories.
- C. Samples: Sixteen (16) inch lengths of each type of cable indicated.
- D. Qualification Data: For Installer and testing agency. Data submitted shall confirm that the person(s) and firm(s) listed in the "Quality Assurance" Article have demonstrated their capabilities and experience. The data shall include, but limited to a list of completed projects with project names, addresses, names of Architects and UMBs. Additional data includes:
- E. Material Certificates: For each cable and accessory type, signed by manufacturers.

- F. Source quality-control test reports. Certified reports of manufacturer’s design and production tests indicating compliance of cable and accessories with reference standards.
- G. Field quality-control test reports. Field test reports indicating and interpreting test results relative to compliance with performance requirements specified. Include certified copies of field test reports.
- H. Installation Manual: Manual shall include all data relative to installing the cables and accessories. Maximum pulling tensions, side wall pressure limitations, type of pulling devices shall all be documented within the manual.
- I. Operation & Maintenance Manual: Include recommendation relating to acceptance and periodic maintenance testing and infrared scanning photometry. Recommendation shall include frequency and type of testing. Operation data shall include data of fault indicators and separable connectors and their accessories.

#### 1.5 QUALITY ASSURANCE

- A. Installer: Engage a cable splicer, trained and certified by splice material manufacturer, to install, splice, and terminate medium-voltage cable. Submit the following within 30-days of contract award:

- 1. Name of individual(s) performing splicing/terminating
- 2. Certification of individual performing test with name and date
- 3. Number of years of medium voltage splicing/terminating experience
- 4. Proof of termination/splice of the type to be installed, under supervision of the kit manufacturer, or representative
- 5. Dummy splice/termination successfully tested as follows. Test to be performed by the splice kit supplier.

Test	Minimum Value
Discharge Ext. Value with, 3 pcs.	13-kV
Ac Withstand, 1 minute	35-kV
DC Withstand, 15 minutes	65-kV

- 6. List of three recent jobs within last twelve (12) months where specific splices/terminations were installed. Include splice/termination manufacturer, catalogue number, cable type and the quantity installed.

- B. Manufacturer Qualifications: Firm experienced in manufacturing medium-voltage cable and accessories similar to those indicated for this project, with a ten (10) year record of successful in-service performance

- C. Testing Agency Qualifications: In addition to the requirements specified in Division 1 Section "Quality Control Services," an independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- D. Source Limitations: Obtain cables and accessories through one source from a single manufacturer.
- E. 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.
- F. Comply with IEEE C2 "National Electrical Safety Code" and NFPA 70.
- G. Production Tests shall be performed on the cable at time of manufacture.
1. Resistance requirements of ICEA S-68-516, section 2.5.
  2. Insulation resistance test shall be performed in accordance with ICEA S-68-516, part 6.28, and shall have an insulation resistance constant of at least 50,000 megohms-1000 feet at 15°C.
  3. A high voltage ac and dc test shall be performed in accordance with part 6.27 of ICEA S-68-516. The test voltage shall be as follows:

Insulation Wall		AC kV (5 Minutes)	DC kV (15 minutes)
115	23	45	
220	44	80	

4. The shield resistance shall be measured and recorded from end to end on the complete cable
5. The cable shall be corona discharge tested in accordance with Section G of AEIC CS<sup>^</sup>. The maximum allowable discharge is five (5) picocoulombs throughout the entire specified test voltage range.
6. Certified test reports shall be furnished to the Engineer, for review, for all cables prior to installation.

## 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by UM or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify UM in writing no fewer than ten (10) days in advance of proposed interruption of electric service.
  - 2. Do not proceed with interruption of electric service without written permission from UMB - PM.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver medium voltage cable on factory reels conforming to NEMA WC 26.
- B. Store cables on reels on elevated platforms in a dry location.
- C. Provide hot-shrink (cold-shrink not permitted) cable end caps for cable stored outside.

## 1.8 WARRANTY/GUARANTEE

- A. See Division 26 Specification Section “Basic Electrical Requirements’ for warranty and guarantee requirements.

## **PART 2 - PRODUCTS**

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one (1) of the following:
  - 1. Cables:
    - a. General Cable Technologies Corporation.
    - b. Okonite Company (The).
    - c. Pirelli Cables & Systems NA.
    - d. Rome Cable Corporation.
    - e. Southwire Company.
    - f. Approved Equal.
  - 2. Cable Splicing and Terminating Products and Accessories:
    - a. G&W Electric Company.

- b. Raychem Corp.; Telephone Energy and Industrial Division; Tyco International Ltd.
  - c. RTE Components; Cooper Power Systems, Inc.
  - d. Thomas & Betts Corporation/Elastimold.
  - e. 3M; Electrical Products Division.
  - f. Approved Equal.
3. Arc Proofing Products:
- a. 3M Products.
  - b. Scotch.

## 2.2 CABLES

- A. Cable Type: MV105, single conductor insulated power cable.
- B. Comply with UL 1072, AEIC CS 8, ICEA S-93-639, and ICEA S-97-682, ASTM B-8 or B-231.
- C. Conductor: Copper.
- D. Conductor Stranding: Compact round, concentric lay, Class B.
- E. Conductor Insulation: Ethylene-propylene rubber (EPR) conforming to NEMA WC74 (ICEA S-68-516 and AEIC CS6).
  - 1. Voltage Rating: 5 and 15 kV.
  - 2. Insulation Thickness: 133 percent insulation level.
- F. Engineer to determine overlay percentage based on available fault current and project requirements, Shielding: Copper tape, helically applied over semiconducting insulation shield.
  - 1. 12-1/2% tape overlay
  - 2. 25% tape overlay
- G. Shielding and Jacket: Corrugated copper drain wires embedded in extruded, chlorinated, polyethylene jacket.

## 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. 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.

## 2.4 SOLID TERMINATIONS

- A. 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 nontracking tubes; multiple, molded, nontracking skirt modules; and compression-type connector.
  - 3. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief shield terminator; multiple-wet-process, porcelain, insulator modules; shield ground strap; and compression-type connector.
  - 4. Class 1 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, compression-type connector, and end seal.

## 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. Test-Point Fault Indicators: Applicable current-trip ratings and arranged for installation in test points of load-break separable connectors, and complete with self-resetting indicators capable of being installed with shotgun hot stick and tested with test tool.
- G. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, ground cable set and carrying case.

## 2.6 FAULT INDICATORS

- A. Indicators: Manually reset fault indicator with inrush restraint feature, arranged to clamp to cable sheath and provide a display after a fault has occurred in cable. Instrument shall not be affected by heat, moisture, and corrosive conditions and shall be recommended by manufacturer for installation conditions.
- B. Resetting Tool: Designed for use with fault indicators, with moisture-resistant storage and carrying case.

## 2.7 PROTECTIVE CABLE END CAPS

- A. Protect MV cables from water penetration on job site, before, during and after cable pulling. Seal cable end with heat-shrinkable end cap. This cap will remain in place until the actual time of termination. Sealing compounds and/or taping shall not constitute acceptable environmental protection. End sealing caps shall be as produced by Raychem Corporation, Type ESC, or equal.

## 2.8 ARC-PROOFING MATERIALS

- A. Tape for First Course on Metal Objects: 10-mil- thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.
- B. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch thick, compatible with cable jacket.
- C. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1/2 inch wide.

## 2.9 SOURCE QUALITY CONTROL

- A. Test and inspect cables according to ICEA S-97-682, NEMA WC74 before shipping.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

## 3.2 INSTALLATION

- A. Install cables according to manufacturer's written instructions and IEEE 576.
- B. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
  - 1. Where necessary, use NRTL - listed and manufacturer-approved pulling compound or lubricant that will not deteriorate conductor or insulation.
  - 2. 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.
  - 3. Provide written calculations confirming pulling tensions and side wall pressure limits are within cable manufacturer's recommendations. Submit to Engineer prior to start of work.
- C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- D. Install "buried-cable" warning tape twelve (12) inches above cables.
- E. Install fault indicators on each phase where indicated.
- F. 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 at intervals adequate to prevent sag.



- G. Install cable splices at pull points and elsewhere as indicated; use standard kits.
- H. Install terminations at ends of conductors with standard kits.
- I. 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.
- J. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. 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 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 one (1) inch- wide bands of half-lapped, adhesive, glass-cloth tape two (2) inches o.c.
- K. 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.
- L. Identify cables according to Division 26 Section "Identification for Electrical Systems."
- M. Prior to installing cables, pull a mandrel sized 1/4" less than conduit ID. Then clean each conduit with a stiff brush to remove debris.
- N. Use pulling means including, fish tape, cable, rope, basket-weave wire/cable grips and pulling eyes that will not damage cable or raceways. Do not use rope hitches for pulling attachments to cable.

### 3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections: Engage an independent, testing and inspecting agency to perform the following field tests and inspections and prepare test reports at no additional cost to UM:
  - 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 before electrical circuitry has been energized, test for compliance with requirements.

- a. VLF high potential per IEEE 400.2-2004
  - b. Shield Continuity
  - c. Provide live phasing test to ensure redundant feeders are phased and synchronized
  - d. If installed cable is being spliced to an existing cable, VLF Hi-Pot test shall be performed prior to it being spliced. Temporary terminations shall be used where appropriate. After splicing is complete, testing shall be performed as indicated above.
3. Infrared Scanning: After Substantial Completion, but not more than sixty (60) days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
- a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice eleven (11) months after date of Substantial Completion.
  - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.
- B. Test Reports: Prepare a written report to record the following:
1. Test procedures used.
  2. Test results that comply with requirements.
  3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Remove and replace malfunctioning units and retest as specified above, listing all deficiencies and corrective actions.

END OF SECTION 260513