

SECTION 26 05 13

MEDIUM VOLTAGE CABLES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish and install medium voltage cable.

1.2 REFERENCES

A. Standards referenced in this Section are:

1. AEIC CS8, Specification for Extruded Dielectric Shielded Power Cables Rated 5 through 46 kV.
2. ANSI C2, National Electrical Safety Code.
3. ANSI/NETA ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems
4. ASTM B3, Specification for Soft or Annealed Copper Wire
5. ASTM B8, Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
6. ASTM B33, Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.
7. ICEA S-93-639, 5-46 KV Shielded Power Cables for use in the Trans-mission and Distribution of Electric Energy.
8. IEEE 48, Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5kv through 765kv.
9. IEEE 404, Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500 000 V
10. UL 1072, Medium-Voltage Power Cables.

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Tests by Independent Regulatory Agencies: Cable shall bear the label of the Underwriters' Laboratories, Inc.
2. Utilities:
 - a. Work in connection with the utility service shall be done in strict conformance with their requirements.

B. Test Equipment, Calibration and Reporting: Test equipment, instrument calibration, and test reports shall be in accordance with the latest edition of NETA acceptance testing specification.

1.4 SUBMITTALS

- A. Action Submittals: Submit the following:
 - 1. Shop Drawings:
 - a. Literature identifying the methods and materials proposed for making splices and terminations. Submittal shall consist of manufacturer literature evidencing compatibility of conductor insulation, shield, and jacket of cable with splicing or terminating materials, and methods proposed for use.
 - b. Listing of locations where splices are proposed.
 - 2. Product Data:
 - a. Manufacturer's literature and technical information indicating compliance with the Contract Documents.
- B. Informational Submittals: Submit the following:
 - 1. Certificates:
 - a. Certification from cable Supplier that cable installation is in accordance with cable manufacturer's recommendations.
 - 2. Source Quality Control Submittals: Submit results of factory tests. Include testing procedures utilized.
 - 3. Field Quality Control Submittals: Submit results of field quality control testing. Include testing procedures utilized.
 - 4. Qualifications Statements:
 - a. Qualifications of splicing and termination personnel
 - b. Independent testing agency.
- C. Closeout Submittals: Submit the following:
 - 1. Record Documentation:
 - a. Include on record documents actual location and routing of medium voltage cable installations in accordance with Section 01 78 39, Project Record Documents.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. General:
 - 1. Cable provided under this Section shall be rated for insulation level of 133 percent at 5 KV.
 - 2. Cable insulation shall be thermosetting rubber-based suitable for normal installation indoors or outdoors, in conduit, in air, and intermittent or continuous submergence in water.
 - 3. Cable shall be single conductor bearing UL label "MV 105" and comply with or exceed applicable ICEA and AEIC standards.
- B. Manufacturers: Provide products of one of the following:
 - 1. Kerite Company.
 - 2. The Okonite Company.
 - 3. General Cable Corporation.

4. Southwire.
5. Approved equivalent.

C. Materials:

1. Conductor: Conductors shall be Class B concentric compressed stranded bare soft annealed copper per ASTM B-8 or compact stranded bare soft annealed copper per ASTM B-496.
2. Insulation System: Cable insulation system shall include two separate screen layers, primary insulation and shield.
 - a. Conductor screen shall consist of extruded inner layer of non-conducting energy suppression or semi-conducting material. Conductor screen shall be in intimate contact with outer surface of conductor.
 - b. Primary insulation shall be high quality ozone-resistant ethylene-propylene rubber based compound. Insulation system shall be suitable for use at conductor temperatures not exceeding 105 degrees C for normal operation, 140 degrees C for emergency overload conditions, and 250 degrees C for short circuit conditions. Minimum and maximum thickness of insulation system shall be 85/120 mils for five kV systems, 210/220 mils for 15 kV systems, and 400/450 mils for 35 kV systems.
 - c. Insulation screen shall be outer layer of thermosetting semi-conducting material. Insulation screen shall be in intimate contact with outer insulation surface.
 - d. Insulation shield shall be a five-mil copper tape applied helically with minimum 12.5 percent overlap.
3. Jacket: Continuous jacket of moisture, heat, oil resistant black polyvinyl chloride shall be applied over insulation and shielding system. Minimum thickness of jacket shall be in accordance with ICEA.

D. Cable Connectors:

1. Connectors shall be copper, tin-plated, long-barrel compression type, suitable for voltage applications up to 35 KV.
2. For sizes 250 MCM and larger, connectors shall be two-hole mount type with provisions for two bolts for joining to apparatus terminal.
3. Manufacturers: Provide products of one of the following:
 - a. FCI-Burndy.
 - b. T&B Connectors.
 - c. Approved equivalent.

E. Cable Terminations:

1. Cable terminations shall comply with Class 1 requirements of IEEE 48.
2. Terminations shall be molded elastomer, wet-process porcelain or heat-shrinkable types with grounding provisions for cable shielding.
3. Manufacturers: Provide products of one of the following:
 - a. Elastimold.
 - b. G&W Electric Company.
 - c. Raychem Corporation.
 - d. 3M Company.
 - e. Approved equivalent.

F. Cable Splices:

1. Make cable splices using standard splice kits that reinstate cable's insulation and jacket and continue metallic shielding through entire cable joint.
2. Splices shall be premolded, conventional tape or heat-shrinkable type.
3. Manufacturers: Provide products of one of the following:
 - a. Elastimold.
 - b. G&W Electric Company.
 - c. Raychem Corporation.
 - d. 3M Company.
 - e. Approved equivalent.

G. Pulling Compound:

1. Provide pulling compound to facilitate wiring pulling. Compound shall be UL-listed, waxed or water based type. Compound shall be compatible with all jacket types.
2. Pulling tension coefficient of friction shall not exceed 0.35.
3. Use winter-grade compound for outdoor, low-temperature installations.
4. Manufacturers: Provide products of one of the following:
 - a. Ideal Industries.
 - b. Greenlee.
 - c. Approved equivalent.

F. Fireproofing Tape for Cables in Manholes, Handholes, and Boxes:

1. Tape shall be 30-mils thick of self-extinguishing material that does not support combustion. Tape shall not deteriorate when subjected to water, salt, sewage, or fungus
2. Secure tape with glass cloth tape.

G. Color code cables by applying general purpose, flame-retardant tape, wrapped in overlapping turns covering an area of at least two inches. Colors shall be as follows:

1. Grounded Neutral: White.
2. Phase A: Brown.
3. Phase B: Orange.
4. Phase C: Yellow.

2.2 SOURCE QUALITY CONTROL

A. Factory Testing:

1. Cables shall be factory tested in accordance with testing standards of ICEA and UL.
2. Conductors shall comply with electrical resistance requirements of ICEA.
3. Perform insulation resistance test in accordance with ICEA. Each cable shall have an insulation resistance not less than that corresponding to insulation resistance constant of 20,000 megohms-1000 feet at 15.6 degrees C.
4. Perform high voltage AC test in accordance with ICEA.
5. Measure and record shield resistance from end to end on completed cable.

6. Corona Test: Each reel of completed shielded power cable shall be partial discharge tested in accordance with ICEA.
7. Record cable physical measurements.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install cables complete with proper terminations at both ends. Check for proper phase sequence and proper motor rotation.
- B. Splice and terminate medium voltage cables in accordance with cable manufacturer's recommendations.
 1. Use experienced personnel familiar with materials and procedures to be employed.
 2. Make splices watertight for below-grade installations, and submersible in manholes and handholes.
- C. Pulling:
 1. Use insulating types of pulling compounds containing no mineral oil.
 2. Pulling tension shall be within limits recommended by cable manufacturer.
 3. Use dynamometer when mechanical means are used.
 4. Cut off section subject to mechanical means.
- D. Bending Radius: Limit to twelve times cable overall diameter.
- E. Slack: Provide maximum slack at terminal points and in manholes.
- F. Identification: Identify conductors by circuit number and phase at each terminal or splice location.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Perform acceptance testing of medium voltage cable system. Each cable circuit shall be inspected and tested on an individual, per-phase basis. Testing and inspection shall be performed by independent testing agency.
 2. Visual and Mechanical Inspection: Inspect each power cable installation in accordance with ANSI/NETA ATS. Inspect each splice and termination.
 3. Electrical Tests: Perform electrical testing of each power cable in accordance with ANSI/NETA ATS and manufacturer's recommended testing procedures. Testing shall include:
 - a. Shield continuity test.
 - b. DC or AC high potential test.
 - c. Adhere to following procedures before performing over-potential tests:
 - 1) Disconnect all equipment, including but not limited to: transformers, switches, motors, circuit breakers, and surge arrestors from cable

- circuit to prevent test interruptions due to flashovers or trip-outs resulting from excessive leakage current.
- 2) Establish adequate clearance between circuit test ends and grounded objects and to other equipment not under test.
- 3) Ground all circuit conductors not being tested, all cables shields, and nearby equipment.
- 4) Clean insulation surfaces.
- 5) Keep cable ends dry.
- d. Apply high-potential slowly in eight to ten equal steps to 80 percent of manufacturer's test value. Record leakage current at each test voltage and plot resulting curve on graph paper.
- e. Stop the test if leakage current increases excessively or if a "knee" appears in the curve before reaching maximum test voltage.
- f. Upon reaching specified maximum test voltage, maintain voltage for 15 minutes, record leakage current at 30 seconds, one minute, and at one-minute intervals thereafter. Plot leakage current versus time on the same graph as step voltage curve.
- g. Reduce conductor test potential to zero and measure residual voltage at discrete intervals.
- h. Apply grounds for a time period adequate to drain all insulation stored charge.
- i. Repair or replace and retest new cable that fails tests.
- j. Test curves shall be signed by the individual performing tests and submitted to ENGINEER.

B. Cable Tension Field Quality Control: Testing and Supplier Services:

1. Provide services at the Site during cable installation to ensure that cable tensions are not exceeded. Provide cable splicing when tension exceeds cable manufacturer's recommendations.
2. Provide services of cable manufacturer's representative to prepare cable pulling calculations. Manufacturer's representative shall inspect, monitor, and assist in cable installation, and shall certify that cables have been correctly installed.
3. Required field services include:
 - a. Document, with assistance of manufacturer's representative, actual ductbank installation parameters needed to prepare cable pulling calculations.
 - b. Prepare pulling calculations in advance of cable installation.
 - c. Monitor actual pulling tensions during installation to ensure that recommended tensions are not exceeded.
 - d. Certify jointly with manufacturer's representative that cable installation is in accordance with cable manufacturer's recommendations.
4. Provide equipment, coordinate, and identify information necessary to ensure proper installation of cables. Contract Price shall include all costs associated with equipment, coordination, and identification of all information necessary for complete, functional system.

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