

SECTION 26 05 13

MEDIUM VOLTAGE CABLE (OVER 600 VOLTS)

PART 1 GENERAL

1.01 PRINCIPAL WORK IN THIS SECTION

- A. Provide medium voltage cable complete with accessories.
- B. Cable rated 15 KV, 3-phase, 60 hertz distribution systems.

1.02 QUALITY ASSURANCE

- A. Refer to General Provisions, Division 01.
- B. Testing: Developer Design/Builder shall pay for the services of a qualified testing laboratory to perform the specified field test. Developer Design/Builder shall provide all material required for testing.

1.03 REFERENCES

- A. Institute of Electrical and Electronics Engineers.
  - 1. IEEE 48 – Standard Test Procedures and Requirements for Alternating Current Cable Terminations 2.5 kV thru 765 kV
  - 2. IEEE C2 – National Electrical Safety Code.
- B. National Electrical Manufacturers Association
  - 1. NEMA WC3 – Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
  - 2. NEMA WC 5 – Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
  - 3. NEMA WC 7 – Cross Linked Thermosetting Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electric Energy.
  - 4. NEMA WC 8 – Ethylene Propylene Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
- C. International Electrical Testing Association
  - 1. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.04 SUBMITTALS

- A. Shop Drawings:
  - 1. Catalog cuts to include the following:
    - a. Cable construction.
    - b. Shielding.
    - c. Insulation materials.
    - d. Thickness of insulation and jacket.
    - e. Voltage rating.
    - f. Government Specification Compliance.

2. Submit resume of cable splicer and termination for review. Qualified Developer Design/Builder Cable Contractor shall have a minimum of 10 years experience in splicing and terminating cable.
- B. Acceptance or no exceptions taken by the County's Representative on any substitution proposed by the Developer Design/Builder shall not be construed as relieving the Developer Design/Builder from compliance with the project's specifications and performance requirements nor departure there from. The Developer Design/Builder remains responsible for details and accuracy for confirming and correlating quantities and dimensions and for the selection of fabrication processes, techniques and assembly, coordination of his work with that of all other trades and making any needed modifications consequent to the substitution at his own cost and for performing the work in a safe manner.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver cable packaged in factory-sealed containers wound on NEMA cable reels. Each end of each length of cable shall be hermetically sealed and securely attached to the reel. The minimum diameter of the reel drum shall be 14 times the overall diameter of the cable. A pulling eye shall be installed by the manufacturer for each length of cable supplied.
- B. Storage: Store cable in a clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- C. Cable reels shall be stored and handled in a manner which will prevent physical damage to the cable. Cable reels shall be stored on a hard surface to prevent contact between cable insulation and earth due to sinking of the reel. Impact damage between reels shall be prevented by aligning reels flange-to-flange or by using guards across flanges. During storage, the ends of all cable shall be protected with heat shrink end caps. Heat shrink end caps shall be installed at the factory prior to shipment, and in the field by the Developer Design/Builder on all cut cable ends at all termination points in switchgear and manholes prior to installing termination connectors.
- D. Handling: Handle cable carefully to avoid abrading, puncturing, and tearing cable insulation and sheathing. Ensure that dielectric resistance integrity of cables is maintained. After installation, all cable sections shall be DC Hi-pot tested. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

### PART 2 PRODUCTS

#### 2.01 SINGLE CONDUCTOR SHIELDED CABLES

- A. Voltage Class: 15kV single conductor.
- B. Size: As noted.
- C. Conductor: Copper, Class B stranded.
- D. Cable Construction: Cable construction in accordance with ASTM and ICEA Standards, suitable for wet and dry location and underground installation.
- E. Conductor screen: Extruded semi-conductor thermosetting "EPR" compound with resistivity not less than 50,000 ohm-cm at temperature of 90°C.
- F. Insulation: Ethylene propylene with average thickness of 220 mils. Minimum thickness at any cross section not less than 90 percent of the average thickness.
- G. Insulation screen: Extruded semiconductor thermosetting "EPR" compound with resistivity not in excess of 50,000 ohm-cm at 90°C. Average thickness; 30 mils.

- H. Jacket: Polyvinylchloride (PVC). Cable size up to 500 mcm shall have a minimum jacket thickness of 80 mils.
- I. Shield: Minimum five mil copper tape applied helically with a 25 percent minimum overlap (excess fault duty shall be carried by an appropriate size ground conductor).
- J. Cable supports: Vertical or slopping runs shall be properly supported when conduit runs exceed 25 feet. Provide non-metallic tape to grip cable securely. Support vertical runs of cable at intervals not exceeding those noted in the Electrical Code.
- K. Cable bugs and connectors shall be made of copper alloy and shall be high pressure indent type. Manufacturers: Burndy, Thomas and Betts or equal.

## 2.02 CABLES, SPLICES AND CONNECTORS

### A. Manufacturers

#### 1. Medium Voltage Cable:

- a. Kerite.
- b. Okonite.
- c. Pirelli.
- d. Phillips Dodge.
- e. General Electric.
- f. Rome.

#### 2. Splice Kits:

- a. 3M.
- b. Chardon.
- c. As recommended by the cable manufacturer.

#### 3. Load Break Connectors:

- a. Elastimold.
- b. RTE.
- c. Chardon.

#### 4. Substitutions: Division 01 - Product Requirements

- B. General: Provide Underwriters Laboratories, Inc. (UL) listed single conductor stranded copper cable of sizes, ampacity, temperature ratings, and insulation materials as required to complete the work. Cables shall be manufactured and tested in accordance with latest editions of ICEA S-68-516, AEIC CS6 and UL Standard 1072. Cable splice kits shall be manufactured and tested in accordance with IEEE 386.
- C. Insulation: Provide insulation level of 133 percent.
- D. Cable shall be manufactured by an extrusion process utilizing compounds which have been formulated and mixed at the manufacturer's facilities.
- E. The extruded cable core shall be wrapped with a non-magnetic shielding tape with an overall PVC jacket.
- F. Splices and Termination Kits: Provide splice and termination kits containing factory formed parts.
  - 1. Kits shall be heavy duty, pressure type fittings, designed for proper size of cables and wires being spliced and terminated.
  - 2. Splices and terminations shall not be less than the voltage rating of cable and shall include shielding and stress core material.

3. Kits shall be suitable for interior, exterior, or submersible applications.
  4. Premolded rubber devices shall have a minimum of 0.125 inch semi-conductive shield material covering entire housing.
  5. Grounding of metallic shield shall be accomplished by solderless connector enclosed in watertight rubber housing.
  6. All cable connections shall be made with a hexagonal compression connection sized as per manufacturer's recommendation for the cable.
  7. Splice kits in manholes shall be rated and sized for cable installed.
- G. Fireproof tape: Provide tape fabricated of flexible, conformable fabric of organic composition coated on one side with flame-retardant elastomer.
1. Tape shall be arc-proof, fireproof, self-extinguishing and shall not support combustion.
  2. Tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and shall not be resistant to sunlight and ultraviolet light.
  3. Provide securing tape fabricated of glass cloth electric tape not less than 7 mils thick and ¾ inch wide.
- H. Grounding: Equipment grounding conductors are required for medium voltage cable equipped with metallic sheath, or provided with ground conductor in cable interstices and bonded to non-current carrying metallic equipment at both ends.
- I. Shielding: Provide shielding as follows:
- J. Ethylene propylene (EP) or ethylene propylene rubber (EPR), single conductor cables shall be shielded for grounded and ungrounded.
- K. Cable Identification: Provide on each cable outer jacket showing the name of the manufacturer, the year in which the cable was manufactured, and a number for identification purposes. The information shall be closely grouped on the cable at standard intervals to permit complete identification and in accordance with AEIC CS6 and UL listed for type MV-90 cable.
- L. Flammability: Cables not enclosed in metallic conduit shall be tested for flammability. The assembly shall not support combustion for more than 3 seconds after application of flame or spark and shall not convey flame during or after application of flame or spark.

## PART 3 EXECUTION

### 3.01 INSTALLATION OF CABLE

- A. General: Install cable in accordance with manufacturer's requirements NEMA.
- B. Shielding: Provide continuous shielding in cable runs grounded at each end and at each splice.
- C. Personnel Qualification: The personnel involved in splicing and assembling medium voltage termination shall be qualified having not less than 10 years experience. Qualifications of cable splicers shall be submitted to the County's Representative for review. Once a termination of splice has been started by a worker, the same person shall complete that particular splice. Each termination and splice shall be started and completed in one continuous work period within presence of cable manufacturer's representative.
- D. Splices and Terminations: Make splices and terminations as follows:
1. Splices shall be made in manholes except where cable terminations are specifically indicated. Splicing and terminating of cables shall be expedited to minimize exposure and cable deterioration.
  2. Cables shall be terminated as herein specified. Dry terminations with high voltage pennants, preformed or pre-fabricated stress cones may be used for terminating cables.

3. Terminations shall be field fabricated from termination kits supplied by and in accordance with the manufacturer's recommendations for the type, size, and electrical characteristics of the cable.
  4. The installation shall include heat or cold shrink stress-relief cones at the terminals of all shielded cables and at the terminals of single conductor cables.
  5. Dielectric tests on insulators shall be conducted and certified by the manufacturer. Thermal and routing tightness tests on factory-assembled kits shall be in accordance with IEEE 48.
  6. Cable splices shall be field fabricated from splicing kits supplied by and in accordance with the cable manufacturer's recommendations for the type, size, and electrical characteristics of the cable specified. Cable splices in manholes shall be located midway between cable racks on walls of manholes and supported with cable arms.
  7. Cable manufacturer shall review connectors and methods proposed by Developer Design/Builder. Cable manufacturer shall be notified by the Developer Design/Builder prior to any terminations being performed, and at the discretion of the manufacturer, be present for all field terminations in order to assure that the warranty is maintained.
  8. Do not exceed manufacturer's recommended maximum cable pulling tension during pulling. For cable pulls exceeding 200 feet, and/or exceeding two 90° bends. Provide calculations of pulling tension.
  9. Solder block throughout stranded grounding wires which will penetrate the splicing and terminating materials.
  10. Eliminate air voids throughout the splices and terminators.
  11. Prior to installation at cables all conduit shall be thoroughly cleaned. The cable jacket and/or conduit walls shall be completely lubricated when cable is pulled. Use only pulling compounds recommended by the cable manufacturer. The compound shall be ideal yellow #77, Greenlee #699 or equal. A mechanical wire puller may be used where needed. The cable shall be drawn into the conduit of duct using basket grips on swivel connections.
  12. Radius of cable bend shall be minimum 10 times the outside diameter of cable.
  13. Stretch each layer of tape during installation.
  14. Cable not to the left under horizontal longitudinal tension.
  15. Provide cable fire proofing in all manholes and splice chambers.
- E. The cables shall be looped around the inside surface of all manholes, pullboxes and gutters to provide extra cable for expansion and contraction and for possible future splicing.
- F. All cables shall be tagged with 2-inch diameter, anodized aluminum tags 5/32-inch high white letters on black background, showing the size of the cable, what the cable feeds and the date it was first energized. The tags shall be attached to the cables with wire solder and shall be located in every pullbox, junction box, etc., and at every splice and termination. The cables shall also be phase marked "A," "B," and "C."
- G. Stress cones shall be made on all cable splices and terminations, and shall be made in accordance with the printed recommendations of the cable manufacturer.
- H. The conductor shields shall be grounded at each termination of the cable run, and on both sides of all splices, using a stranded, #6 BC wire to the nearest ground system. Conductor shield continuity shall be maintained at all splices. The ground wire shall be protected from mechanical injury by enclosing it in a metal protective covering of by placing it where it will not be subject to damage.
- I. Single conductor cables in gutters or wireways, or racks in vaults, shall have the three conductors of each circuit bound together with plastic cable ties at points not over three feet apart.

### 3.02 CERTIFICATION

- A. Provide the following:
1. Prior to installation of cable, deliver 4 certified copies of all factory tests required by referenced NEMA standards, including quality control. Tests on each length of cable shall include conductor resistance; thickness of lead sheath, where specified; ionization high voltage; and flammability, where specified. Tests on each sample of cable shall include mechanical integrity, bending test, high-voltage time test, dielectric power loss, and power-factor tests.

2. Furnish 4 copies of manufacturer's written certification that the products furnished for this project meet or exceed referenced NEMA standards and NFPA 70 requirements.
3. After testing, submit 4 certified copies of each graph, specified hereinafter under field testing. Include adequate information identifying cable locations, types, voltage rating and sizes.
4. After splices and terminations have been installed and tested, deliver 4 copies of certificate which includes the following:
  - a. A statement that materials, detail drawings and printed instructions were those contained in kits approved for this Contract.
  - b. A statement that each splice and each termination was completely installed without any overnight interruption.
  - c. A statement that field made splices and terminations conform to these specifications.

### 3.03 CERTIFIED TESTS AFTER INSTALLATION

- A. Perform visual and mechanical inspection after cable installation, splices, and terminations have been made, but before connection to equipment, as follows:
  1. Inspect exposed sections for physical damage.
  2. Verify cable is supplied and connected in accordance with single-line diagram.
  3. Inspect for shield grounding, cable support, and termination.
  4. Check for visual cable bends against ICEA or manufacturer's minimum allowable bending radius.
  5. Inspect for proper fireproofing in common cable area.
  6. Visually inspect jacket and insulation condition.
  7. Inspect for proper phase identification and arrangements.
  
- B. Perform electrical tests prior to connecting equipment and in the presence of an independent testing company hired by the Developer Design/Builder. Tests shall be as follows:
  1. Each conductor shall be individually tested with all other conductors grounded. All shields shall be grounded.
  2. A D.C. high potential shall be applied in equal increments of not more than 5000 volts or less than eight (8) steps until maximum test voltage is reached. D.C. leakage current shall be recorded at each step after a charging current decay.
  3. A graphic plot shall be made of leakage current versus voltage and leakage current versus time.
  4. The test conductor shall be raised to a maximum test voltage and held for a total time elapse as specified by the IPCEA for the type and voltage rating if insulation being tested. Reading of leakage current versus time shall be recorded.
  5. The applied conductor test potential shall be reduced to zero (0) and grounds applied for a period adequate to drain all insulation stored potential.
  6. Maximum test voltage shall be in accordance with applicable IPCEA, AEIC and manufacturer's recommended 60 percent levels.
  7. Perform a shielded continuity test by ohmmeter method. Ohmic value shall be recorded.
  8. Test values:
    - a. Step voltage slope shall be reasonably linear.
    - b. Absorption slope shall be flat or negative. In no case should slope exhibit positive characteristics.
    - c. Current decay rate shall be uniform.
    - d. Perform: Prior to connecting equipment and in presence of authorized representative.
    - e. Submit written report to the County's Representative.
    - f. Correct or replace cable with testing below manufacturer's standards.

END OF SECTION