

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 – Common Work Results – Electrical.
- .2 Section 01 91 13 – General Commissioning (CX) Requirements

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA-C22.2 No. 131-07, Type TECK 90 Cable.
- .2 National Electrical Manufacturers' Association (NEMA)/Insulated Cable Engineers Association (ICEA)
  - .1 ICEA S-93-639/NEMA WC74-[06], 5-46 KV Shielded Power Cable for Use in the Transmission and Distribution of Electrical Energy.
  - .2 ICEA S97-682 – Utility Power Cables Rated 5 Through 46 kV

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures].
  - .1 Provide manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Quality assurance submittals: submit following in accordance with Section 26 05 00 – Common Work Results – Electrical.
  - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for recycling.

**Part 2 Products**

**2.1 TECK POWER CABLE (1001 - 15000 V)**

- .1 Cable: to CSA-C22.2 No. 131 in accordance with Section 26 05 00 - Common Work Results - Electrical
- .2 Bare copper grounding conductor, size as indicated.
- .3 Copper circuit conductors, size and number as indicated.
- .4 Strand shielding.

- .5 Insulation: chemically cross-linked thermosetting polyethylene rated RW90 15 kV to ICEA S-93-639/NEMA WC74].
- .6 Insulation shielding: semi-conducting non-metallic tape over insulation and served wire shield over tape to ICEA S-93-639/NEMA WC74.
- .7 Separator tape over conductor assembly.
- .8 Inner jacket of PVC.
- .9 Interlocked steel armour.
- .10 Overall PVC jacket rated minus 40 degrees C.

## **2.2 PILC POWER CABLE**

- .1 PILC copper cables supplied by Departmental Representative.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Demolish and replace faulty cables with medium voltage power cables.
- .2 Install power cable in ducts and manholes or as indicated.
- .3 Provide supports and accessories for installation of medium voltage power cable.
- .4 Install stress cones, terminations and splices in accordance with manufacturer's instructions
- .5 Install grounding in accordance with inspection authority.
- .6 Provide cable identification tags and identify each phase conductor of power cable.
- .7 All work on cables shall be done only when such conductors and equipment are de-energized. Unless otherwise noted on drawings, or directed by Departmental Representative, any tie-ins or connections to existing utilities or equipment that necessitate interruptions shall be performed on off office hours, Saturday, Sunday or holidays, without additional contract costs. The Contractor shall not interrupt any main electrical utility without a written request for power shutdown submitted at least 14 days in advance to and subsequent approval by the Departmental Representative.
- .8 The work to be performed during an interruption of electrical utilities will be preceded by all possible preparation and will be carefully coordinated to minimize the duration of the power interruption and work will proceed continuously until the system is restored to normal.
- .9 Phasing of reconnected cables shall be identical to the existing phasing
- .10 Install and terminate cables in accordance with the manufacturer's approved recommendations and tools suggestions. The cables shall be free of kinks and twists, and all bends shall be formed with smooth radius not smaller than twelve times the diameter of the cable nor smaller than the minimum radius recommended by the manufacturer, whichever is greater. All terminations shall be mounted to avoid any stress on the terminations.
- .11 Use a swivel between the cable grip and pulling rope

- .12 Lubricate cables with Cablelube or Minnearallac cable pulling compound or the type approved by the cable manufacturer.
- .13 Maximum pull tensions shall not exceed values recommended by the cable manufacturer.
- .14 Cable shield shall be grounded with #2/0 bare copper conductor to manhole ground at all terminations to provide permanent, low-resistance bond.
- .15 After cables have been spliced or terminated and fireproofing tape applied, each cable shall have a spiral wrap of colored 1/2" wide tape 3M #35 vinyl plastic applied over the fireproofing tape. Spiral wrap of colored tape shall be over the total length of cable, with maximum of 127 mm separation between spirals. The color coding for 15,000 volt is Blue Tape (3M #10240).
- .16 Seal all duct runs in manholes going inside buildings with a water-tight seal.
- .17 Cables shall be identified by tags in manholes (at conduit entrances and T-splice) and entrances into equipment. Information on tags shall include: cable number and routing (Example: Cable 2FA to manhole G31). Tags shall be installed on each cable after fireproofing tapes are applied.
- .18 Cables of the same circuit shall have the phasing identified with color tape in manhole. Phase A with one wrap, Phase B with two wraps, Phase C with three wraps.
- .19 After cutting, if cable ends are not to be terminated in same working day cut, immediately protect cable ends from damage or moisture by sealing with cable caps and silicone sealant. Provide stress relief at all terminations. Provide correct phasing of the conductors of each circuit at all terminations. Provide proper connections of tape shield or tape shield and drain wire to ground.
- .20 Turn over surplus cables supplied by PWGSC and deliver them back to PWGSC depot.

### **3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and Section 01 91 13 – General Commissioning (CX) Requirements.
- .2 Use of qualified tradespersons for installation, splicing, termination and testing of high voltage power cables.
- .3 Engage a certificated testing agent to test high voltage power cable. Submit test result and inspection certificate.

### **3.3 TESTS AND RECORDS**

- .1 Prior to installation of cables, perform continuity and low frequency "Tan Delta" insulation integrity tests in the presence of the Department Representatives.
- .2 Perform again continuity and low frequency "Tan Delta" insulation integrity tests after installing cables in ducts, but prior to splicing or termination in the presence of the Department Representatives.
- .3 After splicing and termination of the cables perform the following tests in the presence of the Departmental Representatives:
  - .1 Continuity tests to verify good connections of splices and terminations with a very low resistance meter

- .2 Insulation resistance tests on cables with a 500V DC megger tester.
- .3 Voltage withstand (insulation integrity) tests on cables by means of very low Frequency Tan Delta test procedures
- .4 Load tests to verify the cable, splices, terminations and the associated components can carry the rated capacity
- .4 Submit test forms to Departmental Representative for review prior to tests to be performed. Test forms shall clearly describe type of tests, methods, procedures, test instrumentation, measured results, observations and comments.
- .5 Exposed ends of cable shall be prepared and cleaned prior to testing in order to minimize any leakage current.
- .6 Cable circuit ends must be cleaned and guarded for personnel safety during cable testing. Circuits not under test in the immediate vicinity shall be grounded.
- .7 To perform very low frequency Tan Delta tests, cables must be de-energized and each end isolated. Using a VLF AC Hipot, the test voltage is applied to the cable while the tan delta controller takes measurements. Typically, the applied test voltage is raised in steps, with measurements first taken up to  $1U_o$ , or normal line to ground operating voltage. If the tan delta numbers indicate good cable insulation, the test voltage is raised up to  $1.5 - 2 U_o$ . The tan delta numbers at the higher voltages are compared to those at lower voltages and an analysis is made.
- .8 Plot results obtained from the tests: Loss Angle (Tan Delta) against VLF Voltage. Compare results obtained from tests before and after cables splicing or termination.
- .9 After testing, cables shall be grounded for a minimum of 4 times (4X) as long as the test voltage was applied during the tests to assure complete discharge.

**END OF SECTION**