

## TECHNICAL SPECIFICATION FOR 3.5x400 SQ. MM ARMoured LT XLPE CABLE

### 1.0. SCOPE:

This specification covers design, engineering, manufacture, stage testing, inspection and testing before supply and delivery at site of 1.1 kV 3.5x400 sq. mm, armoured LT XLPE cable for use with effectively earthed distribution system.

- 1.1. It is not the intent to specify completely herein all the details of the design and construction of material. However the material shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such, components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

### 2.0. STANDARDS:

- 2.1. The materials shall conform in all respects to the relevant Indian Standard Specifications with latest amendments thereto.

Indian Standard No.	Title	Internationally Recognized standard
IS-7098 Part-I/1988	Specification for Cross Linked Polyethylene Insulated PVC Sheathed Cables for working Voltages Up to and including 1100V	IEC 502 (1983)
IS-5831/1984	PVC insulation and sheath of electric cables	IEC 502 (1983)
IS-8130/1984	Conductors for insulated electric cables and Flexible cords	IEC 228 (1978)
IS 3975/1979	Specification for armouring	
IS-10418/1982	Specification for cable drum	

Material conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above, would also be acceptable. In case the Bidders who wish to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Four copies of such standards with authentic English Translations shall be furnished along with the offer. . In case of conflict the order of precedence shall be (i) IS, (ii) IEC, (iii) Other standards. In case of any difference between provisions of these standards

and provisions of this specification, the provisions contained in this specification shall prevail.

Moderately hot and humid tropical climate, conducive to rust and fungus growth.

### 3.0. **PRINCIPAL PARAMETERS :**

The material shall conform to the following specific parameters:

Sl. No.	Item	Specification
1.	<b>Type of Installation</b>	Outdoor
2.	System Voltage	433 V (+10% -15%)
3.	System Frequency	50 Hz +/- 5%
4.	No. of Phases	Three
5.	System of earthing	Solidly grounded

### 4.0 **TECHNICAL REQUIREMENTS:**

#### 4.1 **MAIN FEATURES:**

The power cables shall be of LT 1.1 kV Grade, stranded compacted, high conductivity, aluminum conductor, XLPE insulated, ST-1 type extruded PVC inner sheathed and ST-2 type extruded P.V.C. outer sheathed, conforming to relevant standards suitable for LT AC three phase, 50 c/s, effectively earthed distribution system.

#### 4.2 **MATERIALS AND CONSTRUCTION:**

##### 4.2.1 **CONDUCTOR:**

The cable conductor shall be made from stranded aluminum to form compacted shaped conductor having resistance within the limits specified in IS-8130/1984

##### 4.2.2 **INSULATION:**

The XLPE insulation shall be suitable for the specified system voltage. The manufacturing process shall ensure that the insulation is free from voids. The insulation shall withstand mechanical and thermal stresses under steady state as well as transient operating conditions. The extrusion method shall give smooth surface of insulation. The insulation shall be so applied that it fits closely on the conductor and it shall be easily possible to remove it without damaging the conductor.

##### 4.2.3 **INNER SHEATH: -**

An extruded PVC inner sheath shall be provided over laid up cores. The sheath shall be suitable to withstand the site conditions and the desired temperature. It shall be of thickness as per the relevant standards, consistent quality and free from all defects. The binding tape (non adhesive) used over the laid up cores to give it a better round shape shall not be constructed as a part of the inner sheath.

**4.2.4. OUTER SHEATH:**

Extruded PVC outer sheath of **black** colour shall be applied with suitable additives to prevent attack by rodents and termites. Outer sheathing shall be designed to offer high degree of mechanical protection and shall also be heat, oil, chemical, abrasion and weather resistant. Common acids, alkalies, saline solutions etc., shall not have adverse effects on the PVC sheathing material used.

**4.2.5 ARMOUR:**

Galvanized flat steel strips be applied as closely as possible over the inner sheath of cable for armoring conforming to IS-3975-1979 (with latest amendments).

**4.2.6 CONSTRUCTION:**

- 1) All materials used in the manufacture of cable shall be new, unused and of finest quality. All materials shall comply with the applicable provisions of the tests of the relevant Standards.
- 2) The PVC material used in the manufacture of cable shall be of reputed make. **No recycling of the PVC is permissible.** The purchaser reserves the right to ask for documentary proof of the purchase of various materials to be used for the manufacture of cable and to check that the conductor is complying with quality control.
- 3) The cable shall be suitable for laying in covered trenches and/or buried underground to meet the out door application purposes.
- 4) Cables shall have suitable fillers laid up with the conductors to provide a substantially circular cores section before the sheath is applied. Fillers shall be suitable for the operating temperature of the insulation & compatible with the insulation material

**4.2.7 Minimum guaranteed weight of aluminium conductor used in the cable shall be following-**

Nominal Area(mm <sup>2</sup> )	Min. weight of aluminium
400	3742 kg/km

**4.2.8 CURRENT RATING:**

The cables shall have current ratings and derating factors as per relevant Indian Standards. The current ratings shall be based on maximum conductor temperature of 90 deg. C with ambient site condition specified for continuous operating at the rated current. The one-second short circuit current rating shall be as per table given below at maximum temperature of 250 deg C.

Nominal Area  
(mm<sup>2</sup>)

Short Circuit Current Rating  
(kA)

400

37.60

#### 4.2.9 OPERATION:

Cables shall be capable of satisfactory operation, under a power supply system frequency variation of  $\pm 5$  c/s, voltage variation of +10% or-15%. Cable shall be suitable for laying in ducts or under ground. Cables shall have heat and moisture resistance properties; these shall be of type and design with proven record on Distribution Network service.

#### 4.2.10 LENGTH:

The cable shall be supplied in wooden drums and the standard drum length shall be as follows-

(a) 3.5 x 400 sq. mm

250 meters  $\pm 5\%$

Substandard drum length of not less than 100 meters upto a maximum of 5% of the quantities ordered shall be accepted. However substandard drum length upto a maximum of 5% shall be acceptable only in a particular lot offered for inspection

#### 4.2.11 IDENTIFICATION:

For identification of individual cores, coloured strips of red, yellow and blue colours respectively shall be used on the cores to identify phase conductors as per relevant ISS.

#### 4.2.12 EMBOSSING:

The cable shall be embossed through out the length with the name of the manufacturer and the letters "Property of P.V.V.N.L., Specification No., voltage grade with cable size and the month & year of manufacture". The embossing shall be done only on the outer sheath, the distance between any two consecutive embossings shall not be more than 2 Meter. The cable shall also be embossed (clearly visible) for the verification of its length at intervals of 1 Meter say 1,2,3 up to full length.

#### 4.2.13 GUARANTEED TECHNICAL PARTICULARS:

The guaranteed technical particulars as detailed in the specification annexure-I shall be guaranteed and a statement of guaranteed technical particulars shall be furnished in the format along with the bid **without which the Bid shall be treated as Non -Responsive.**

Immediately after completion of the electrical tests (during routine/acceptance tests), the ends of the cable shall be enclosed by rubber/PVC caps of wall thickness not less than 2.5 mm and then sealed by non hygroscopic material (the cores being suitably insulated from the cap). The cap shall be of robust construction and tight fit, and it shall have the trademark of the manufacturer embossed thereon

**5.0. TESTS:**

**5.1 Type Test:**

The material offered shall be fully type tested at CPRI/ERDA/NTH by the Bidder as per the relevant standards but test reports shall not be more than five years old from the date of opening of bid. The bidder shall furnish complete set of following type test reports along with the bid. **The bids received without these type test reports shall be treated as Non-responsive.**

1. Tests on conductors
2. Test for thickness of insulation and sheath
3. Physical tests for insulation
4. Physical tests for outer sheath
5. Insulation resistance test
6. High voltage test

**5.2. Acceptance and Routine test:** All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier in presence of purchaser's representative.

**6.0 INSPECTION:**

**6.1** The inspection shall be carried out by the purchaser's representative during manufacture and before dispatch. The supplier shall keep the purchaser informed in advance, about the manufacturing programme so that arrangement can be made for inspection.

The manufacturer shall grant free access to the purchaser's representative, at a reasonable time, when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser, shall not relieve the supplier of his obligation of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.

**6.2** All Acceptance tests and inspection shall be made at the place of manufacturer unless otherwise especially agreed upon by the Bidder and purchaser at the time of purchase.

The purchaser reserves the right to insist for witnessing the acceptance/ routine testing of the bought out items. The supplier shall give 15 days (for local supply)/ 30 days (incase of foreign supply) advance intimation to enable the purchaser to depute his representative for witnessing the acceptance and routine tests. Material shall be dispatched only after getting the dispatch authorization from Inspectors representing purchaser, after successful testing.

**6.3** If successful type tests have been carried out on the offered design during last five years (counted from the date of tender opening), repetition of type tests is not required.

On the other hand, if the offered design is not type tested during last five years, the cable shall be subjected to all type test in accordance with IS: 1554 (Part-I)/1988 and amendment thereof at recognized test house of repute. All charges/fee/transportation etc. to conduct these tests shall be borne by Contractor.

Regular supply of the material shall commence only after successful type testing and dispatch authorization from the competent authority.

However, the purchaser reserves the right to get cable type tested at any stage during the currency of contract at his own expenses in any reputed test house. The transportation and arrangement of testing of sample to test laboratory shall be the responsibility of the contractor.

6.4 Routine tests report shall be sent by the manufacturers with their offer for inspection, the following acceptance tests as laid down in the referred ISS (with latest amendments) shall be carried out by the inspecting officer of the PVVNL on Samples selected at random as per Appendix 'A' in IS-1554 (Part-I) 1988.

- |   |                          |
|---|--------------------------|
| 1. Tests on conductor   | Reference to I.S.S.      |
| a) Tensile test   | IS: 8130-1984            |
| b) Conductor resistance test  | IS: 8130-1984            |
| 2. Test on armoring strips:   |                          |
| a) Measurement of dimension   | IS: 3975 - 1979          |
| b) Tensile test   | IS: 3975 - 1979          |
| c) Elongation test & winding test                                       | IS: 3975 - 1979          |
| d) Zinc coating   | IS: 2633 - 1984          |
| 3. Test for thickness of insulation and sheath                          | IS: 5831 - 1984          |
| 4. Tensile strength and elongation<br>at break of insulation and sheath | IS: 5831 - 1984          |
| 5. Insulation Resistance Test   | IS: 5831 - 1984          |
| 6. High voltage test at room temperature                                | IS: 1554 (Part-I) - 1988 |

In addition to above, length/weight check and bending test on one drum per inspection shall also be carried out by the inspecting officers for which contractor will make all necessary arrangements and provide all necessary facilities at his own cost.

**7.0 CALBE DRUMS:**

The cables shall be supplied in non-returnable substantially lagged wooden drums of heavy construction suitable for transportation by goods train or truck and for storage at site. The wood used for construction of the drum shall be properly seasoned and sound and wood preservative shall be applied to the entire drum. All ferrous parts shall be treated with a suitable rust preventive finish or coating to avoid rusting during transit or storage. The drum shall also conform to specn. No. IS: 10418-1982 with latest amendment thereof.

Each drum shall have the following information marked on it with indelible ink alongwith other important information including technical data: -

1. Property of PVVNL & Specification No. – PVVNL-MT/ .....
2. Designation of consignee & destination railway station.
3. Drum Number.
4. Aluminium Core Cable.
5. Cable rating eg. Voltage grade, No. of cores, sizes etc.
6. Height of empty drum.
7. Length of Cable.
8. Gross weight of drum with cable.
9. Year of manufacture.

**8.0 PACKING AND TRANSPORT:**

All the material covered under this specification shall be adequately packed for transportation by Rail/Road. A layer of waterproof paper shall be applied to the surface of the drums and over the outer cable layer. A clear space of atleast 40 mm shall be left between the cable and the laggings. The packing shall be adequate to protect the cable from damage, in transit and contractor shall be responsible for it and make good at his own expense any and all damages due to improper packing etc.

**9.0 VARIATION OF QUANTITY:**

The supplied quantity can vary within Plus/Minus 1% of the ordered quantity.