

## **TECHNICAL SPECIFICATION OF SINGLE CORE 50 Sq.mm LT UV Resistant XLPE CABLES**

### **1.0 SCOPE:**

- 1.1 This specification provides for design, manufacture, engineering, inspection, stage testing and testing before supply, packing, forwarding and delivery at site of LT Single core XLPE Cable complete with all fittings, accessories specified herein which are required for efficient and trouble free operation as specified here under, for use with effectively earthed distribution system.
- 1.2 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, 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 material offered shall be complete with all components necessary for its 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 the commercial order or not.

### **2.0 STANDARDS:**

- 2.1 The material shall conform to the latest issues / amendments of standards given below, except to the extent explicitly modified in the specifications.

<b>INDIAN STANDARDS SPECIFICATION NO</b>	<b>TITLE</b>
1. IS:7098 Part-I/1988	Specification for Cross Linked Polyethylene Insulated PVC Sheathed Cables for working voltages upto and including 1100V
2. IS:5831/1984	PVC Insulation and sheath of electric cables
3. IS:8130/1984	Conductors for insulated electric cables and flexible cords.
4. IS:10810/1984	Methods of test for cables
	Indian Electricity Rules,1956

- 2.2 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 any the orders of precedence shall be as per IS. In case of any difference between provisions of these standards and provisions of the specification, the provisions contained in this specification shall prevail.

### **3.0 SERVICE CONDITIONS:**

#### **3.1 Climatic Conditions:**

The material to be supplied against this specification shall be suitable for satisfactory continuous – operation under the following tropical conditions.

<b>Sl. No.</b>	<b>Location</b>	<b>In the state of Andhra Pradesh</b>
i.	Max. ambient air temperature (Deg.C)	50
ii.	Min. ambient air temperature (Deg.C)	7.5
iii.	Average daily ambient air temperature (Deg.C)	35
iv.	Max. Relative Humidity (%)	74
v.	Max. altitude above mean sea level (m)	1000
vi.	Average Annual rainfall (mm)	925
Vii.	Max.wind pressure (kg./sq.m)	200
viii.	Isoceraunic level (days per year )	50
ix.	Seismic level (Horizontal acceleration)	0.10g
x.	Average No. of thunderstorms days/years	40
xi.	Average number of rainy days/years	90
xii.	Average number of months/tropical monsoon condition per year	3

Moderately hot and humid tropical climate, conducive to rust and fungus growth. The climatic conditions are also prone to wide variations in the ambient conditions. Smoke is also present in the atmosphere. Heavy lightning also occurs during June to October.

#### **4.0 PRINCIPAL PARAMETERS : LT XLPE Single Core Cables**

4.1 The material covered in this specification shall meet the Technical Requirement listed below.

<b>SL.No.</b>	<b>Particulars</b>	<b>Requirement</b>
1	Type of Cable	Cross linked polyethylene insulated PVC sheathed Aluminum cable
2	No.of cores	Single
3	Conductor Nominal Area.	50 Sq.mm
4	Conductor material	H4 grade Aluminum
5	Max. DC Resistance (Ohms/km)	As per IS standards
6	System of voltage (Nominal & variation)	1100Volts +10% -15%
7	Short circuit rating for 1 second (KA rms)	As per IS
8	System frequency & variation	50 Hz +/-5%
9	Current rating (standard condition) in air at 40 Deg. C	As per IS
10	Safe overload capacity	10%
11	Insulation	XLPE UV Resistant
12	Maximum allowable temp, for cable and accessories	
a)	During continuous operation at rated full load current the maximum temperature of the conductor shall not exceed (Deg. C).	90 <sup>0</sup> C
b)	The conductor temperature after a short circuit for one second shall not exceed (Deg.C).	250 <sup>0</sup> C

13	System earthing	Effectively GROUNDED
----	-----------------	----------------------

## **5.0 GENERAL TECHNICAL REQUIREMENTS :**

### **5.1 L T XLPE SINGLE CORE ALUMINUM POWER CABLES:**

- 5.1.1 The power cable shall be of LT 1100V grade, stranded, compact, circular, high conductivity H4 grade aluminum conductor of flexibility grade-2, Single core XLPE insulated, extruded PVC outer sheathed, overall, confirming to IS:7098 (Part-I/1988) with latest amendments thereto suitable for LT,AC 3-Phase 50 Cycle per second effectively earthed distribution system.
- 5.1.2. The cable-size required is 50 Sq.mm stranded aluminum conductor XLPE insulated and PVC sheathed overall cable as per IS : 7098 part-I/1988 with latest amendments thereto suitable for 1.1KV earthed system.
- 5.1.3. Outer sheathing shall be designed to afford high grade of mechanical protection and shall be heat, oils, chemicals abrasion and weather resistant. Common acids, alkalines, saline solutions etc., shall not have adverse effects on the PVC sheathing materials used.
- 5.1.4. The cable shall be suitable for laying in Air/and or in covered trenches and/or buries underground to meet the outdoor application requirements.

### **5.2. Materials and construction :**

#### **5.2.1 CONDUCTOR :**

The cable conductor, composed of electrically pure H4 grade flexibility class 2 plain aluminum wires, shall be stranded together and compacted. Conductor construction and testing shall be as per IS:8130/1984 including amendments thereto. Stranding and compacting should be such that it should bring out smooth surface so as to ensure minimum stress development on the surface of the conductor.

#### **5.2.2 INSULATION :**

The XLPE shall be suitable for 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 very smooth surface. 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. The XLPE shall be of high standard and quality conforming to the requirements specified in the Table-1 of IS-7098 (Part-I)1988. Thickness of insulation and tolerance thereof shall be as specified vide clauses 9.2 and 9.3 of IS-7098/Part-I/1988,IS 5831&IS 14255. No armouring is required.

**Outer sheath:** The core shall be provided with an outer sheath applied by extrusion of UV Resistant PVC, type ST-2 to IS-5831/1984 to withstand site conditions and a continuous conductor temperature of 90 Deg. C. It shall have adequate thickness, consistent quality and be free from all defects. The outer sheath shall be so applied that it fits closely on the core and it shall be possible to remove it without damage to the insulation. The outer sheath material shall be so chosen as to be compatible with the temperature ratings of the cable and shall have no deleterious effect on any other component of the cable.

The average thickness of outer sheath shall be not less than the nominal value specified under column-3 of table-8 and the smallest of the measured values shall be less than the minimum value specified in column-4 table-8 of IS:7098/part-I/1988. Color of the outer sheath shall be black. Suitable additives to prevent attack by rodents and termites shall be added to the sheath material.

- 5.2.3. **Embossing :** The cable shall be embossed through out the length with the name of the manufacturer or trademark and the letters “APEPDCL” along with ISI marking, size of the cable and the year of manufacture. The embossing shall be done only on the outer sheath. The cable shall be embossed for the verification of its length at intervals of one meter say 1,2,3 up to full lengths.

**5.2.4. Current rating :** The cable shall have current ratings and derating factor as per relevant IS. The rating shall be based on the maximum conductor temperature of 90 Deg. C. with site ambient conditions specified for continuous operation at rated current.

**5.2.5. Operation:** The cable shall be of given satisfactory operation under a power supply system frequency variation of +/-5% voltage variation of +/-10% to -15%. Cables shall have heat and moisture resistant properties. Their type and design shall have proven record on distribution network service.

**5.2.6. General:** All materials used in the manufacture of cables shall be new, unused and of finest quality. All materials shall comply the applicable provisions of the tests of the specifications, IS, Indian Electricity Rules, Indian Electricity Act and any other such applicable statutory provisions, rules regulations etc. The purchaser reserves the right to call for documentary proof of purchase of various input materials to be use in the manufacture of cables and to check that the supplier is complying with quality control.

Caution: The PVC material used in the manufacture of cables shall be of reputed make  
**RECYCLING OF PVC IS NOT PERMISSIBLE.**

**5.2.8 GUARANTEED TECHNICAL PARTICULARS:**

The guaranteed technical particulars as detailed in the specifications Annexure-I shall be guaranteed and a statement of Guaranteed Technical Particulars shall be furnished in the formats along with the Bid without which the Bid will be treated Non-Responsive.

**GUARANTEED TECHNICAL PARTICULARS FOR SINGLE CORE LT XLPE  
ALUMINUM POWER CABLES**

SL. No.	Characteristics	50 Sq.mm
A		
1	Name and country of manufacture	
2	Type of Cable	
3	Trade Name/Brand Name	
4	Voltage Grade	
5	No of cores	
6	Conductor Nominal Area (Sq.mm)	
7	Conductor material	
8	Max. DC Resistance (Ohms/km)	
9	Permissible frequency variation and voltage variation for satisfactory operation	
10	Short circuit rating for 1 second.(KA rms)	
11	Safe overload capacity	
12	Maximum allowable temp for cable and accessories	
A	During continuous operation at rated full load current the maximum temperature of the conductor shall not exceed	
B	The conductor temperature after rated short circuit.	
13	Safe pulling force (Kg)	
14	Specific insulation resistance at 90 Deg.C (Ohms/km)	
15	Insulation resistance at 27 Deg.C (Mega Ohm/km)	
16	Short circuit current (Sec)	
	i) Short circuit current (KA rms)	
	ii) Duration of short circuit (Sec.)	
	iii) Allowable/attainable maximum conductor	

	temperature when carrying current continuously (Deg.C)	
	i) Allowable/attainable maximum conductor temperature at the termination of short circuit (Deg.C)	
<b>B 1</b>	<b>CABLES</b>	
2	Material and grade	
<b>3</b>	<b>CONDUCTOR</b>	
3.1	Material and Grade	
3.2	Minimum number of wires/strands per conductor	
3.3	Diameter of wire/strand (mm)	
3.4	Diameter of conductor (mm)	
3.5	Whether compacted	
<b>4.0</b>	<b>Insulation</b>	
4.1	Material	
4.2	Thickness of insulation (mm)	
4.3	Diameter of core over insulation (mm)	
4.4	Whether XLPE insulation gas cured or steam cured	
4.5	Whether xlpe insulation filled or unfilled	
4.6	Whether the XLPE insulation is UV resistant	
<b>5.0</b>	<b>OUTER SHEATH</b>	
5.1	Material and type	
5.2	Minimum thickness of sheath (mm)	
5.3	Tolerance of thickness	
5.4	Overall diameter of cable (mm)	
5.5	Whether PVC recycled	
<b>6.0</b>	<b>CABLE CONSTANTS</b>	
6.1	DC Resistance per core at 20 Deg.C(Ohms/km)	
6.2	AC Resistance per core at the maximum operating temperature of 90 Deg. C(Ohms/km)	
7.0	Continuous current carrying capacity (or current rating)	
	i) For standard conditions as per IS	
	----- in air at 40 Deg. C (Amps)	
	----- in ground at 30Deg. C (Amps)	
	----- in duct at 30 Deg. C (Amps)	
	----- in trench (Amps)	
	ii) For standard conditions as per IS	
	----- in air (Amps)	
	----- in ground (Amps)	
	----- in trench (Amps)	
7.1	Rating factors	
	i) For variation in ambient air temperature	
	----- temperature (Deg. C )	
	----- factory (Deg. C )	
	ii) For variation in ground temperature	
	----- temperature (Deg. C )	

	----- factory (Deg. C )	
7.2	Are the offered cables guaranteed to perform satisfactorily under insulation conditions specified. If yes, furnish relevant calculations in support including the following data.	
	i) Maximum continuous and short time (1sec) voltage withstand capability of inner PVC sheath of the cable (volts)	
8.0	PHYSICAL DETAILS	
8.1	Cable weight (kg/mm)	
8.2	Cable drum	
	----- Cable net weight (kg/drum)	
	----- Gross shipping weight (kgs)	

## **6.0 TESTS :**

### **6.1 Type Test:**

6.1.1. All the materials offered by the Bidder shall be fully type tested in a Govt./NABL approved lab as per the relevant Standards IS: 7098 (Part I)/1988 with amendment No1. The following type tests must have been conducted not earlier than five years. The Bidder shall furnish two sets of the following type tests reports along with the offer.

- i) Test on conductor
  - a) Tensile test (for aluminum)
  - b) Resistance test
- ii) Test for thickness of insulation and sheath
- iii) Insulation resistance test (Volume Resistivity Test)
- iv) High voltage test
- v) Flammability test
- vi) Physical tests for insulation.
- vii) Physical tests for sheath
- viii) UV exposure test for 6 hrs. as per ASTM G 154

6.1.2. THE OFFERS RECEIVED WITHOUT ABOVE COMPLETE AND SATISFACTORY TYPE TEST CERTIFICATES SHALL BE TREATED AS NON-RESPONSIVE.

6.1.3. THE TENDERER SHALL FURNISH A COPY OF VALID BIS LICENCE FOR ISI MARKING TOGETHER WITH THEIR OFFER, WITHOUT WHICH THE OFFER SHALL BE TREATED AS NON-RESPONSIVE.

### **6.1.4. Acceptance and Routine tests :**

All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier in the presence of purchaser's representatives.

Immediately after finalization of the program of acceptance/routine testing, the supplier shall give fifteen days advance intimation to the purchaser, to enable him to depute his representative for witnessing the tests. Optional tests on the sheath are not applicable.

## **7.0 INSPECTION :**

### **7.1. General**

- i) The purchaser shall have access at all time to the works and all other places of manufacture where the materials are being manufactured and the Bidder shall provide purchasers representatives all facilities for unrestricted inspection of the Bidder's works, raw materials, manufacture of all the accessories and for

- conducting necessary tests as detailed herein.
- ii) The successful Bidder shall keep the Purchaser informed in advance of the time of starting and of the progress of manufacture of equipment in its various stages so that arrangements could be made for inspection.
- iii) No material shall be dispatched from its point of manufacture unless the materials has been satisfactory inspected and tested.
- iv) The acceptance of any quantity of material shall in no way relieve the successful Bidder of his responsibility for meeting all the requirement of this specification and shall not prevent subsequent rejection if such material are later found to be defective.
- v) The Bidder shall give 15 days (for local supplies)/30 days (in case of foreign supplies) advance intimation to enable the purchaser to depute his representative for witnessing acceptance and routine tests.
- vi) The purchaser reserves the right to appoint at his cost any inspection agency to carry inspection.

## **7.2 Inspection Programme.**

- a. The Bidder shall chalk out a detailed inspection and testing programme for manufacturing activities for the various components.
- b. Stages of inspection and purchaser's participation would be defined and tied up at the time of award of contract.

## **8.0 QUALITY ASSURANCE PLAN:**

- 8.1. The bidder shall invariably furnish the following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of material offered.
- (i) The structure of Organisation.
  - (ii) The duties and representative assigned to staff ensuring Quality of work.
  - (iii) The system of Purchasing, taking delivery and verification of materials.
  - (iv) The system for ensuring quality of workmanship.
  - (v) The quality assurance arrangements shall conform to the relevant requirement of ISO-9001 or ISO-9002 of applicable.
  - (vi) Statement giving list of important raw materials names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of Bidder's representative, copies of test certificates.
  - (vii) Information and copies of test certificate as in (vi) above in respect of bought out accessories.
  - (viii) List of manufacturing facilities available
  - (ix) Level of automation achieved and list of areas where manual process exists.
  - (x) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
  - (xi) Lists of testing equipment available with the bidder for final testing of equipment specified and test plant limitation. If any, vis-à-vis the type, special acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in schedule of deviations from specified test requirements.

## **8.2 The Contractor shall within 15 days of placement of order, submit following**

**information to the purchaser.**

- (i) List of raw materials as well as bought out accessories and the names of sub suppliers selected from those furnished along with offers.
- (ii) Type test certificates of the raw materials and bought out accessories if required by the purchaser.
- (iii) Quality Assurance Plan (QAP) with hold points for purchaser's inspection. The quality assurance plan and purchasers hold points shall be discussed between the purchaser and Contractor before the QAP is finalized.

**8.3 The Contractor shall operate systems which implement the following:**

- (i) Hold point: A stage in the material procurement of workmanship process beyond which work shall not proceed without the documental approval of designated individuals or organization. The Purchaser written approval is required to authorize work to progress beyond the hold points indicated in approved quality plans.
- (ii) Notification Point: A stage in material procurement of workmanship process for which advance notice of activities required facilitate witness.
- (iii) If the Purchaser does not attend after receiving documented notifications in accordance with the agreed procedures and with the correct period of the notice then the work may proceed.

The Contractor shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing if required by the purchaser and ensure that the Quality Assurance Requirements of the specification are followed by the sub-contractors.

The Quality Assurance Program shall give a description of the Quality System and Quality Plans with the following details.

(i) **Quality System:**

- The structure of the organization
- The duties and representatives assigned to staff ensuring Quality of work.
- The system of Purchasing, taking delivery and verification of materials.
- The system for ensuring quality workmanship
- The system for control of documentation.
- The system for retention of records.
- The arrangement for Contractors internal audition
- A list of the Administrator and work procedures required to achieve contractors Quality requirements. These procedures shall be made readily available to the purchaser for Inspection on request.

(ii) **Quality Plans:**

An outline of the proposed work and program sequence

- The structure of contractor organizations for the contract.
- The duties and responsibilities assigned to staff ensuring quality of work.
- Hold and Notification points.
- Submission of Engineering document required by the specification.
- The inspection of the materials and components on request.
- Reference to Contractors work procedures appropriate to each activity.
- Inspection during fabrication /Construction.



- Final inspection and Test.

## **9.0 PACKING AND FORWARDING:**

- 9.1 Packing & Drum marking: The cables shall be wound on drums and packed. The ends of the cables shall be sealed by means of non-hygroscopic sealing material. The cables shall be supplied strictly in SINGLE CONTINUOUS LENGTHS OF 500 Mtrs +/-5%
- Tolerance in overall length ordered, shall be not in excess of +/-5%
  - Manufacturer's capability to supply maximum drum lengths may be specified. Purchaser shall have, however, the right to choose and decide on the drum lengths at the time of ordering.
  - Type and material of the drum shall be specified by the supplier, preferably by means of a dimensional drawing.
  - The drum packing shall be robust enough for rough handling that is occasioned during transport by sea/road.
- 9.2 The cable shall carry the following information either stenciled on the reel or a label attached to it.
- Reference IS with IS certification mark.
  - Manufacturer's name, brand name or trade mark.
  - Type of cable, voltage grade.
  - No. of cores/nominal area of cross-section of conductor cable code.
  - Length of cable on drum (m)
  - Direction of rotation of drum (by arrow)
  - Gross weight of drum (Kgs)
  - Year of manufacture.
  - The drum shall be marked "APEPDCL "
- 9.3. The equipment shall be packed in create suitable for vertical/horizontal transport as the case may be, and suitable to withstand handling during transport and outdoor stores during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with and appropriate caution symbol. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc., shall be provided. Any material found short inside the packing cases shall be supplied immediately by supplier without any extra cost.
- 9.4 Each consignment shall be accompanied with a detailed packing list containing the following information.
- Name of the consignee.
  - Details of consignment.
  - Destination.
  - Total weight of consignment.
  - Handling and packing instructions.
  - Bill of Material indicating contents of each package.
- 9.5 The supplier shall ensure that the packing list and bill of material are approved by the purchaser before dispatch.
- 9.6 The packing shall be done as per the manufacturer's standard practice. However, he should ensure the packing is such that, the material should not get damaged during transit by Road/Sea.

## **10. QUANTITY AND DELIVERY REQUIREMENTS :**

The quantity and delivery requirement are indicated in Annexure-II.

**11. SUPERVISION SERVICES; NIL**

The purchaser will arrange for unloading of the consignments.

**12. TECHNICAL DEVIATIONS:**

Technical deviations to “Technical Specification” shall be specifically and clearly indicated in the “Annexure-III.

**CHIEF GENERAL MANAGER / P&MM  
CORPORATE OFFICE :: A.P.E.P.D.C.L  
VISAKHAPATNAM  
(Ph No. 0891-2582311, 2582301)**

**ANNEXURE-I  
SYSTEM PARTICULARS**

SL. No.	Item	Specification
1	Type of Installation	Outdoor
2	System Voltage	415V+10%- 15%
3	System frequency	50Hz +/-5%
4	No of phases	Single
5	System of earthing	Effectively earthed

