

STANDARD TECHNICAL SPECIFICATION COVER SHEET

Specification No. : ENG-EHV-1009

**Specification Name : ENG-ELC-070- TECHNICAL SPECIFICATION FOR 33kV
XLPE COVERED CONDUCTOR- R1**

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TECHNICAL SPECIFICATION FOR 33kV XLPE
COVERED CONDUCTOR

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1. SCOPE

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading at site/store of 33kV All Aluminum Alloy Stranded XLPE Covered Conductors. The material shall be complete with all components, which are necessary or usual for their efficient performance and trouble-free operation.

2. APPLICABLE STANDARDS

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest editions of the following Indian, International Standards and shall conform to the regulations of the local authorities:

Ref. IS	Description
IS 398:1996 (Part IV)	Specification for aluminum conductors for overhead distribution purpose
EN 50397-1:2006	Covered Conductor Specification for voltage 1kV to 33kV
IS : 10418	Reels and drums for bare conductors

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

SL.NO.	CONDITONS	VALUES
1	Max. altitude above sea level	1200m
2	Max. Ambient Temperature	50 °C
3	Max. Daily average ambient temp	35 °C
4	Min Ambient Temp	0 °C
5	Maximum temperature attainable by an object exposed to sun	60 °C
6	Maximum Humidity	95%
7	Minimum Humidity	10%
8	Average No. of thunderstorm days per annum	70
9	Average Annual Rainfall	150 cm
10	Average No. of rainy days per annum	120
11	Thermal Resistivity of soil	150 Deg. Ccm/W

12	Wind Pressure	126 kg/sq. m up to an elevation of 10 meter.
14	Earthquakes of intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
15	Earthquakes of intensity in vertical direction	equivalent to seismic acceleration of 0.15g
16	Wind velocity	300 km/hr.

Environmentally, some of the regions, where the work will take place include coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will frequently be salt laden. On occasions, the combination of salt and condensation may create pollution conditions for outdoor insulators. Some places are in heavily industrial polluted areas. Therefore,

Outdoor material and equipment shall be designed and protected for use in exposed, heavily polluted, salty, corrosive and humid coastal atmosphere.

The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. The design of equipment and accessories shall be suitable to withstand seismic forces as mentioned above.

4. GENERAL TECHNICAL REQUIREMENTS:

The XLPE covered conductor shall comply in all respect with IS: 398 (Part.4)/1996 with latest amendment, if any from the date of its applicability

Sl. No.	Technical Parameters	Desired Values		
1	Name of the manufacturer	To be furnished by Bidder		
2	Applicable Standard	EN 50397-1:2006, IS 398-IV/1994		
3	Type of Conductor	AAAC XLPE Covered Conductor		
4	Voltage Grade	36kV/ 33kV		
5	Nominal Cross-sectional area of conductor	100	148	232
6	Conductor			
a)	Material	Aluminium Alloy (AAAC)		
b)	Shape	Stranded Circular and Watertight		
c)	No / diameter of wire (before stranding)	7x4.26	19x3.15	19x3.94
d)	Approx. conductor diameter	12.78 mm	15.75 mm	19.7 mm

e)	Max. D.C. Resistance at 20°C	0.339 Ω/Km	0.229 Ω/Km	0.1471 Ω/Km
f)	Resistance Temperature co-efficient	0.004 / °C	0.004 / °C	0.004 / °C
g)	Minimum Tensile strength of conductor	29.26 kN	43.5 kN	68.05 kN
7	Thickness and dimensions			
7.1	Conductor Screen			
a)	Material	Extruded Semi-Conducting Compound		
b)	Nominal Thickness	0.4 mm	0.4 mm	0.4 mm
7.2	Insulation inner layer			
a)	Material	Extruded XLPE		
b)	Nominal thickness	2.43 mm	2.43 mm	2.43 mm
7.3	Insulation Outer layer			
a)	Material	Track Resistance, UV Resistant and Erosion Resistance XLPE (Black)		
b)	Nominal thickness	1.2 mm	1.2 mm	1.2 mm
8	Lightening Impulse withstand strength of XLPE Layer	170 KVp	170 KVp	170 KVp
9	Approx. Overall Diameter	20.5 mm	23.5 mm	28.1 mm
10	Maximum continuous operating temperature	90 °C	90 °C	90 °C
11	Max short circuit current, 1 sec (KA)	9.4kA	13.912kA	21.808kA
12	Approx. Weight	480 kg/km	700 kg/km	970 kg/km
13	Standard Packing length	1000 (+/- 5%) as per PO terms	1000 (+/- 5%) as per PO terms	1000 (+/- 5%) as per PO terms
14	Raw Material Make	Conductor raw material shall be procured from reputed suppliers viz., BALCO/ HINDALCO/ NALCO/ Vedanta		

5. GENERAL CONSTRUCTIONS:

5.1 CONDUCTOR

a) The properties of stranded all aluminum alloy conductors of various sizes are as follows

Actual Area	Stranding & wire dia.	Approx. overall dia.	Approx. mass	Calculated resistance at 20 d.c. (max.)	Approx. calculated Breaking Load	Reactance per km	Current Rating
mm. sq.	mm	mm	Kg/km	Ohm/km	kN	Ohms	Amps
100	7/ 4.26	12.78	272.86	0.339	29.26	0.3394	325
148	19/ 3.15	15.75	406.91	0.2290	43.50	0.3238	440
232	19 / 3.94	19.70	636.67	0.1471	68.05	0.3146	520

- b) The properties of aluminum alloy wires to be used in the construction of the Stranded conductors are as follows:

Diameter		Cross sectional area of Nominal Diameter	Mass	Minimum Breaking Load after stranding	Resistance at 20 deg.c
Nom	Max				
mm	mm	Sq.mm	Kg	kN	Ohm/kM
3.15	3.18	7.793	21.04	2.29	4.290
3.94	3.98	12.190	32.92	3.58	2.746
4.26	4.30	14.25	38.48	4.18	2.345

- c) No negative tolerance shall be permitted on the nominal diameter aluminum wire used in the manufacture of XLPE COVERED CONDUCTOR. However, positive tolerance in this respect shall be as provided in IS: 398 (Part IV)/1994 (amended up to date).
- d) The wire shall be smooth and free from all imperfections such as spills, splits, slag inclusion, dia. marks scratches, fittings, blow holes, projections, looseness, overlapping of strands, chipping of aluminum layers etc. and all such other defects which may hamper the mechanical and electrical properties of the conductor. Special care should be taken to keep away dirt, grit etc. during stranding.
- e) There shall be no joint in any wire of a stranded conductor containing seven wires, except those made in the base rod or wire before final drawing.
- f) In conductors containing more than seven wires, joints in individual wires are permitted in any layer except the outermost layer (in addition to those made in the brass rod or wire before final drawing) but no two such joints shall be less than 15 m apart in the complete stranded conductor, such joint shall be made by resistance or cold pressure butt welding. They are not required to fulfill the mechanical requirement of unjointed wires. Joints made by resistance butt welding shall, subsequent to welding, be annealed over a distance of at least 200 on each side of the joint.
- g) The wires used in the construction of a stranded conductor shall, before stranding satisfy all the relevant requirements of this standard.
- h) Conductor raw material shall be procured from reputed suppliers viz., BALCO/ HINDALCO/ NALCO/ Vedanta
- i) The lay ratio of the different layers shall be within the limits given below: -

No. of wires in Conductors	Lay Ratio in			
	6 - wire layer		12 - wire layer	
	Min.	Max.	Min.	Max.
7	10	14	-	-

19	10	16	10	14
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5.2 FILLING (WATER BLOCKING):

The Stranded Conductor shall be longitudinally water tight by means of a water blocking material incorporated during the extrusion process. The use of grease/water swell able tape / water swell able powder etc. is not permitted. The water blocking material shall be stable at maximum operating conductor temperature of 90 Deg. Cent. The water blocking compound shall be compatible with the conductor material as well as the semi conducting screen above it and not adversely affect its electrical or mechanical properties.

5.3 SEMICONDUCTING SCREEN:

An extruded semi conductive compound should be applied over the filled stranded conductor to ensure a lower voltage stress on the Insulation applied over the screen.

5.4 INSULATIONS:

The Insulation should be dual layered with the Inner Layer being XLPE with a nominal thickness of 2.43 mm and the Outer Layer being a suitable XLPE which is UV Resistant, Anti Tracking and Erosion Resistant with a nominal wall thickness of 1.2 mm. The minimum combined Insulation Thickness of both Layers should be 3.63 mm.

The conductor manufacturing and stranding process shall incorporate the longitudinal water blocking also.

The Semiconducting Screen, Inner Insulation and Outer Insulation should be extruded in one step i.e. triple extrusion to ensure a good, permanent bond between the three layers and also with the conductor. It shall be possible to remove the Semi Conducting Screen, Inner and Outer Insulation Layers without damage to the conductor.

6. MARKING:

The following particulars shall be properly legible embossed on the covered conductor at the intervals of not exceeding one meter throughout the length of the Conductor. The covered conductor with poor and illegible embossing shall be liable for rejection.

- Name & Trade mark of the manufacturer
- Voltage Grade
- Year of manufacture
- Size of Covered Conductor
- EN 50397-1: 2006
- PO Number

- g) "TPWODL/ TPCODL/ TPNODL/ TPSODL" Name

Note: - Sequential meter marking shall be printed (after each meter)

Following details shall be provided on flanges of drum:

- a) Manufacturer's name
- b) Type of Cable/Conductor
- c) Size of Cable/Conductor
- d) Voltage Grade
- e) Length of the cable/conductor on the drum
- f) Direction of the rotation of the drum
- g) Gross mass
- h) Country of manufacture
- i) Year and month of manufacture
- j) Purchase Order no.
- k) Drum No.

7. TESTS

A type test shall be performed on every covered conductor type, irrespective of the cross-sectional area. All the type test, Routine test and acceptance test should be as per EN 50397-1:2006 and latest amendment. The bidder shall be required to submit complete set of the following test reports along with the offer: -

7.1 ACCEPTANCE TESTS

- a) Visual examination and Dimension Check Test
- b) Conductor Resistance Test
- c) High Voltage Test
- d) Spark Test
- e) Hot Set Test on covering
- f) Longitudinal Water Tightness Test
- g) Anti-tracking Test
- h) Marking

7.2 ROUTINE TESTS

- a) Visual examination and Dimension Check Test
- b) Conductor Resistance Test
- c) High Voltage Test
- d) Spark Test
- e) Hot Set Test on covering

- f) Longitudinal Water Tightness Test
- g) Marking

7.3 TYPE TESTS

i) Electrical Test

- a) Conductor Resistance Test
- b) High Voltage Test
- c) Spark Test
- d) Leakage Test
- e) Tracking Resistance

ii) Non-Electrical Test on Covering

- a) Mechanical properties Test
- b) Carbon Black Content
- c) Resistance to UV rays
- d) Ageing of complete product sample
- e) Shrinkage Test
- f) Hot Set Test
- g) Pressure Test At High Temperature
- h) Water Absorbs Test
- i) Hardness Test
- j) Longitudinal Water Tightness Test
- k) Marking
- l) Slippage Test

iii) Visual examination and Dimension Check Test

iv) Mechanical properties of the conductor.

8. TYPE TEST CERTIFICATES:

The Bidder shall furnish the type test certificates for the tests as mentioned above as per the corresponding standards and as per CEA guide line. All the tests shall be conducted at CPRI / ERDA as per relevant IS/ IEC standard. Type tests should have been conducted in certified Test laboratories during the period not exceeding 10 years from the date of opening the bid. In the event of any discrepancy in the test reports, i.e. any test report not acceptable, same shall be carried out without any cost implication to TPWODL/ TPCODL/ TPNODL/ TPSODL.

9. PRE-DISPATCH INSPECTION:

The material shall be subject to inspection by a duly authorized representative of the TPWODL/ TPCODL/ TPNODL/ TPSODL. Inspection may be made at any stage of manufacture at the

discretion of the purchaser and the equipment, if found unsatisfactory as to workmanship or material, the same is liable to rejection. Bidder shall grant free access to the places of manufacture to TPWODL/ TPCODL/ TPNODL/ TPSODL's representatives at all times when the work is in progress. Inspection by the TPWODL/ TPCODL/ TPNODL/ TPSODL or its authorized representatives shall not relieve the bidder of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by TPWODL/ TPCODL/ TPNODL/ TPSODL. Following documents shall be sent along with material.

- a) Test reports
- b) MDCC issued by TPWODL/ TPCODL/ TPNODL/ TPSODL
- c) Invoice in duplicate
- d) Packing list
- e) Drawings & catalogue
- f) Guarantee / Warrantee card
- g) Delivery Challan
- h) Other Documents (as applicable).

10. INSPECTION AFTER RECEIPT AT STORES:

The material received at TPWODL/ TPCODL/ TPNODL/ TPSODL, Odisha store will be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection and one copy of the report shall be sent to Engineering department.

11. GUARANTEE:

Bidder shall stand guarantee towards design, materials, workmanship & quality of process/ manufacturing of items under the contract for due and intended performance of the same, as an integrated product delivered under this contract. In the event any defect is found by the Company up to a period of 24 months from the date of commissioning or 30 months from the date of last supplies made under the contract, whichever is earlier, supplier shall be liable to undertake to replace/rectify such defects at his own costs. within mutually agreed timeframe, and to the entire satisfaction of the Company, failing which the Company will be at liberty to get it replaced/rectified at supplier's risks and costs and recover all such expenses plus the Company's own charges (@ 20% of expenses incurred), from the supplier or from the "Security cum Performance Deposit" as the case may be.

The bidder shall further be responsible for 'free replacement' for another period of THREE years from the end of guarantee period for any 'latent defects' if noticed by the company.

12. PACKING:

Supplier shall ensure that all the equipment covered under this specification shall be prepared for rail/road transport and be packed in such a manner so as to protect the equipment from damage in transit. The material used for packing shall be environmentally friendly. The bidder shall provide instructions regarding handling and storage precautions to be taken at site. The Conductor shall be wound on wooden/STEEL drums and packed in line with requirements of IS 10418-1982. The ends of the Conductor shall be sealed by means of non-hygroscopic sealing material. Heat or cold Shrinkable end caps with sealant shall be used for effectively sealing the end terminals of the covered conductor. The inner diameter range of cap shall be such that it shall tightly fit to the covered conductors to prevent moisture ingress.

13. TENDER SAMPLE:

Bidder shall submit the sample of material during submission of Bids.

14. QUALITY CONTROL:

The bidder shall submit with the offer Quality Assurance Plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and bought out items and fully assembled component and equipment after finishing. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. The Purchaser's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections. The bidder shall ensure that the material supplied is as per the Guaranteed Technical Particulars as specified in the specifications.

15. TESTING FACILITIES:

Bidder shall have adequate in-house testing facilities for carrying out all routine tests & acceptance tests as per relevant International / Indian standards.

16. MANUFACTURING ACTIVITIES:

The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer.

17. SPARES, ACCESSORIES AND TOOLS

Not applicable.

18. DRAWINGS AND DOCUMENTS

Following drawings and documents shall be submitted in line with the requirement of Tender

specifications:

- a) Completely filled in Schedule “A” Guaranteed Technical Particulars & Schedule “B” Deviations
- b) Work Experience details
- c) Type test certificates.
- d) Drawing 1 set of Hard Copy & Soft copy PDF File containing complete information about manufacturing.

19. SCHEDULE- “A” GUARANTEED TECHNICAL PARTICULARS

Sl. No.	Technical Parameters	To Be Furnished By The Bidder		
1	Name of the manufacturer			
2	Applicable Standard			
3	Type of Conductor			
4	Voltage Grade			
5	Nominal Cross-sectional area of conductor	100	148	232
6	Conductor			
a)	Material			
b)	Shape			
c)	No / diameter of wire (before stranding)			
d)	Approx. conductor diameter			
e)	Max. D.C. Resistance at 20°C			
f)	Resistance Temperature co-efficient			
g)	Minimum Tensile strength of conductor			
7	Thickness and dimensions			
7.1	Conductor Screen			
a)	Material			
b)	Nominal Thickness			
7.2	Insulation inner layer			
a)	Material			
b)	Nominal thickness			
7.3	Insulation Outer layer			
a)	Material			
b)	Nominal thickness			
8	Lightening Impulse withstand strength of XLPE Layer			
9	Approx. Overall Diameter			
10	Maximum continuous operating temperature			

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11	Max short circuit current, 1 sec (KA)			
12	Approx. Weight			
13	Standard Packing length			
14	Raw Material make			

20. SCHEDULE “B” DEVIATIONS:

(TO BE ENCLOSED WITH TECHNICAL BID)

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the purchaser's specifications:

SL. No	Clause No.	Details of deviation with justifications

We confirm that there are no deviations apart from those detailed above.

Seal of the Company:

Signature

Designation