Replies of pre-bid queries
Tender No **TPSODL/OT/2025-26/2500001073**
Package Name **Rate Contract for electrification of unelectrified 8 nos of villages of Kotia Gram Panchayat, Potangi Block, Koraput District.**

Sr. No.	Detailed Reference to TPSODL Technical Document. Please specify Document No / Clause No / Page No	Description as per Bid Document	Remarks - Query / Clarification	TPSODL Response
1	2	3	4	5
1	**BOQ:** 1. Bill of Material for 11kV line with 11mtr. GI H-pole and AAAC Conductor.	**SL. No-11,** GI barbed wire	Against the item Unit mentioned as '**No'.** Unit will be in 'No' or else. Please clarify.	Its should be treated as 'Number"
2	3. Bill of Material for Installation of New Distribution Transformer	**SL. No-44**, Cable 1.1 KV Al 1Cx50 SQMM UN ARM	Please provide Technical specification.	Technical Specification Attached
3		**Sl. No-4**5, Cable 1.1 KV Al 1Cx95 SQMM UN ARM	As per item description Cable is **Un ARM**. But Technical specification available in the tender document is for Armoured Cable. Clarification required.	Technical Specification Attached
4		**Sl.No- 46**, Cable 1.1 KV Al 1Cx100 SQMM UN ARM	Please provide Technical specification.	Revised to Cable 1.1 KV Al 1Cx150 SQMM UN ARM Technical Specification Attached
5		**Sl. No-47**, Gland for Arm Cable	Please confirm Gland is for Arm Cable or UnArm Cable.	Gland for Arm Cable
6	5. Bill of Material for Service connection	**Sl. No-3,** Service support shall comprise of GI angle of 50x50x6mm as per IS:2062, IS:2633 with two no's of fasteners for clamping on wall & anchor clamps to hold the service cable	Please provide length of the GI angle of 50x50x6mm.	Insteat of GI Angle, 20 mm GI Bend Pipe would be used for Service connetion.
7			**Please provide approved Vendor list.**	Attached

STANDARD TECHNICAL SPECIFICATION COVER SHEET

Specification No. : ENG-LV-3001

Specification Name : ENG-ELC-034- TECHNICAL SPECIFICATION FOR 1.1 KV POWER CABLES- R1

JYOTIPRAKASH MOHANTY	Ranjan Kumar Sahoo	SHANTAPRIYA JENA	SATYA PRASAD NAYAK	VARUN BHATNAGAR	VARUN BHATNAGAR
Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
TPWODL	TPSODL	TPNODL	TPCODL	TPWODL	TPWODL
16-01-2023	16-01-2023	16-01-2023	17-01-2023	17-01-2023	17-01-2023

CONTENTS

1. SCOPE:

This specification covers the technical requirements of design, manufacture, testing at manufacturer's work, packing, forwarding, supply and unloading at site/store of 1.1 kV LT XLPE Power Cable for trouble free and efficient operation.

Applicable for 1.1 kV LT XLPE insulated Power Cable of following sizes:

Four Core Cables	Two Core Cables	Single Core Cable
4C X 300 sq.mm. 4C X 240 sq. mm. 4C X 150 sq.mm. 4C X 95 sq.mm. 4C X 50 sq.mm. 4C X 35 sq.mm. 4C X 25 sq.mm. 4C X 16 sq.mm. 4C X 10 Sq.mm.	2C X 50 sq. mm. 2C X 25 sq. mm. 2C X 16 sq. mm. 2C X 10 sq. mm. 2C X 6 Sq. mm. 2C X 4 Sq. mm.	1C X 630 sq. mm. 1C X 300 sq. mm. 1C X 185 sq. mm. 1C X 150 sq. mm. 1C X 95 sq. mm. 1C X 50 sq. mm. 1C X 25 sq. mm. 1C X16 sq. mm. 1C X 4 sq. mm. 1C X 2.5 sq. mm.

2. APPLICABLE STANDARDS:

LT 1.1 kV Cable covered by this specification shall unless otherwise stated, be designed, manufactured, and tested in accordance with latest revisions of relevant Indian Standards/ IEC/ International Standards and shall conform to the regulations of local statutory authorities.

Standards	Title
IS-7098 (Part-I)	Specifications for Cross Linked Polyethylene PVC Sheathed Cables: Part 1-For Working Voltages up to and including 1100 Volts
IS-8130	Conductor for insulated electric cables & flexible cords.
IS-5831	PVC insulation and sheath of electric cables.
IEC-60228/3-	Conductor of insulated cables
IS 10810	Methods of tests for Cables
IEC-60502-1	Specification for power cables with extruded solid insulation with a rated voltage rating between 1 kV and 3 kV
IS-3975	Low carbon galvanized steel wires, formed wires & tapes for armouring of cables
IS 10418	Specification for Drums of Electric cables
IS 3961 Part 6	Recommended Current Ratings for Cables – XLPE insulated PVC sheathed cables
IS 4826	Hot-dipped galvanized coatings on round steel wires
IS 1554 (Part-1)	PVC insulated (heavy duty) electric cables
IEC 332-1	Test on electric cables on fire conditions
IS 10462-1	Fictitious calculation method for determination of dimensions of protective coverings of cables
ICEA T-31-610	Test method for conducting longitudinal water penetration resistance tests on blocked conductors
ASTM 2863	Oxygen Index Test
IEC 60754	Test on gases evolved during combustion of materials from cables - Part 1: Determination of the halogen acid gas content

**In case of any conflict on any technical particular in the specification, the stricter requirement*

mentioned in the relevant standard shall be valid.

3. CLIMATIC CONDITIONS:

SL.NO.	CONDTIONS	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, heavilypolluted, salty, corrosive and humid coastal atmospheres.

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

4. GENERAL TECHNICAL REQUIREMENTS:

S. No.	Parameter	Requirement		
1	Voltage level	1.1 kV (Earthed System)		
2	Nominal System voltage	415 V- 433V		
3	Supply frequency	50 Hz		
4	Variation in supply frequency	± 5%		
5	Types of Cables	4 core (3 phase + 100% neutral), 2 core (1 phase + 100% neutral), 1 core (1 phase)		
6	**Cable components**	**4 CORE CABLE**	**2 CORE CABLE**	**1 CORE CABLE**
	Conductor	Less than 150 sq.mm.		Stranded Aluminium
		150 sq.mm. and above		Watertight Stranded Aluminum
	Insulation	XLPE		
	Core identificationn strip	As per Clause No. 5. III of ENG-LV-3001		NA
	Inner sheath	Extruded PVC ST-2 type		NA
	Armour	Annealed low carbon heavily coated galvanized steel round wires		NA
	Outer sheath	PVC FRLSH ST-2 type		

5. GENERAL CONSTRUCTION:

The cross-linked polyethylene insulated (XLPE) 1.1 kV cable (Sioplas/ self-cured) shall be manufactured and tested strictly in accordance with the Indian Standard IS 7098 (Part – 1)/ relevant IEC/International standards and their latest amendments. All material used in the manufacturing of cables shall be virgin and shall be selected as the best available for the intended use. The rating factors for variation in ground and air temperature, depth of laying, thermal resistivity of soil and for different laying configuration of cables shall be provided by the bidder

I. CONDUCTOR:

S. No.	Parameter	Requirement			
1	Material	Plain Aluminium, grade H2/H4 as per IS 8130			
2	Class	Class II			
3	Shape	**No. of Cores**		**Size of cable**	**Shape**
		Single Core Cable		2.5 sq.mm. 4 sq.mm.	Stranded Non-Compacted Circular
				16 sq.mm. and above	Stranded Compacted Circular
		Two Core Cable		10 sq.mm.	Stranded Non-Compacted Circular
				16 sq.mm. and above	Stranded Compacted Shaped
		Four Core Cable		10 sq.mm.	Stranded Non-Compacted Circular
				16 sq.mm. and above	Stranded Compacted Shaped
4	No. of strands & electrical parameters	Nominal size of conductor mm^2	Min. number of strands	Max. DC resistance @ 20 deg C (Ohm/km)	Conductor Short circuit current rating for 1 second(kA)
		2.5	3	12.1	0.235
		4	3	7.41	0.376
		6	3	4.61	0.564
		10	7	3.08	0.94
		16	6	1.91	1.50
		25	6	1.20	2.35
		35	6	0.868	3.31
		50	6	0.641	4.70
		95	15	0.320	8.93
		150	15	0.206	14.2
		185	30	0.164	17.39
		240	30	0.125	22.6

		300	30	0.10	28.20
		630	53	0.0469	59.22
6	Longitudinal water sealing of conductor (For 150 sq.mm.and above only)	a) Non-conductive water swellable yarn/tape/ combination of both shall be provided in between interstices of the conductor. b) Water swellable tape and yarn shall be compatible to withstand conductor continuous temperature of 90 deg C and short circuit temperature of 250 deg C without any decay. c) It shall not affect the electrical conductivity of the conductor.			
7	Cleanliness and uniformity	a) Before stranding, the cross-section of the Aluminium conductor shall be circular, and shall have uniform smooth surface, free from sharp edges and free from any defects. b) Stranded Conductor shall be free from oil traces & aluminum dust. Conductor (after stranding) shall be super cleaned. c) Traces of aluminum dust on conductor shall not be acceptable.			
8	Raw material supplier	Conductor raw material shall be procured from reputed suppliers viz., BALCO/ HINDALCO/ NALCO/ Vedanta only.			
9	Diameter of conductor (For single core cable only)	To be specified by bidder			
10	Weight of conductor/km (approx.)	Nominal size of conductor mm^2	Min. weight of conductor (kg/km/core)		
		2.5	6.5		
		4	10.4		
		6	15.6		
		10	26		
		16	42		
		25	65		
		35	91		
		50	130		
		95	247		
		150	390		
		185	482		

		240	625
		300	780
		630	1640

II. INSULATION:

S. No.	Parameter	Requirement
1	Material and extrusion process	XLPE insulation shall be applied through extrusion process.
2	Curing process	Curing shall be done by Sioplas/ self-curing method.
3	Min. thickness of Insulation	As per Table no. 3 of IS 7098 part 1. Tolerance on thickness shall be as per Clause no. 9.3 of IS 7098—Part 1
4	Raw material supplier	(i) XLPE compound shall be super cleaned and procured from reputed raw material suppliers viz., Dow, Borealis, Hanwa Kalpana, KLJ only. (ii) XLPE compound from cable manufacturer may be considered only after evaluation of the compound manufacturing process.
5	Thermal stability	The insulation properties shall be stable under thermal conditions arising out of continuous operation at conductor temperature of 90 deg. C rising momentarily to 250 deg. C under short circuit conditions.
6	Insulation fitting to the conductor	(i) Insulation shall fit tightly to the conductor and shall be applied concentrically about the conductor in thickness consistent with the voltage classification. (ii) The insulation shall be so applied that it shall be possible to remove it without damaging the conductor.
7	Weight of core	To be specified by bidder

III. CORE IDENTIFICATION

4C Cable	Core color: 'red' for R phase, 'blue' for B phase, 'yellow' for Y phase & 'Black' for Neutral.
2C Cable	Core color: 'red' for phase, & 'Black' for Neutral.
1C Cable	For single core cable, XLPE insulation shall be black in colour.

IV. LAYING UP OF CORES

Laying up	(i) Cores shall be laid up together as per table-4 of Clause 11.2 of IS 7098, Part-1. (ii) Where necessary, the interstices shall be filled with non-hygroscopic material.

V. INNER SHEATH (For Multi core cables only)

S. No.	Parameter	Requirement
1	Material	Black coloured Polyvinyl chloride (PVC) type ST-2 compound.
2	Thickness	(i) The sheath shall have adequate thickness, mechanical strength and elasticity, as per IS 5831. (ii) Min. thickness of inner sheath shall be as per Table no.5 of IS 7098 part 1. (iii) For 2 Core: Inner sheath shall be applied by pressure extrusion method. For 4 Core: Inner sheath shall be applied by normal extrusion process.
3	Raw material supplier	**PVC compound shall be procured from reputed raw material suppliers viz., Shakun, Kalpana, KLJ, DCM ShriRam,** **PVC compound from cable manufacturer may be considered only after evaluation of the compound manufacturing process.**

VI. ARMOUR (For Multi core cables only)

<table>
<tr><th>S. No.</th><th>Parameter</th><th colspan="2">Requirement</th></tr>
<tr><td>1</td><td>Material</td><td colspan="2">Annealed (soft) low carbon hot dipped heavily coated galvanized round steel wires.</td></tr>
<tr><td>2</td><td>Compliance to Standard</td><td colspan="2">It shall comply with the requirements of IS 3975 along with the latest amendments.

Hot dipped galvanizing layer shall be uniform on low carbon annealed steel wires.

Zinc coating shall be heavily coated as per IS 4826:1979.</td></tr>
<tr><td rowspan="6">4</td><td rowspan="6">Approx. Armour Short circuit rating of armour for 1 sec (kA)</td><td>Area of Conductor (sq.mm.)</td><td>Short circuit rating of Armour for 1 sec (kA)</td></tr>
<tr><td>4</td><td>1.37</td></tr>
<tr><td>6</td><td>1.53</td></tr>
<tr><td>10</td><td>1.88</td></tr>
<tr><td>16</td><td>2.54</td></tr>
<tr><td>25</td><td>3.17</td></tr>
</table>

		35	4.30
		50	5.22
		95	6.97
		150	10.98
		240	13.92
		300	16.18
5	Jointing in the armour wires	Not acceptable in any armour wire	
6	Laying of armour	The armor wires shall be applied as closely as practicable. Shall not be less than 90% of total circumference.	
7	Binding	Rubberized cotton binding tape shall be applied to bind the armor wires such that it shall not affect the electrical properties of the armor wires and the overall cable.	
8	Weight of armor Kg/km	To be furnished by Bidder	
9	Raw material supplier	Armour steel shall be procured from reputed raw material suppliers viz., TATA Steel, Jindal Steel, SAIL, Bansal (BWIL)	

VII. Outer Sheath

S. No.	Parameter	Requirement
1	Material	Polyvinyl chloride (PVC) ST-2 **FRLSH** type compound (as per IS 5831) with **'lead napthenate'** additive.
2	Configuration	Polyvinyl chloride (PVC) ST-2 **FRLSH** type compound with **'lead napthenate'** additive as 'termite & rodent repellent' shall be applied by extrusion process. The outer sheath shall have adequate thickness, mechanical strength and elasticity, as per IS 5831. Thickness of outer sheath shall be as per Table no. 8 of IS 7098 part 1.
3	Colour	Blue, colour code: 103 as per IS 5:2007.
4	Surface uniformity	(i) The outer sheath shall be ultraviolet protected for operation in direct sunlight. (ii) Surface of outer sheath shall be free from cavity/ nicks/ other visible defects.

5	Raw material supplier	**PVC compound shall be procured from reputed raw material suppliers viz.,** Shakun, Kalpana, KLJ, DCM ShriRam
		PVC compound from cable manufacturer may be considered only after compound manufacturing process evaluation.
6	Weight of outer sheath kg/km	To be provided by bidder
7	Weight of complete cable Kg/km	To be provided by bidder
8	Overall diameter of cable	To be provided by bidder

VIII. Other Requirements

Parameter	Requirement
End seal	Adhesive coated polyolefin heat shrinkable end caps shall be provided on both ends of cable.

6. MARKING:

Wooden drums shall be free from sharp edges and visual defects.

Cable length on one drum shall be:

(a) 4 Core Cable – 95 sq.mm. to 300 sq.mm. – 500 meters with + 5% tolerance

(b) 4 Core Cable – 16 sq.mm. to 50 sq.mm. – 1000 meters with + 5% tolerance

(c) 2 Core & 1 Core Cables – 1000 meters with + 5% tolerance (as per PO terms and conditions)

i. Following details shall be provided on flanges of **drum**:

a) Manufacturer's name
b) Type of Cable
c) Size of Cable
d) Voltage Grade
e) Length of the cable on the drum (as per PO terms)
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.

ii. The following details shall be **embossed** on the **outer PVC sheath.**

Embossing shall be clearly visible. **At interval of every 1 meter, following details to beembossed:**

a) Sequential meter marking ***(shall be marked through printing)***
b) Property of TPCODL/TPNODL/TPSODL/TPWODL
c) Manufacturer name
d) Month & Year of Manufacture
e) Voltage grade
f) Size of the cable
g) Purchase Order no.
h) Cable code

7. TESTS:

All routine, acceptance & type tests shall be carried out in accordance with the relevant IS/IEC. All routine/acceptance tests shall be witnessed by TPCODL/TPNODL/TPSODL/TPWODL's authorized representative. All the components should also be type tested as per the relevant standards. The following tests shall be necessarily conducted on the 1.1 kV cables in additionto others specified in IS/IEC standards.

7.1 ACCEPTANCE TESTS

All acceptance tests mentioned below shall be witnessed by TPCODL/TPNODL/TPSODL/TPWODL's representative during the inspection stage.

S.No.	Test name	Specific value		Test method	
		ClauseNo.	Reference Standard	Clause No.	Reference Standard
(I) Test on Conductor					
1	Conductor resistance test	ClauseNo. 5(A.4)	ENG-LV-3001	10	IS 10810-part 5
2	Test for non-conductivity of water swellable tape/yarn of conductor (For conductor size: 150 sq.mm.and above)	ClauseNo. 5(A.6)	ENG-LV-3001	Through multimeter	
3	Visual inspectionfor conductor cleanliness	ClauseNo. 5(A.7)	ENG-LV-3001	Check for presence of any Aluminium dust	

4	Tensile test (non-compacted conductor only)	Clause No.3.1	IS 8130	8	IS 10810-part 2
5	Wrapping test (non-compacted conductor only)	Clause No.6.2.2	IS 8130	8	IS 10810-part 3
6	Conductor water penetration test	ICEA T-31-610			
(II) Test on Insulation					
7	Tensile strength & Elongation at break (before ageing)	Table 1	IS 7098 parts 1	8	IS 10810-part 7
8	Insulation thickness	Table 3	IS 7098 parts 1	8	IS 10810-part 6
9	Depth of embedded, extruded colourline (For multi-corecable only)	Max depth 50% of insulation thickness	ENG-LV-3001	Through profile projector/ magnifyingoptical scale	
10	Brightness of embedded, extruded colourline (For multi-corecable only)	ClauseNo. 5.C	ENG-LV-3001	Visual check from a distance of 1meter	
11	Hot set test	Table 1	IS 7098-part 1	8	IS 10810-part 30
12	Surface smoothness of insulation	ClauseNo. 5(B.7)	ENG-LV-3001	To be checked by inspector	
(V) Test on Inner sheath					
13	PVC thickness	Table 5	IS 7098 parts 1	8	IS 10810-part 6
14	Colour of inner sheath	ClauseNo. 5 (D.1)	ENG-LV-3001	To be checked by inspector	

(VI) Test on Armour (for multicore cables only)					
15	Tensile test	8	IS 3975	IS 1608	
16	Mass of zinc coating	Table 1 Heavily coated soft wire	IS 4826	IS 6745	
17	Uniformity of zinc coating	9	IS 3975	IS 2633	
18	Adhesion test	9	IS 3975	IS 3975	
19	Diameter	Table 6	IS 7098 parts 1	Value to be measured by inspector	
20	No. of wires & Coverage %	ClauseNo. 5(E.6)	ENG-LV-3001	Value to be measured by inspector	
(VII) Test on PVC Outer Sheath					
21	Thickness		IS 7098 parts 1		IS 10810 Part 6
22	Tensile strength and Elongation at break (before ageing)	Table 2	IS 5831	8	IS 10810 part 7
23	Colour of outer sheath	ClauseNo. 5 (F.3)	ENG-LV-3001	To be checked by inspector	
24	Surface uniformity of outer sheath (onfull drum)/ shall befree from any damage-void, nick, cavity.	ClauseNo. 5 (F.4)	ENG-LV-3001	Through rewinding of drum (As per TPCODL/TPNODL/TPSODL /TPWODL specification)	
25	Anti-termite and rodent property test in PVC outersheath	Chemicaltest	As per manufacturer Process/ Method	To be checked by inspector	

26	Flammability test	IS 10810-part 61			
27	Oxygen index	IS 10810-part 58			
28	Temperature Index test	IS 10810-part 64			
29	Acid gas generation	IS 10810-part 59			
30	Smoke density	IS 10810-part 63			
(VIII) Tests for complete cable					
31	High voltage test	7.2 kVfor 5 minutes As per Clauseno. 16.2.1	IS 7098 parts 1	8	IS 10810 part 45
(IX) Additional tests					
32	Raw material consumption	Clause No. A.8, B.4, D.3, E.9, F.5	Document verification as proof to be submitted		
		Invoice to be shown from procurement to consumption			
33	Sequential marking check	Clause no. 6.ii	ENG-LV-3001	To be checked by inspector	
34	Cable drumlength verification	Clause no. 6	ENG-LV-3001	To be checked by inspector	
35	Packaging of cable-on-cabledrum	By recyclable PVC sheet- As per Clauseno.12	ENG-LV-3001	To be checked by inspector	
36	End caps	Clause No. G	ENG-LV-3001	To be checked by inspector	

37	Weight of conductor Kg/km	To be checked by inspector
38	Weight of core Kg/km	To be checked by inspector
39	Weight ofarmour Kg/km	To be checked by inspector
40	Weight of complete cable Kg/km	To be checked by inspector
41	Overall approx. diameter of complete cable	To be checked by inspector

7.2 ROUTINE TESTS

Test	Clause No.	Reference Standard
Conductor resistance test	15.3	IS 7098-part 1
High voltage test with power frequency	15.3	IS 7098-part 1

7.3 TYPE TESTS

S.No.	Test	Specific value		Test method	
		Clause No.	Reference Standard	Clause No.	Reference Standard
Tests on Conductor					
1	Conductor resistance test	Table 2	IS 8130	10	IS 10810 part 5

2	Conductor water penetration test (For conductor size - 150 sq.mm. and above)	ICEA T-31-610	ICEA T-31-610	4	ICEA T-31-610
3	Tensile strength (For non-compacted conductor)	6.2.1	IS 8130	8	IS 10810 part 2
4	Wrapping test (For non-compacted conductor)	6.2.2	IS 8130	8	IS 10810 part 3
Tests on Insulation					
5	Tensile strength & Elongation at break (Before ageing)	Table 1	IS 7098 part 1	8	IS 10810 part 7
6	Ageing in air oven	Table 1	IS 7098 part 1	8	IS 10810 part 11
7	Tensile strength & Elongation at break (After ageing)	Table 1	IS 7098 part 1	8	IS 10810 part 7
8	Tests for thickness of insulation	Table 3	IS 7098 part 1	8	IS 10810 part 6
9	Hot set test	Table 1	IS 7098- part 1	8	IS 10810 Part 30
10	Shrinkage test	Table 1	IS 7098 part 1	8	IS 10810 part 12
11	Gravimetric test (Water absorption)	Table 1	IS 7098 part 1	8	IS 10810 part 33
12	Volume resistivity/ Insulation Resistance	Table 1	IS 7098 part 1	8	IS 10810 part 43
Tests on Inner Sheath					

13	PVC thickness	Table 5	IS 7098 part 1	8	IS 10810 part 6
Tests on Outer Sheath (PVC)					
14	Flammability test for outer sheath	Clause No. 16.3	IS 7098 Part 1	As per IEC 332-part 1	
15	Tensile strength and Elongation at break (Before ageing)	Table 2	IS 5831	8	IS 10810 part 7
16	Tensile strength and Elongation at break (After ageing)	Table 2	IS 5831	8	IS 10810 part 7
17	Variation due to ageing	Table 2	IS 5831	8	IS 10810 part 7
18	Loss of mass test	Table 2	IS 5831	8	IS 10810 part 10
19	Shrinkage test	Table 2	IS 5831	8	IS 10810 part 12
20	Hot deformation test	Table 2	IS 5831	8	IS 10810 part 15
21	Heat shock test	Table 2	IS 5831	8	IS 10810 part 14
22	Thermal stability test	Table 2	IS 5831	Appendix B	IS 5831:1984
23	Oxygen index	As per ASTM 2863			
24	Temperature index	ASTM 2863			
25	Acid gas generation	IEC 60754			
26	Smoke density	ASTM 2843			
Tests on Armour for multi-core Cable					

27	Tensile test	8	IS 3975	6	IS 1608
28	Torsion test	8	IS 3975	7	IS 1717
29	Wrapping test	8	IS 3975	5	IS 1755
30	Resistance test	8	IS 3975	8	IS 10810 Part 42
31	Mass of zinc coating	Table 1	IS 4826	6	IS 6745
32	Uniformity of zinc coating	9	IS 3975	4	IS 2633
33	Adhesion test	9	IS 3975	9.3	IS 3975
Tests on complete cable					
34	High voltage test	7.2 kV for 5 minutes As per Clause no. 16.2	IS 7098 part 1	8	IS 10810 Part 45

8. TYPE TEST CERTIFICATES:

The bidder shall furnish the type test report of **1.1 kV** cable for the tests as mentioned inClause no. 7 of this specification and as per reference standards.

Complete set of Type Tests shall be conducted at certified test laboratories, which are CPRI / ERDA/ Approved labs by TATA ODISHA DISCOMs only. Type test report shall be submitted for the type, size and rating of thecable mentioned in the bid/ OR for any size higher (than required) of similar type and similar voltage grade. Conductor Water penetration test as per ICEA T 31-610 shall be conducted at CPRI/ERDA Approved labs by TATA ODISHA DISCOMs only.

Type test should have been conducted in certified test laboratories during the period not exceeding from the date of 10 years from the date of opening of bid. **In the event of any** discrepancy in the test reports i.e. any test report not acceptable or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out withoutany cost implication to TPCODL/TPNODL/TPSODL/TPWODL.

In case the type test certificates are dated beyond 5 years and up to 10 years, though thebasic component design of cable is same, then acceptance for *'no change in design'* shallbe submitted by bidder on their organization's letter head.

TPCODL/TPNODL/TPSODL/TPWODL will have the rights to accept/reject these type test reports.

9. PRE-DISPATCH INSPECTION:

Inspection shall be carried out by duly authorized representative of TPCODL/ TPNODL/ TPSODL/ TPWODL.

The bidder shall grant free access to the places of manufacture to TPCODL/ TPNODL/ TPSODL/ TPWODL's representatives at all times when the work is in progress.
Inspection may be made at any stage of manufacturing at the discretion of TPCODL/TPNODL/TPSODL/TPWODL and the equipment, if found unsatisfactory as to workmanship or material, the same is liable to rejection.
Inspection by TPCODL/TPNODL/TPSODL/TPWODL or its authorized representatives shall not relieve the bidder of his obligation of furnishing equipment in accordance with the specification.

Dispatch of material: Material shall be dispatched after specific MDCC (Material DispatchClearance Certificate) is issued by TPCODL/TPNODL/TPSODL/TPWODL.
Following documents shall be sent along with the supplied material:

a) Test reports
b) MDCC issued by TPCODL/TPNODL/TPSODL/TPWODL
c) Invoice in duplicate
d) Packing list
e) Delivery Challan

10. INSPECTION AFTER RECEIPT AT STORE:

The material received at TPCODL/TPNODL/TPSODL/TPWODL, Odisha store will be inspected for acceptance and shall beliable for rejection, if found different from the reports of the pre-dispatch inspection.

11. GUARANTEE:

The bidder shall confirm for guarantee towards design, material, workmanship & quality of process / manufacturing for integrated product delivered under the contract.

In the event any defect is found by TPCODL/TPNODL/TPSODL/TPWODL, up to a period of at least 60 months from the date of commissioning or 72 months from the date of last supplies made under the contract whichever is later, bidder shall be liable to undertake to replace/rectify such defects at their own costs, within mutually agreed time frame, and to the entire satisfaction of TPCODL/TPNODL/TPSODL/TPWODL, failing which TPCODL/TPNODL/TPSODL/TPWODL will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the TPCODL/TPNODL/TPSODL/TPWODL's own charges (@ 20% of expenses incurred), from the Bidder or from 'Security cum Performance Deposit' as thecase may be.

Free replacement: Bidder shall further be responsible for 'free replacement' for another period of THREE years from the end of the guarantee period for any 'Latent Defects' if noticed and reported by TPCODL/TPNODL/TPSODL/TPWODL.

12. PACKING AND TRANSPORT:

a) Standard length of Cable: The cable shall be supplied in continuous **standard length** as per Clause no.6 of this specification.

b) Filling condition: Drum shall not be overfilled.

c) Cable drum: The cable shall be wound on non-returnable drums without any extra cost to TPCODL/TPNODL/TPSODL/TPWODL as per IS 10418 and its latest amendments.

d) Sealing of cable ends: The ends of the cable shall be sealed by means of heat shrinkable polyolefin end caps.

e) Requirements for Cable drums: Cable drums shall be so constructed as to have required mechanical strength so that the drum flanges and other components do not break during transport, in actual use or in storage. The flanges and the outside surface of the barrel shall be free from protruding materials/projections/ unevenness/ sharp edges that can damage the cable or hands of the operator during rotation of drums.

Material preservation shall be applied to the entire drum.

f) The bottom end of cable should be clamped on drum by jute or nylon rope.

g) Rail/ Road transportation: The bidder shall ensure that the equipment covered under this specification shall be prepared for rail/road transport in a manner so as to protect the equipment from damage in transit. The drums shall withstand normal handling and transport.

h) Packaging shall be as per climate change perspective.

The cable wound on cable drum shall be covered by recyclable PVC sheet for dustproof.

TPCODL/TPNODL/TPSODL/TPWODL encourages the use of environmentally friendly packaging.

13. TENDER SAMPLE:

Not Applicable

14. QUALITY CONTROL:

The bidder shall submit a 'Quality Assurance Plan' followed by him in respect of bought out items, items manufactured by him, Raw materials in process, Final inspection Packaging & Marking. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. TPCODL/TPNODL/TPSODL/TPWODL reserves the sole rights for the type test of random sample from the lot and in case of any discrepancy or deviation fromthe Type test certificates submitted along with the bid, the complete Lot shall be rejected.

TPCODL/TPNODL/TPSODL/TPWODL's nominated representative shall have free access to the bidder's works to carry out inspections

15. TESTING FACILITIES:

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

16. MANUFACTURING FACILITIES:

The successful bidder will have to submit (after placement of RC) technical compliance document and drawing of cable as per RC line items for getting approval before mass manufacturing. Bidder shall start manufacturing of mass quantity only after getting CAT-A approved drawings and technical compliances or as per intimation from TPCODL/TPNODL/TPSODL/TPWODL.

17. SPARES, ACCESSORIES AND TOOLS

Not applicable.

18. DRAWINGS AND DOCUMENTS:

Following documents shall be submitted along with the bid for approval after award of RC/PO:

a) Completely filled–in clause wise compliance of this specification
b) Type test Certificates for each specified test
c) Cross sectional drawing of the cable
d) Rating factors for variation in ground and air temperature, depth of laying, thermal resistivity of soil and different laying configuration of cables.

Following documents shall be submitted after award of contract for approval before manufacturing:

a) Completely filled–in clause wise compliance of this specification
b) Cross sectional drawing of the cable

All the Documents and Drawings shall be in English Language.

19. SCHEDULE- "A" GUARANTEED TECHNICAL PARTICULARS:

Bidder to submit clause wise compliance.

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 thisschedule. 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

STANDARD TECHNICAL SPECIFICATION COVER SHEET

Specification No. : ENG-LV-3001

Specification Name : ENG-ELC-034- TECHNICAL SPECIFICATION FOR 1.1 KV POWER CABLES- R1

JYOTIPRAKASH MOHANTY	Ranjan Kumar Sahoo	SHANTAPRIYA JENA	SATYA PRASAD NAYAK	VARUN BHATNAGAR	VARUN BHATNAGAR
Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
TPWODL	TPSODL	TPNODL	TPCODL	TPWODL	TPWODL
16-01-2023	16-01-2023	16-01-2023	17-01-2023	17-01-2023	17-01-2023

CONTENTS

1. SCOPE:

This specification covers the technical requirements of design, manufacture, testing at manufacturer's work, packing, forwarding, supply and unloading at site/store of 1.1 kV LT XLPE Power Cable for trouble free and efficient operation.

Applicable for 1.1 kV LT XLPE insulated Power Cable of following sizes:

Four Core Cables	Two Core Cables	Single Core Cable
4C X 300 sq.mm. 4C X 240 sq. mm. 4C X 150 sq.mm. 4C X 95 sq.mm. 4C X 50 sq.mm. 4C X 35 sq.mm. 4C X 25 sq.mm. 4C X 16 sq.mm. 4C X 10 Sq.mm.	2C X 50 sq. mm. 2C X 25 sq. mm. 2C X 16 sq. mm. 2C X 10 sq. mm. 2C X 6 Sq. mm. 2C X 4 Sq. mm.	1C X 630 sq. mm. 1C X 300 sq. mm. 1C X 185 sq. mm. 1C X 150 sq. mm. 1C X 95 sq. mm. 1C X 50 sq. mm. 1C X 25 sq. mm. 1C X16 sq. mm. 1C X 4 sq. mm. 1C X 2.5 sq. mm.

2. APPLICABLE STANDARDS:

LT 1.1 kV Cable covered by this specification shall unless otherwise stated, be designed, manufactured, and tested in accordance with latest revisions of relevant Indian Standards/ IEC/ International Standards and shall conform to the regulations of local statutory authorities.

Standards	Title
IS-7098 (Part-I)	Specifications for Cross Linked Polyethylene PVC Sheathed Cables: Part 1-For Working Voltages up to and including 1100 Volts
IS-8130	Conductor for insulated electric cables & flexible cords.
IS-5831	PVC insulation and sheath of electric cables.
IEC-60228/3-	Conductor of insulated cables
IS 10810	Methods of tests for Cables
IEC-60502-1	Specification for power cables with extruded solid insulation with a rated voltage rating between 1 kV and 3 kV
IS-3975	Low carbon galvanized steel wires, formed wires & tapes for armouring of cables
IS 10418	Specification for Drums of Electric cables
IS 3961 Part 6	Recommended Current Ratings for Cables – XLPE insulated PVC sheathed cables
IS 4826	Hot-dipped galvanized coatings on round steel wires
IS 1554 (Part-1)	PVC insulated (heavy duty) electric cables
IEC 332-1	Test on electric cables on fire conditions
IS 10462-1	Fictitious calculation method for determination of dimensions of protective coverings of cables
ICEA T-31-610	Test method for conducting longitudinal water penetration resistance tests on blocked conductors
ASTM 2863	Oxygen Index Test
IEC 60754	Test on gases evolved during combustion of materials from cables - Part 1: Determination of the halogen acid gas content

**In case of any conflict on any technical particular in the specification, the stricter requirement*

mentioned in the relevant standard shall be valid.

3. CLIMATIC CONDITIONS:

SL.NO.	CONDTIONS	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, heavilypolluted, salty, corrosive and humid coastal atmospheres.

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

4. GENERAL TECHNICAL REQUIREMENTS:

S. No.	Parameter	Requirement		
1	Voltage level	1.1 kV (Earthed System)		
2	Nominal System voltage	415 V- 433V		
3	Supply frequency	50 Hz		
4	Variation in supply frequency	± 5%		
5	Types of Cables	4 core (3 phase + 100% neutral), 2 core (1 phase + 100% neutral), 1 core (1 phase)		
6	**Cable components**	**4 CORE CABLE**	**2 CORE CABLE**	**1 CORE CABLE**
	Conductor	Less than 150 sq.mm.		Stranded Aluminium
		150 sq.mm. and above		Watertight Stranded Aluminum
	Insulation	XLPE		
	Core identificationn strip	As per Clause No. 5. III of ENG-LV-3001		NA
	Inner sheath	Extruded PVC ST-2 type		NA
	Armour	Annealed low carbon heavily coated galvanized steel round wires		NA
	Outer sheath	PVC FRLSH ST-2 type		

5. GENERAL CONSTRUCTION:

The cross-linked polyethylene insulated (XLPE) 1.1 kV cable (Sioplas/ self-cured) shall be manufactured and tested strictly in accordance with the Indian Standard IS 7098 (Part – 1)/ relevant IEC/International standards and their latest amendments. All material used in the manufacturing of cables shall be virgin and shall be selected as the best available for the intended use. The rating factors for variation in ground and air temperature, depth of laying, thermal resistivity of soil and for different laying configuration of cables shall be provided by the bidder

I. CONDUCTOR:

S. No.	Parameter	Requirement			
1	Material	Plain Aluminium, grade H2/H4 as per IS 8130			
2	Class	Class II			
3	Shape	**No. of Cores**		**Size of cable**	**Shape**
		Single Core Cable		2.5 sq.mm. 4 sq.mm.	Stranded Non-Compacted Circular
				16 sq.mm. and above	Stranded Compacted Circular
		Two Core Cable		10 sq.mm.	Stranded Non-Compacted Circular
				16 sq.mm. and above	Stranded Compacted Shaped
		Four Core Cable		10 sq.mm.	Stranded Non-Compacted Circular
				16 sq.mm. and above	Stranded Compacted Shaped
4	No. of strands & electrical parameters	Nominal size of conductor mm^2	Min. number of strands	Max. DC resistance @ 20 deg C (Ohm/km)	Conductor Short circuit current rating for 1 second(kA)
		2.5	3	12.1	0.235
		4	3	7.41	0.376
		6	3	4.61	0.564
		10	7	3.08	0.94
		16	6	1.91	1.50
		25	6	1.20	2.35
		35	6	0.868	3.31
		50	6	0.641	4.70
		95	15	0.320	8.93
		150	15	0.206	14.2
		185	30	0.164	17.39
		240	30	0.125	22.6

		300	30	0.10	28.20
		630	53	0.0469	59.22
6	Longitudinal water sealing of conductor (For 150 sq.mm.and above only)	a) Non-conductive water swellable yarn/tape/ combination of both shall be provided in between interstices of the conductor. b) Water swellable tape and yarn shall be compatible to withstand conductor continuous temperature of 90 deg C and short circuit temperature of 250 deg C without any decay. c) It shall not affect the electrical conductivity of the conductor.			
7	Cleanliness and uniformity	a) Before stranding, the cross-section of the Aluminium conductor shall be circular, and shall have uniform smooth surface, free from sharp edges and free from any defects. b) Stranded Conductor shall be free from oil traces & aluminum dust. Conductor (after stranding) shall be super cleaned. c) Traces of aluminum dust on conductor shall not be acceptable.			
8	Raw material supplier	Conductor raw material shall be procured from reputed suppliers viz., BALCO/ HINDALCO/ NALCO/ Vedanta only.			
9	Diameter of conductor (For single core cable only)	To be specified by bidder			
10	Weight of conductor/km (approx.)	Nominal size of conductor mm^2	Min. weight of conductor (kg/km/core)		
		2.5	6.5		
		4	10.4		
		6	15.6		
		10	26		
		16	42		
		25	65		
		35	91		
		50	130		
		95	247		
		150	390		
		185	482		

		240	625
		300	780
		630	1640

II. INSULATION:

S. No.	Parameter	Requirement
1	Material and extrusion process	XLPE insulation shall be applied through extrusion process.
2	Curing process	Curing shall be done by Sioplas/ self-curing method.
3	Min. thickness of Insulation	As per Table no. 3 of IS 7098 part 1. Tolerance on thickness shall be as per Clause no. 9.3 of IS 7098—Part 1
4	Raw material supplier	(i) XLPE compound shall be super cleaned and procured from reputed raw material suppliers viz., Dow, Borealis, Hanwa Kalpana, KLJ only. (ii) XLPE compound from cable manufacturer may be considered only after evaluation of the compound manufacturing process.
5	Thermal stability	The insulation properties shall be stable under thermal conditions arising out of continuous operation at conductor temperature of 90 deg. C rising momentarily to 250 deg. C under short circuit conditions.
6	Insulation fitting to the conductor	(i) Insulation shall fit tightly to the conductor and shall be applied concentrically about the conductor in thickness consistent with the voltage classification. (ii) The insulation shall be so applied that it shall be possible to remove it without damaging the conductor.
7	Weight of core	To be specified by bidder

III. CORE IDENTIFICATION

4C Cable	Core color: 'red' for R phase, 'blue' for B phase, 'yellow' for Y phase & 'Black' for Neutral.
2C Cable	Core color: 'red' for phase, & 'Black' for Neutral.
1C Cable	For single core cable, XLPE insulation shall be black in colour.

IV. LAYING UP OF CORES

Laying up	(i) Cores shall be laid up together as per table-4 of Clause 11.2 of IS 7098, Part-1. (ii) Where necessary, the interstices shall be filled with non-hygroscopic material.

V. INNER SHEATH (For Multi core cables only)

S. No.	Parameter	Requirement
1	Material	Black coloured Polyvinyl chloride (PVC) type ST-2 compound.
2	Thickness	(i) The sheath shall have adequate thickness, mechanical strength and elasticity, as per IS 5831. (ii) Min. thickness of inner sheath shall be as per Table no.5 of IS 7098 part 1. (iii) For 2 Core: Inner sheath shall be applied by pressure extrusion method. For 4 Core: Inner sheath shall be applied by normal extrusion process.
3	Raw material supplier	**PVC compound shall be procured from reputed raw material suppliers viz., Shakun, Kalpana, KLJ, DCM ShriRam,** **PVC compound from cable manufacturer may be considered only after evaluation of the compound manufacturing process.**

VI. ARMOUR (For Multi core cables only)

<table>
<tr><th>S. No.</th><th>Parameter</th><th colspan="2">Requirement</th></tr>
<tr><td>1</td><td>Material</td><td colspan="2">Annealed (soft) low carbon hot dipped heavily coated galvanized round steel wires.</td></tr>
<tr><td>2</td><td>Compliance to Standard</td><td colspan="2">It shall comply with the requirements of IS 3975 along with the latest amendments.

Hot dipped galvanizing layer shall be uniform on low carbon annealed steel wires.

Zinc coating shall be heavily coated as per IS 4826:1979.</td></tr>
<tr><td rowspan="6">4</td><td rowspan="6">Approx. Armour Short circuit rating of armour for 1 sec (kA)</td><td>Area of Conductor (sq.mm.)</td><td>Short circuit rating of Armour for 1 sec (kA)</td></tr>
<tr><td>4</td><td>1.37</td></tr>
<tr><td>6</td><td>1.53</td></tr>
<tr><td>10</td><td>1.88</td></tr>
<tr><td>16</td><td>2.54</td></tr>
<tr><td>25</td><td>3.17</td></tr>
</table>

		35	4.30
		50	5.22
		95	6.97
		150	10.98
		240	13.92
		300	16.18
5	Jointing in the armour wires	Not acceptable in any armour wire	
6	Laying of armour	The armor wires shall be applied as closely as practicable. Shall not be less than 90% of total circumference.	
7	Binding	Rubberized cotton binding tape shall be applied to bind the armor wires such that it shall not affect the electrical properties of the armor wires and the overall cable.	
8	Weight of armor Kg/km	To be furnished by Bidder	
9	Raw material supplier	Armour steel shall be procured from reputed raw material suppliers viz., TATA Steel, Jindal Steel, SAIL, Bansal (BWIL)	

VII. Outer Sheath

S. No.	Parameter	Requirement
1	Material	Polyvinyl chloride (PVC) ST-2 **FRLSH** type compound (as per IS 5831) with **'lead napthenate'** additive.
2	Configuration	Polyvinyl chloride (PVC) ST-2 **FRLSH** type compound with **'lead napthenate'** additive as 'termite & rodent repellent' shall be applied by extrusion process. The outer sheath shall have adequate thickness, mechanical strength and elasticity, as per IS 5831. Thickness of outer sheath shall be as per Table no. 8 of IS 7098 part 1.
3	Colour	Blue, colour code: 103 as per IS 5:2007.
4	Surface uniformity	(i) The outer sheath shall be ultraviolet protected for operation in direct sunlight. (ii) Surface of outer sheath shall be free from cavity/ nicks/ other visible defects.

5	Raw material supplier	**PVC compound shall be procured from reputed raw material suppliers viz.,** Shakun, Kalpana, KLJ, DCM ShriRam
		PVC compound from cable manufacturer may be considered only after compound manufacturing process evaluation.
6	Weight of outer sheath kg/km	To be provided by bidder
7	Weight of complete cable Kg/km	To be provided by bidder
8	Overall diameter of cable	To be provided by bidder

VIII. Other Requirements

Parameter	Requirement
End seal	Adhesive coated polyolefin heat shrinkable end caps shall be provided on both ends of cable.

6. MARKING:

Wooden drums shall be free from sharp edges and visual defects.

Cable length on one drum shall be:

(a) 4 Core Cable – 95 sq.mm. to 300 sq.mm. – 500 meters with + 5% tolerance

(b) 4 Core Cable – 16 sq.mm. to 50 sq.mm. – 1000 meters with + 5% tolerance

(c) 2 Core & 1 Core Cables – 1000 meters with + 5% tolerance (as per PO terms and conditions)

i. Following details shall be provided on flanges of **drum**:

a) Manufacturer's name
b) Type of Cable
c) Size of Cable
d) Voltage Grade
e) Length of the cable on the drum (as per PO terms)
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.

ii. The following details shall be **embossed** on the **outer PVC sheath.**

Embossing shall be clearly visible. **At interval of every 1 meter, following details to beembossed:**

a) Sequential meter marking ***(shall be marked through printing)***
b) Property of TPCODL/TPNODL/TPSODL/TPWODL
c) Manufacturer name
d) Month & Year of Manufacture
e) Voltage grade
f) Size of the cable
g) Purchase Order no.
h) Cable code

7. TESTS:

All routine, acceptance & type tests shall be carried out in accordance with the relevant IS/IEC. All routine/acceptance tests shall be witnessed by TPCODL/TPNODL/TPSODL/TPWODL's authorized representative. All the components should also be type tested as per the relevant standards. The following tests shall be necessarily conducted on the 1.1 kV cables in additionto others specified in IS/IEC standards.

7.1 ACCEPTANCE TESTS

All acceptance tests mentioned below shall be witnessed by TPCODL/TPNODL/TPSODL/TPWODL's representative during the inspection stage.

S.No.	Test name	Specific value		Test method	
		ClauseNo.	Reference Standard	Clause No.	Reference Standard
(I) Test on Conductor					
1	Conductor resistance test	ClauseNo. 5(A.4)	ENG-LV-3001	10	IS 10810-part 5
2	Test for non-conductivity of water swellable tape/yarn of conductor (For conductor size: 150 sq.mm.and above)	ClauseNo. 5(A.6)	ENG-LV-3001	Through multimeter	
3	Visual inspectionfor conductor cleanliness	ClauseNo. 5(A.7)	ENG-LV-3001	Check for presence of any Aluminium dust	

4	Tensile test (non-compacted conductor only)	Clause No.3.1	IS 8130	8	IS 10810-part 2
5	Wrapping test (non-compacted conductor only)	Clause No.6.2.2	IS 8130	8	IS 10810-part 3
6	Conductor water penetration test	ICEA T-31-610			
(II) Test on Insulation					
7	Tensile strength & Elongation at break (before ageing)	Table 1	IS 7098 parts 1	8	IS 10810-part 7
8	Insulation thickness	Table 3	IS 7098 parts 1	8	IS 10810-part 6
9	Depth of embedded, extruded colourline (For multi-corecable only)	Max depth 50% of insulation thickness	ENG-LV-3001	Through profile projector/ magnifyingoptical scale	
10	Brightness of embedded, extruded colourline (For multi-corecable only)	ClauseNo. 5.C	ENG-LV-3001	Visual check from a distance of 1meter	
11	Hot set test	Table 1	IS 7098-part 1	8	IS 10810-part 30
12	Surface smoothness of insulation	ClauseNo. 5(B.7)	ENG-LV-3001	To be checked by inspector	
(V) Test on Inner sheath					
13	PVC thickness	Table 5	IS 7098 parts 1	8	IS 10810-part 6
14	Colour of inner sheath	ClauseNo. 5 (D.1)	ENG-LV-3001	To be checked by inspector	

(VI) Test on Armour (for multicore cables only)					
15	Tensile test	8	IS 3975	IS 1608	
16	Mass of zinc coating	Table 1 Heavily coated soft wire	IS 4826	IS 6745	
17	Uniformity of zinc coating	9	IS 3975	IS 2633	
18	Adhesion test	9	IS 3975	IS 3975	
19	Diameter	Table 6	IS 7098 parts 1	Value to be measured by inspector	
20	No. of wires & Coverage %	ClauseNo. 5(E.6)	ENG-LV-3001	Value to be measured by inspector	
(VII) Test on PVC Outer Sheath					
21	Thickness		IS 7098 parts 1		IS 10810 Part 6
22	Tensile strength and Elongation at break (before ageing)	Table 2	IS 5831	8	IS 10810 part 7
23	Colour of outer sheath	ClauseNo. 5 (F.3)	ENG-LV-3001	To be checked by inspector	
24	Surface uniformity of outer sheath (onfull drum)/ shall befree from any damage-void, nick, cavity.	ClauseNo. 5 (F.4)	ENG-LV-3001	Through rewinding of drum (As per TPCODL/TPNODL/TPSODL /TPWODL specification)	
25	Anti-termite and rodent property test in PVC outersheath	Chemicaltest	As per manufacturer Process/ Method	To be checked by inspector	

26	Flammability test	IS 10810-part 61			
27	Oxygen index	IS 10810-part 58			
28	Temperature Index test	IS 10810-part 64			
29	Acid gas generation	IS 10810-part 59			
30	Smoke density	IS 10810-part 63			
(VIII) Tests for complete cable					
31	High voltage test	7.2 kVfor 5 minutes As per Clauseno. 16.2.1	IS 7098 parts 1	8	IS 10810 part 45
(IX) Additional tests					
32	Raw material consumption	Clause No. A.8, B.4, D.3, E.9, F.5	Document verification as proof to be submitted		
		Invoice to be shown from procurement to consumption			
33	Sequential marking check	Clause no. 6.ii	ENG-LV-3001	To be checked by inspector	
34	Cable drumlength verification	Clause no. 6	ENG-LV-3001	To be checked by inspector	
35	Packaging of cable-on-cabledrum	By recyclable PVC sheet- As per Clauseno.12	ENG-LV-3001	To be checked by inspector	
36	End caps	Clause No. G	ENG-LV-3001	To be checked by inspector	

37	Weight of conductor Kg/km	To be checked by inspector
38	Weight of core Kg/km	To be checked by inspector
39	Weight ofarmour Kg/km	To be checked by inspector
40	Weight of complete cable Kg/km	To be checked by inspector
41	Overall approx. diameter of complete cable	To be checked by inspector

7.2 ROUTINE TESTS

Test	Clause No.	Reference Standard
Conductor resistance test	15.3	IS 7098-part 1
High voltage test with power frequency	15.3	IS 7098-part 1

7.3 TYPE TESTS

S.No.	Test	Specific value		Test method	
		Clause No.	Reference Standard	Clause No.	Reference Standard
Tests on Conductor					
1	Conductor resistance test	Table 2	IS 8130	10	IS 10810 part 5

2	Conductor water penetration test (For conductor size - 150 sq.mm. and above)	ICEA T-31-610	ICEA T-31-610	4	ICEA T-31-610
3	Tensile strength (For non-compacted conductor)	6.2.1	IS 8130	8	IS 10810 part 2
4	Wrapping test (For non-compacted conductor)	6.2.2	IS 8130	8	IS 10810 part 3
Tests on Insulation					
5	Tensile strength & Elongation at break (Before ageing)	Table 1	IS 7098 part 1	8	IS 10810 part 7
6	Ageing in air oven	Table 1	IS 7098 part 1	8	IS 10810 part 11
7	Tensile strength & Elongation at break (After ageing)	Table 1	IS 7098 part 1	8	IS 10810 part 7
8	Tests for thickness of insulation	Table 3	IS 7098 part 1	8	IS 10810 part 6
9	Hot set test	Table 1	IS 7098- part 1	8	IS 10810 Part 30
10	Shrinkage test	Table 1	IS 7098 part 1	8	IS 10810 part 12
11	Gravimetric test (Water absorption)	Table 1	IS 7098 part 1	8	IS 10810 part 33
12	Volume resistivity/ Insulation Resistance	Table 1	IS 7098 part 1	8	IS 10810 part 43
Tests on Inner Sheath					

13	PVC thickness	Table 5	IS 7098 part 1	8	IS 10810 part 6
Tests on Outer Sheath (PVC)					
14	Flammability test for outer sheath	Clause No. 16.3	IS 7098 Part 1	As per IEC 332-part 1	
15	Tensile strength and Elongation at break (Before ageing)	Table 2	IS 5831	8	IS 10810 part 7
16	Tensile strength and Elongation at break (After ageing)	Table 2	IS 5831	8	IS 10810 part 7
17	Variation due to ageing	Table 2	IS 5831	8	IS 10810 part 7
18	Loss of mass test	Table 2	IS 5831	8	IS 10810 part 10
19	Shrinkage test	Table 2	IS 5831	8	IS 10810 part 12
20	Hot deformation test	Table 2	IS 5831	8	IS 10810 part 15
21	Heat shock test	Table 2	IS 5831	8	IS 10810 part 14
22	Thermal stability test	Table 2	IS 5831	Appendix B	IS 5831:1984
23	Oxygen index	As per ASTM 2863			
24	Temperature index	ASTM 2863			
25	Acid gas generation	IEC 60754			
26	Smoke density	ASTM 2843			
Tests on Armour for multi-core Cable					

27	Tensile test	8	IS 3975	6	IS 1608
28	Torsion test	8	IS 3975	7	IS 1717
29	Wrapping test	8	IS 3975	5	IS 1755
30	Resistance test	8	IS 3975	8	IS 10810 Part 42
31	Mass of zinc coating	Table 1	IS 4826	6	IS 6745
32	Uniformity of zinc coating	9	IS 3975	4	IS 2633
33	Adhesion test	9	IS 3975	9.3	IS 3975
Tests on complete cable					
34	High voltage test	7.2 kV for 5 minutes As per Clause no. 16.2	IS 7098 part 1	8	IS 10810 Part 45

8. TYPE TEST CERTIFICATES:

The bidder shall furnish the type test report of **1.1 kV** cable for the tests as mentioned inClause no. 7 of this specification and as per reference standards.

Complete set of Type Tests shall be conducted at certified test laboratories, which are CPRI / ERDA/ Approved labs by TATA ODISHA DISCOMs only. Type test report shall be submitted for the type, size and rating of thecable mentioned in the bid/ OR for any size higher (than required) of similar type and similar voltage grade. Conductor Water penetration test as per ICEA T 31-610 shall be conducted at CPRI/ERDA Approved labs by TATA ODISHA DISCOMs only.

Type test should have been conducted in certified test laboratories during the period not exceeding from the date of 10 years from the date of opening of bid. **In the event of any** discrepancy in the test reports i.e. any test report not acceptable or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out withoutany cost implication to TPCODL/TPNODL/TPSODL/TPWODL.

In case the type test certificates are dated beyond 5 years and up to 10 years, though thebasic component design of cable is same, then acceptance for *'no change in design'* shallbe submitted by bidder on their organization's letter head.

TPCODL/TPNODL/TPSODL/TPWODL will have the rights to accept/reject these type test reports.

9. PRE-DISPATCH INSPECTION:

Inspection shall be carried out by duly authorized representative of TPCODL/ TPNODL/ TPSODL/ TPWODL.

The bidder shall grant free access to the places of manufacture to TPCODL/ TPNODL/ TPSODL/ TPWODL's representatives at all times when the work is in progress.
Inspection may be made at any stage of manufacturing at the discretion of TPCODL/TPNODL/TPSODL/TPWODL and the equipment, if found unsatisfactory as to workmanship or material, the same is liable to rejection.
Inspection by TPCODL/TPNODL/TPSODL/TPWODL or its authorized representatives shall not relieve the bidder of his obligation of furnishing equipment in accordance with the specification.

Dispatch of material: Material shall be dispatched after specific MDCC (Material DispatchClearance Certificate) is issued by TPCODL/TPNODL/TPSODL/TPWODL.
Following documents shall be sent along with the supplied material:

a) Test reports
b) MDCC issued by TPCODL/TPNODL/TPSODL/TPWODL
c) Invoice in duplicate
d) Packing list
e) Delivery Challan

10. INSPECTION AFTER RECEIPT AT STORE:

The material received at TPCODL/TPNODL/TPSODL/TPWODL, Odisha store will be inspected for acceptance and shall beliable for rejection, if found different from the reports of the pre-dispatch inspection.

11. GUARANTEE:

The bidder shall confirm for guarantee towards design, material, workmanship & quality of process / manufacturing for integrated product delivered under the contract.

In the event any defect is found by TPCODL/TPNODL/TPSODL/TPWODL, up to a period of at least 60 months from the date of commissioning or 72 months from the date of last supplies made under the contract whichever is later, bidder shall be liable to undertake to replace/rectify such defects at their own costs, within mutually agreed time frame, and to the entire satisfaction of TPCODL/TPNODL/TPSODL/TPWODL, failing which TPCODL/TPNODL/TPSODL/TPWODL will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the TPCODL/TPNODL/TPSODL/TPWODL's own charges (@ 20% of expenses incurred), from the Bidder or from 'Security cum Performance Deposit' as thecase may be.

Free replacement: Bidder shall further be responsible for 'free replacement' for another period of THREE years from the end of the guarantee period for any 'Latent Defects' if noticed and reported by TPCODL/TPNODL/TPSODL/TPWODL.

12. PACKING AND TRANSPORT:

a) Standard length of Cable: The cable shall be supplied in continuous **standard length** as per Clause no.6 of this specification.

b) Filling condition: Drum shall not be overfilled.

c) Cable drum: The cable shall be wound on non-returnable drums without any extra cost to TPCODL/TPNODL/TPSODL/TPWODL as per IS 10418 and its latest amendments.

d) Sealing of cable ends: The ends of the cable shall be sealed by means of heat shrinkable polyolefin end caps.

e) Requirements for Cable drums: Cable drums shall be so constructed as to have required mechanical strength so that the drum flanges and other components do not break during transport, in actual use or in storage. The flanges and the outside surface of the barrel shall be free from protruding materials/projections/ unevenness/ sharp edges that can damage the cable or hands of the operator during rotation of drums.

Material preservation shall be applied to the entire drum.

f) The bottom end of cable should be clamped on drum by jute or nylon rope.

g) Rail/ Road transportation: The bidder shall ensure that the equipment covered under this specification shall be prepared for rail/road transport in a manner so as to protect the equipment from damage in transit. The drums shall withstand normal handling and transport.

h) Packaging shall be as per climate change perspective.

The cable wound on cable drum shall be covered by recyclable PVC sheet for dustproof.

TPCODL/TPNODL/TPSODL/TPWODL encourages the use of environmentally friendly packaging.

13. TENDER SAMPLE:

Not Applicable

14. QUALITY CONTROL:

The bidder shall submit a 'Quality Assurance Plan' followed by him in respect of bought out items, items manufactured by him, Raw materials in process, Final inspection Packaging & Marking. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. TPCODL/TPNODL/TPSODL/TPWODL reserves the sole rights for the type test of random sample from the lot and in case of any discrepancy or deviation fromthe Type test certificates submitted along with the bid, the complete Lot shall be rejected.

TPCODL/TPNODL/TPSODL/TPWODL's nominated representative shall have free access to the bidder's works to carry out inspections

15. TESTING FACILITIES:

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

16. MANUFACTURING FACILITIES:

The successful bidder will have to submit (after placement of RC) technical compliance document and drawing of cable as per RC line items for getting approval before mass manufacturing. Bidder shall start manufacturing of mass quantity only after getting CAT-A approved drawings and technical compliances or as per intimation from TPCODL/TPNODL/TPSODL/TPWODL.

17. SPARES, ACCESSORIES AND TOOLS

Not applicable.

18. DRAWINGS AND DOCUMENTS:

Following documents shall be submitted along with the bid for approval after award of RC/PO:

a) Completely filled–in clause wise compliance of this specification
b) Type test Certificates for each specified test
c) Cross sectional drawing of the cable
d) Rating factors for variation in ground and air temperature, depth of laying, thermal resistivity of soil and different laying configuration of cables.

Following documents shall be submitted after award of contract for approval before manufacturing:

a) Completely filled–in clause wise compliance of this specification
b) Cross sectional drawing of the cable

All the Documents and Drawings shall be in English Language.

19. SCHEDULE- "A" GUARANTEED TECHNICAL PARTICULARS:

Bidder to submit clause wise compliance.

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 thisschedule. 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