

**WEST BENGAL STATE ELECTRICITY DISTRIBUTION COMPANY
LIMITED
(A Govt. of West Bengal Enterprise)**

**TECHNICAL SPECIFICATION FOR 1-CORE 1000 SQMM
XLPE INSULATED PVC SHEATHED ARMoured ALUMINUM
CABLE SUITABLE FOR
EFFECTIVELY EARTHED 11 KV SYSTEM**

MAY'2026

XLPE CABLE SUITABLE FOR USE IN EFFECTIVELY EARTHED 11 KV SYSTEMS

1. SCOPE :

The specification covers the design, manufacture, testing, supply and delivery in proper packed condition of 11KV voltage grades of 1-core Aluminum Conductor, Cross-linked polyethylene (XLPE) insulated, PVC sheathed, Armoured, screened Power Cables.

2. DEVIATION :

Normally the offer should be as per Technical Specification without any deviation. But any deviation felt necessary to improve performance, efficiency and utility of equipment must be mentioned in the "Deviation Schedule" with reasons duly supported by documentary evidences and advantages of such deviation. Such deviation suggested may or may not be accepted. But deviations not mentioned in "Deviation Schedule" will not be considered afterwards.

3. LOCATION :

3.1 The Cables may be laid buried directly in ground at a depth of one meter in average, anywhere in West Bengal and terminated for outdoor connection to a power transformer or to overhead lines.

3.2 The Cables may also be laid within covered cable trenches, in cable racks or open air ladder trays etc. for certain portions of lengths.

4.0 SYSTEM DETAILS

4.1	Voltage grade (KV) of cable required	::	6.35/11KV
4.2	Service Voltage	::	11 KV
4.3	Highest Voltage	::	12 KV
4.4	Earthing System	::	Solidly Earthed
4.5	B.I.L. For Cable	::	75 KV for 11 KV Grade
4.6	Fault Level (Maxm.)	::	94 KA
4.7	Frequency	::	50 C/S

5.0 WEATHER CONDITION :

5.1 Monsoon prevails generally from the month of June to October with showers sometimes heavy, acidic, smoky, industrial and foggy.

5.2 Maximum ambient temperature :: 50 degree C.

5.3 Minimum ambient temperature :: 4 degree C

5.4 Thermal resistance of soil :: 4 degree C
5.5 Maximum Depth :: 150 degree C-Cm/Watt

5.5 Maximum Daily average ambient temp :: 150 degree C

5.6 Maximum relative humidity :: 100.00%

5.7 Average rainfall per annum :: 100.00%

5.8 Maximum height above the ground :: 200 cm

5.8 Maximum height above the Sea level :: 200 cm
:: 1000 Meters

6.0 STANDARDS:

6.1 The Cable shall conform to the following standards to the extent of WBSEDCL's requirement is fulfilled.

1) IS: 7098 (Part-II)-2011 Specification for cross-linked polyethylene Insulated PVC Sheathed Cables for working Voltages from 3.3 KV up to and including 33 KV (with Latest amendment)

2) IS:8130-1984: Specification for Conductors for insulated electric cables and flexible cords

- 3) IS:5831-1984: PVC insulation & sheath of electric cables
- 4) IS: 3975-1970: Armour for cables (for 1 Core)
- 5) IS:10810-1984: Methods of test for Cables.
- 6) IS:10418-1982: Cable Drums for Electric Cables.

6.2 The cable, joints, outdoor termination and their accessories and fittings may conform to other Indian and/or equivalent Standards or important publications to improve upon their performance, but shall not fall short of the requirement of this specification. The tenderer shall clearly indicate such standards in their offers.

7.0 ELECTRICAL CHARACTERISTICS & PERFORMANCE:

7.01 Description of Cables:

Stranded compacted circular Aluminium Conductor (H4 grade as per IS 8130/1984) of class 2 shielded with black extruded semi-conducting compound, XLPE insulated, core shielded with black extruded semi-conducting compound and single layer of non magnetic round hard drawn aluminum wire armoured with more than 90% coverage and Blue extruded PVC (Type ST-2) overall sheathed, conforming generally to IS:7098(Part-II) and its latest amendments. The Cable must be manufactured by triple extrusion method and cured by dry Nitrogen gas and cooled through CCV line.

7.02 Maxm. Conductor temp. : 90 degree C at maxm. continuous current.

7.03	Permissible Maxm. Short Ckt.	11K.V. System	
		94.0 KA (1790 MVA) for 1 sec for 11 KV , 1C x 1000 sqmm	
	Short Ckt. Current- Single Phase to Earth	Combine Earth Fault Current of Screen & Armour (22 KA (minimum) for 1 Sec)	
7.04	Maximum Permissible emergency overload temp. at 25% overload to 100 hrs. per year or 500 hrs. in life of Cable	:	130 degree C for one hour
7.05	Maxm. Permissible short circuit Temperature	:	250 degree C for one second
7.06	Conductor Material & core	:	H4 Grade Aluminium Conductor of class-2 conforming to IS: 8130 and conductor core shall be stranded compacted circular
7.07	Conductor screening	:	Conductor screening shall be black extruded semi-conducting compound of nominal minimum thickness 0.5 mm .
7.08	Insulation	:	XLPE of thickness, 3.6 mm. (Nominal).
7.09	Insulation Screening :	::	Non-metallic part shall be applied directly over the insulation of core and shall consist of black extruded bonded type semi-conducting compound (0.5 mm minimum thickness) and are easily removable during jointing & termination operations. For 1 Core, Cable, the non-magnetic metal armour will act as metallic part insulation screening.
7.10	Inner Sheathing	:	There will be no inner sheath. Armouring shall be applied over the insulation screen.

7.11	Armouring	:	There will be single layer of non magnetic round armour made of hard drawn aluminium conductor wire of nominal diameter 1.5 mm. Radial coverage of round armoured wire shall be more than 90%.
7.12	Overall Sheathing	:	Blue Coloured extruded PVC Type ST-2 compound to IS:5831. Minimum thickness shall be as per ISS.
7.13	Approx length of Cable in a Drum & tolerance in quantity	:	250/500 meters (as per site requirement) with a tolerance of $\pm 5\%$. However the tolerance shall be restricted upto $\pm 2\%$ on the quantity mentioned per lot in the delivery schedule of purchase order except the last lot. But overall tolerance limit of the total delivered quantity shall be minus (-) 1% against item wise purchase ordered quantity for each Purchase Order and the same shall be taken care of while offering last lot of inspection
7.14	End Sealing	:	H.S. Caps (Heat Shrinkable)
7.15 a)	Max. tan-delta at room temp., at nominal Phase to Neutral Voltage (U_0)	:	0.004
b)	Maxm. Increment of tan-delta between 0.5 U_0 to 2 U_0 at room temp	:	0.002
7.16	Partial Discharge Value	:	10 pc (max.) at 1.73 U_0 (for routine test) /Acceptance Test and 5 pC (Max ^m .) for Type Test as per IS: 7098(II)/2011
7.17	Impulse Tests	:	75 KV for 11 KV as per IS: 7098 (Part-II)/2011.
7.18	H.V. Tests between Conductors & Screen/Armour	:	21 KV (rms) for 11 KV for 5 minutes as per IS: 7098 (Part-II)/2011
7.19	Maximum D.C Resistance per KM	:	0.0291 Ohm/Km

8.0 **CABLE CONSTRUCTION:**

8.1 XLPE Underground Cable is to be manufactured in catenary continuous vulcanization process at controlled elevated temperature and pressure in inert atmosphere with use of suitable materials for Conductor screening, XLPE main insulation and insulation screening with semi-conducting screen. The cable to be manufactured through Triple Extrusion method and Cured in Dry Nitrogen atmosphere and to be cooled through CCV line. The XLPE Cable in this specification does not have any metal sheath and the short circuit rating of the cable will depend on the conductivity and continuity of the strands of the armour wires which shall be ensured by guarding against corrosion.

8.2 **CONDUCTOR SCREENING:**

A semi-conducting cross-linked polyethylene (XLPE) screening shall be extruded over the conductor to act as an electrical shield which together with the elimination of the so called "Skin Effect" prevents to a great extent air ionization on the surface of the conductor.

8.3 **INSULATION:**

The main insulation of the Cable shall be extruded unfilled, chemically cross-linked polyethylene (XLPE) inert gas cured satisfying the requirement of IS: 7098(Part-II).

8.4 **INSULATING SCREEN:**

The screen shall be made up as given in 7.09. The metal screen eliminates tangential stress of rotating electrostatic field surrounding the conductor and uniform electrical stress in the insulation.

The semi-conducting polyethylene (XLPE) screen shall be extruded over the main polyethylene insulating wall to prevent partial discharge at the surface of the insulation. In single core cable, Aluminium wire armouring shall constitute the metallic part of insulation screen. Conductor screening, insulation and insulation screening shall be extruded in triple extrusion processes so as to obtain continuously smooth interfaces.

- i) The partial discharge level at the surface of the insulation is brought to a minimum.
- ii) There will be no displacement of the semi conducting screen and Insulation during expansion and contraction due to load cycles and bending.
- iii) The semi conducting screens are easily removable during jointing and termination operations.

Single layer of non magnetic round hard drawn aluminum wires (2.5 mm Dia) with more than 90% coverage (Armour wires shall be applied as closely as practicable so that gap between the armour wires should be less than the diameter of the single wire).

The supplier shall suggest suitable materials for use, in the event of damage to the over sheath to prevent passage of moisture along the cable.

- a) Manufacturer's Name or Trade Mark.
- b) Type of Cable / Cable Code
- c) Voltage Grade.
- d) Type of insulation & Material of conductor (XLPE Armoured, PVC sheathed Aluminium).
- e) Nominal section and number of cores
- f) Month & Year of manufacture.
- g) Inscription for length of cables at 1.0 meter interval outer sheath by printing/engraving.
- h) Name of the purchaser : WBSDDL
- i) Marking "Electric".

The cable ends of cable in the wooden/ steel drum for delivery shall be sealed with heat shrinkable caps.

The Cable shall be packed in non-returnable wooden or steel drums (Preferably Wooden drum).

a) **Drum identification No.**
b) **Manufacturer's Name, Trade Name/Trade Mark, if any.**
c) IS reference i.e 7098 (part-II)/2011
d) Nominal sectional area of the conductor of the cable.

- e) No. of Cores.
- f) Type of Cable and Voltage Grade with Cable Code.
- g) Length of the Cable in Cable Drum.
- h) Colour of outer sheath
- i) Direction of rotation of Drum (by means of an arrow)
- j) Approximate Weight : Tare : Gross
- k) Month , Year and Country of Manufacture.
- l) Purchase Order No.
- m) Date of Delivery
- n) Name of the Purchaser : WBSEDCL

Drums shall be proofed against attack by white ants or termite conforming to IS : 10418. The Drums may also be marked with ISI Certificate Mark, if applicable.

9.2 Safe Pulling Force: 30 N/mm² (for Conductor)

10.0 Tests to be performed as per IS: 7098 (Part-II)/2011 & IS:8130/1984 and its amendments.

10.1A Type Test: All the tests mentioned below are to be made as per details given in IS:10810. The party shall submit Type Test report from CPRI or ERDA or **NABL accredited third party** LAB as per IS:7098/II/2011 and its latest amendment and other relevant IS/ IEC for each offered item of identical type, voltage grade, size, material and design, carried out within 5 years from the due date of opening of tender. Type Test Certificate should bear NABL Logo. Accreditation of NABL LAB should be displayed in the official website of NABL.

- a) Tests on conductor
 - i) Tensile Test (for aluminium) (not applicable for compacted conductor as per IS:8130-1984)
 - ii) Wrapping Test (for aluminium) (not applicable for compacted conductor as IS:8130-1984)
 - iii) Resistance Test.
- b) Tests for armouring Wires strips.
- c) Test for thickness of insulation and sheath
- d) Physical test for insulation.
 - i) Tensile strength and elongation at break.
 - ii) Ageing in air oven.
 - iii) Hot test.
 - iv) Shrinkage test
 - v) Water absorption (Gravimetric)
- e) Physical tests for outer sheath
 - i) Tensile strength and elongation at break.
 - ii) Ageing in air oven.
 - iii) Shrinkage test.
 - iv) Hot deformation.
 - v) Heat shock.
 - vi) Loss of mass in air oven.
 - vii) Thermal stability.
- f) Partial discharge test.
- g) Bending test.
- h) Dielectric power factor test.
 - i) As a function voltage.
 - 1) As a function of temperature.
- i) Insulation resistance (Volume resistivity) Test.
- j) Heating cycle test.
- k) Impulse with stand test.
- l) High voltage test.
- m) Flammability test.

10.1B The following tests on screened cable shall be performed successively on the same test sample of completed cable, not less than 10m. in length between the test accessories.

- a) P.D. Test.
 - b) Bending Test followed by P.D. Test.
 - c) Dielectric power factor as a function of voltage.
 - d) Dielectric power factor as a function of temperature.
 - e) Heating cycle test followed by dielectric power factor as a function of voltage and P.D. tests.
 - f) Impulse withstand test and
 - g) High voltage test as per para 7.18.
- If a sample fails in test (g) one more sample shall be taken for this test, preceded by tests (b) & (e).

10.2 **Acceptance Test:** The following shall constitute Acceptance Tests:

- a) Tensile test (for aluminium)
- b) Wrapping test (for aluminium)
- c) Conductor resistance test.
- d) Test for thickness of insulation (eccentricity) and sheath.
- e) Hot set test for insulation.
- f) Tensile strength and elongation at break test for insulation and outer sheath.
- g) P.D. test (for screened cables) only on full drum length.
- h) High Voltage test **(4 hours Test as per IS 7098 (Part 2):2011 Section 20.7.1 with latest amendment no. 2 April 2022 & 5 min test on all samples as per Section 20.7.2 of the said IS.)**
- i) Insulation resistance (VOLUME RESISTIVITY) TEST
- j) Flammability test
- k) Visual marking and length checking in 01 (one) drum of offered lot

10.3 **ROUTINE TESTS:**

The routine test shall be carried out on all cables manufactured in accordance with this specification.

The following routine tests shall be made on cable length as specified in the ISS.

- a) Conductor resistance test.
- b) Partial discharge test on full drum length.
- c) High voltage test as per para 7.18

10.4 **TEST WITNESS:**

1. All Tests shall be performed in presence of Purchaser's representative if so desired by the Purchaser.
2. The contractor, shall give at least fifteen (15) days advance notice for witnessing such tests.

11. **TEST CERTIFICATE:**

- 11.1 Certified copies of all routine tests carried out at Works shall be furnished in Six (6) copies for approval of the purchaser.
- 11.2 The cables shall be dispatched from Works only after receipt of Purchaser's written approval of shop test reports.
- 11.3 Type Test Certificates of the Cable offered shall be furnished. Otherwise the cable shall have to be type tested on similar rating as per Clause - 10 free of any charges to prove the design.

12. **DESCRIPTIVE LITERATURES, TEST RESULTS ETC.:**

The following details for the cable shall be submitted with bid.

- a) Manufacturer's Catalogue giving cable construction details and characteristics.
- b) Manufacturing process in detail for cables highlighting the steps to control.
 - i) Contamination.
 - ii) Formation of water trees.
 - iii) Effects of by-products of cross-linking.
 - iv) Stress control etc.
- c) Cross section drawing of the cable.

**SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR
11 KV ARMoured ALUMINIUM XLPE CABLES
(To be filled in by the Supplier)**

1	NAME OF MANUFACTURER & ADDRESS	:	
2	Voltage Grade.	:	6.35/11 KV
3	Core & Cross Section No x sq. mm.	:	1C x 1000
4	Type & Designation (as per ISS)	:	A2XWaY
5	List of Standards applicable	:	-IS: 7098(PT-2) 2011, IS: 8130 - 1984, IS:5831 - 1984, IS:3975 - 1999, IS: 10810 - 1984 & IS: 10418 - 1982, IEC 60502 and all the said IS with latest amendment
6	System suitable for		
a	Service Voltage	:	11KV
b	Neutral Earthing	:	6.35KV
7	Maximum. Conductor temperature	:	
a	Continuous (in Deg. C)	:	90° C
b	Short time (in Deg.C)	:	250° C
8	Conductor	:	
a	Material to IS-8130(Class/Grade)	:	H4 Grade Aluminium of Class-2
b	Size (Sq.mm.)	:	1000
c	Nominal diameter of wires in each. Conductor strand before stranding & compaction (mm.)	:	
d	No. of Strand (Approx)	:	
e	Shape of conductor	:	Stranded Compacted Circular
f	Overall Diameter of Conductor after stranding & compaction (mm)	:	
9	Shielding/screening on Conductor	:	
a	Material	:	Black Semi-conducting compound
b	Type/thickness(mm)	:	Extruded
c	Whether thermosetting?	:	Yes
d	Thickness (Minimum)	:	0.5 mm (Min.)
10	Insulation	:	
a	Material	:	XLPE as per IS 7098 PT-II 2011 with latest amendments
b	Type	:	Extruded
c	Thickness (mm)	:	3.6(nominal)
11	Shielding / screening on insulation	:	
a	Material for Non-metallic	:	Black Semi-conducting compound
i)	Type	:	Extruded
ii)	Thickness (mm)	:	0.5 mm(min)
12	Armouring	:	
a	Material	:	Single layer Non-magnetic round hard drawn Aluminium conductor
b	Nominal Dia. (mm):	:	2.5 mm
c	No's of armour	:	
d)	D.C. resistance at 20 deg.C (Ohm/Km)	:	

e	A.C. resistance at 20 deg.C		
f	Armour Coverage Percentage		More than 90%
13	Overall Sheath	:	
a	Material	:	Extruded PVC (Blue Colour) as per IS:5831/84
b	Type	:	ST-2
c	Minimum Thickness (mm.)	:	
d	Colour of Sheath	:	Blue
14	Approx. overall diameter of the Cable (mm.)	:	
15	Continuous current rating For standard condition, laid direct	:	
a	In ground at temp 30 deg.C	:	595
b	In duct at temp 30 deg.C	:	509
c	In air at temp 40 deg.C	:	954
16	Charging current attracted system voltage A/KM	:	
17	Short Circuit Current in KA(Maxm.)	:	
a	for 1 sec	:	94.30 KA
b	for 0.5 sec	:	133.40 KA
18	Combine Earth Fault Current for Screen and Armour in KA for 1 sec	:	22KA (Min)
19	Electrical Parameters	:	
a	Maxm. D.C. resistance/km of conductor at 20 deg.C (Ohm/Km)	:	0.0291
b	AC resistance/kilometer of conductor at 90 deg.C (approx.)(Ohm/Km)	:	
c	Reactance/kilometer(approx.) (Ohm/Km)	:	
d	Capacitance/Kilometer(approx.) (um/Km)	:	
e	Di-electric losses at rated(Uo/U) system KV, 50 cycles/sec in Watts/KV/Phase)	:	
f	i) tan-delta at 0.5 Uo ii) tan-Delta at Uo iii) tan-Delta at 1.5 Uo iv) tan-Delta at 2 Uo	:	Tan-delta at Uo shall not exceed 0.004 and increment between 0.5 Uo and 2 Uo shall not be more than 0.002 as per relevant ISS
g	Partial discharge value	:	10 PC (max) at test voltage 1.73 Uo for Routine Test/Acceptance test & 5pc for Type Test.
20	Vol. Resistivity at 27 deg.C(ohm/Cm)	:	1X10 ¹⁴
21	Recommended minimum bending radius	:	15 x Over all dia. of cable
22	Derating factor for following ambient temperature in Air/Ground	:	
a	at 30 deg. C	:	
b	at 35 deg. C	:	
c	at 45 deg. C	:	
d	at 50 deg.C	:	
23	Cable Drums	:	
a	Standard Length of Cable/Drum(Mtrs)	:	250 /500 ±5%
b	Net weight of cable/Drum (kg)	:	
c	Dimension of Drum	:	
d	Shipping weight (Kg)	:	Generally as per IS: 10418-1982

24	Overall tolerance in total quantity	:	-1%
25	Safe pulling force (Kg.)	:	30 N/mm2 on conductor
26	Details of the protective measures against attack by white ante varmints etc. to be XLPE's outer sheath during manufacture		
27	Type of curing of XLPE insulations	:	Inert Gas (Nitrogen) curing through CCV Line
28	Cut ends of the Cable shall be sealed	:	Heat shrinkable and caps
29	Cable identification & sequential length marking	:	Cable identification by Embossing The following shall be embossed on the outer sheath of the cable throughout the length of cable at 1.0 meter spacing for identification: a) Manufacturer's Name or Trade Mark. b) Type of Cable / Cable Code c) Voltage Grade. d) Type of insulation & Material of conductor (XLPE, Armoured, PVC sheathed Aluminium Cable) e) Nominal x-section & and number of cores. f) Month & Year of manufacture. g) Inscription for length of cables at 1.0-meter interval on outer sheath by printing/ engraving. h) Name of the purchaser: WBSedCL i) Marking "Electric".
30	Marking on each drum	:	a) Drum identification No. b) Manufacturer's Name, Trade Name/Trade Mark, if any. c) IS reference i.e 7098 (part-II)/2011 d) Nominal sectional area of the conductor of the cable. e) No. of Cores. f) Type of Cable and Voltage Grade with Cable Code. g) Colour of outer sheath h) Length of the Cable in Cable Drum. i) Direction of rotation of Drum (by means of an arrow) j) Approximate Weight : Tare : Gross k) Month & Year of Manufacture. l) Purchase Order No. & date m) Month of Delivery n) Name of the Purchaser: WBSedCL

Signature with Designation & Seal
With Name of the Firm