

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

**TECHNICAL SPECIFICATION FOR 3 CORE  
XLPE ARMoured ALUMINUM CABLE SUITABLE  
FOR  
EFFECTIVELY EARTHED 11 KV SYSTEMS**

**JANUARY'2026**

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- 5.1 Monsoon prevails generally from the month of June to October with showers sometimes heavy, acidic, smoky, industrial and foggy.
- 5.5 Maximum Daily average ambient temp :: 40 degree C
- 5.6 Maximum relatively humidity :: 100.00%
- 5.7 Average rainfall per annum :: 200 cm
- 5.8 Maximum height above the Sea level :: 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) : Specification for cross-linked polyethylene Insulated PVC (2011) and its latest amendment Sheathed Cables for working Voltages from 3.3 KV up to and including 33 KV
- 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 3 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:

a) 6.35/11KV Grade:

Stranded compacted circular Aluminum (H4 Grade) Conductor, shielded with black extruded semi-conducting compound XLPE insulated, core shielded with black extruded semi-conducting compound, copper tape, coloured strips having Red, Yellow & Blue for core identification, shielded cores laid up with fillers, binder taped and **Black extruded PVC (Type ST-2) inner sheath**, single layer of galvanized **flat steel strip armoured** and **Blue extruded PVC (Type ST-2) overall sheathed**, conforming generally to IS:7098(Part-II) and its latest amendments.

7.02 Voltage Grade : 6.35/11KV (For 11 KV System)

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7.03 Size of Cable : 95 sq. mm.  
185 sq.mm.  
240 sq.mm.  
300 sq.mm.  
400 sq.mm.

7.04 Service Voltage : 11 KV

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

7.06	Permissible Maxm. Short Ckt. Current for conductors	<b>11K.V. System</b> 1)47.0 KA(895.47MVA) for 1 sec for 11 KV 500 sq.mm 2) 37.6 KA (716.37MVA) for 1 sec for 11 KV 400 sq mm 3)28.2K.A(537MVA)for 1Sec for 11KV 300 Sq mm 4)22.6 K.A(429MVA)for 1Sec for 11KV 240 Sq mm 5)17.39 K.A(331 MVA)for 1Sec for 11KV 185 Sq mm 6) 8.93 KA(170 MVA) for 1 sec. for 11 KV 95 Sq.mm.
	Short Ckt. Current - Single Phase to Earth	Combine Earth Fault Current of Screen & Armour (KA for 1 sec.) 1. 4.85 for 3C x 95 sq. mm. 2. 5.81 for 3C x 185 sq. mm. 3. 6.76 for 3C x 300 sq. mm. 4. 7.32 for 3C x 400 sq. mm. Considering <b>Cu tape width &amp; thickness as 50 and 0.06 mm (min)</b> respectively. Steel Strip Armour of Trapezium cross section with dimensions 4.0, 3.4 & 0.8 (distance between parallel sides) mm and 30,37,44 & 47 numbers of strip. It is indicative only, bidder shall design for type A armouring with E/F current. <b>However WBSEDCL also request the bidders to furnish their calculations of Earth Fault current for combined screen &amp; armour considering Cu tape thickness 0.06 mm (min) as mentioned in Cl. No. 7.12</b>

7.07	Maximum Permissible emergency overload temp. at 25% overload to 100 hrs. per year or 500 hrs. in life of Cable	: 130° C.
7.08	Maxm. Permissible short circuit Temperature	: 250° C
7.09	Conductor Material	: Material to IS: 8130, H4 Grade Aluminium Conductor, stranded compacted circular
7.10	Conductor screening	: Extruded, cross linked, semi-conducting compound of thickness <b>0.5 mm(nominal)</b> .
7.11	Insulation	: XLPE of thickness <b>3.6 mm. (Nominal)</b> for 11 KV.

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7.12	Insulation Screening :	::	Combination of black extruded semi-conducting compound of <b>thickness 0.3 mm (minimum)</b> as the non-metallic part and annealed copper <b>0.06 mm (minimum)</b> thick tape lapping as metallic part.
7.13	Inner Sheathing	:	<b>Black extruded PVC (Type ST-2) inner sheath</b> for 11 KV and thickness as per ISS.
7.14	Armouring	:	Single layer of galvanized flat steel strips for 11 KV (3 core) as per IS. Armour Coverage Percentage for cables shall be <b>minimum 90%</b> as per IS: 7098: (Part-2) 2011 with Amendment no. 1 March 2015.
7.15	Overall Sheathing	:	PVC Type ST-2 compound conforming to IS:5831, extruded for 11 KV ( <b>blue</b> ). Thickness shall be as per ISS.
7.16	Approx length of Cable in a Drum & tolerance in quantity.	:	250 meters with a tolerance of $\pm 5\%$ per drum for 3-Core. 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 <b>overall tolerance limit of the total delivered quantity</b> shall be <b>minus (-) 1%</b> against item wise purchase ordered quantity for each Purchase Order and the same shall be taken care of <b>while offering last lot of inspection.</b>
7.17	End Sealing	:	H.S. Caps (See Clause 8.11) (Heat Shrinkable)
7.18	Max. tan-delta at room temp., at nominal Phase to Neutral Voltage (U <sub>0</sub> )	:	0.004
	b) Maxm. Increment of tan-delta between 0.5 U <sub>0</sub> to 2 U <sub>0</sub> at room temp	:	0.002
7.19	Partial Discharge Value	:	10 pC (Max) at 1.73 U <sub>0</sub> for Routine/Acceptance Test and 5 pC (Max) at 1.73 U <sub>0</sub> for Type Test as per IS: 7098(II)/2011.
7.20	Impulse Tests	:	<b>75 KV for 11 KV</b> as per IS: 7098 (Part-II)/ 2011.
7.21	H.V. Tests between Conductors & Screen/Armour	:	<b>21 KV (rms)</b> for 11 KV for 5 minutes as per IS7098 (Part-II): 2011.
7.22	Maximum D.C Resistance of conductor per KM	:	As per relevant I.S.S

\* N.B. : The above parameters are applicable for 3-Core Cable, if not otherwise specified.

### 8.0 **CABLE CONSTRUCTION:**

8.1 XLPE Underground Cable is to be manufactured in continuous catenary process at controlled elevated temperature and pressure with use of suitable materials for XLPE main insulation with semi-conducting screen. The inner and outer semi-conducting sheaths and main polyethylene insulation between the sheaths are to be simultaneously extruded during the Triple Extrusion Process of manufacturing and main insulation of the Cable is to be extruded unfilled. 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.

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8.2 **CONDUCTOR SCREEING:**

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/steam cured satisfying the requirement of IS: 7098(Part-II).

8.4 **INSULATING SCREEN:**

The screen shall be made up as given in 7.12. 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. The copper tape shall be wrapped over the semi conducting tape or extrusion as mentioned earlier for 3 core cables. The metal screen so formed around the cores shall be in contact with one another as the cores are laid up at triangular configuration. For 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.

8.5 The mechanical and chemical properties of the materials for semi conducting screens are much more important than their electrical properties, but for obtaining the high overall degree of electrical properties of an E.H.V. cable, the inner and outer semi conducting screens and the main polyethylene insulation between the screens shall be simultaneously extruded during the manufacturing process known as "triple extrusion". The advantages are:

- 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.

8.6 **LAYING UP:**

The phase identification of the cores shall be by colour **strip** as per I.S.S. for 3 core cables only.

**Core Colour**

- Red
- Yellow
- Blue

The screened cores shall be laid up with interstices filled with PVC fillers and taped with a binder tape as to obtain a reasonably circular cable.

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9.0 **DRUMS:**

The Cable shall be packed in non-returnable wooden. Non-returnable Steel Drum may also be accepted in place of non-returnable Wooden Drum without implication of additional cost.

9.1 The following information shall be marked 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

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:**  $30 \text{ N/mm}^2$  (approx.  $3 \text{ kg/mm}^2$ ) for cable pulled by gripping the cable directly with pulling eye on Aluminium area and for cable pulled with stocking should be  $P=9D^2$  where P= Pulling force in Newton, D= Outer Diameter of Cable in MM.

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 Any 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.

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- iii) Hot set 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.
- II. 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 clause 7.21.  
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) Bending Test followed by P.D. Test.

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- i) 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.)
- j) Insulation resistance (VOLUME RESISTIVITY) 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 clause 7.21

**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 byproducts of cross-linking.
  - iv) Stress control etc.
- c) Cross section drawing of the cable.
- d) Cable current ratings for different types of installation inclusive of all derating factors due to ambient temperature, grouping etc.
- e) Over-Load characteristics of the cable without endangering the normal life and electrical quality of the insulation.
- f) Complete technical data of the cables.
- g) List of Customers to whom the Cable of similar rating have been supplied.
- h) Copy of Type Test Report carried out within last 5 years from the due date of opening of Tender on similar type of Cable in a NABL accredited/Govt. approved Test House or Laboratory is to be submitted along with the tender otherwise tender may be rejected.

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d	Extruded/Wrapped	:				
e	Approx. outside diameter	:				
12	Armouring	:				
a	Material	:	Galvanised Steel Strip	Galvanised Steel Strip	Galvanised Steel Strip	Galvanised Steel Strip
b	Size	:				
c	D.C. resistance at 20 deg.C (Ohm/Km.)	:				
d	Armour Coverage Percentage	:	90%(Min)	90%(Min)	90%(Min)	90%(Min)
13	Overall Sheath	:				
a	Material	:	PVC (Blue Colour)	PVC (Blue Colour)	PVC (Blue Colour)	PVC (Blue Colour)
b	Type	:	ST-2	ST-2	ST-2	ST-2
c	Thickness (mm.)	:				
d	Colour of Sheath	:				
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	:				
b	In duct at temp 30 deg.C	:				
c	In air at temp 40 deg.C	:				
16	Charging current attracted system voltage A/KM	:				
17	Short Circuit Current in KA (Maxm.)	:				
a	for 1 sec	:				
b	for 0.5 sec	:				
18	Combine Earth Fault Current for Screen and Armour in KA for 1 sec	:				
19	Electrical Parameters	:				
a	Maxm. D.C. resistance/km of conductor at 20 deg.C (Ohm/Km)	:				
b	conductor at 90 deg.C (approx.) (Ohm/Km)	:				
c	Reactance/kilometer (approx.) (Ohm/Km)	:				
d	Capacitance/Kilometer (approx.) (um/Km)	:				

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27	Details of the protective measures against attack by white ante varmints etc. to be XLPE's outer sheath during manufacture	:				
28	Type of curing of XLPE insulations	:	Inert Gas (Nitrogen)/Steam curing through CCV Line	Inert Gas (Nitrogen)/Steam curing through CCV Line	Inert Gas (Nitrogen)/Steam curing through CCV Line	Inert Gas (Nitrogen)/Steam curing through CCV Line
29	Cut ends of the Cable shall be sealed	:	Heat shrinkable and caps	Heat shrinkable and caps	Heat shrinkable and caps	Heat shrinkable and caps
30	Cable identification shall be made as per class 8.10 (Yes/No)	:				
31	Cable Drums shall be marked with the with the informations of Clauses 9.1 conspicuously (Yes/No)	:				
32	Embossing	:	Name of Manufacturer, ELECTRIC, WBSEDCL (Project Name- on Cable as well as on Drum), 11 KV XLPE Armoured Cable, Size, Cable Type, Month & Year of Manufacturing, Sequential length Marking by printing in each meter interval	Name of Manufacturer, ELECTRIC, WBSEDCL (Project Name- on Cable as well as on Drum), 11 KV XLPE Armoured Cable, Size, Cable Type, , Month & Year of Manufacturing, Sequential length Marking by printing in each meter interval	Name of Manufacturer, ELECTRIC, WBSEDCL (Project Name- on Cable as well as on Drum), 11 KV XLPE Armoured Cable, Size, Cable Type, , Month & Year of Manufacturing, Sequential length Marking by printing in each meter interval	Name of Manufacturer, ELECTRIC, WBSEDCL (Project Name- on Cable as well as on Drum), 11 KV XLPE Armoured Cable, Size, Cable Type, , Month & Year of Manufacturing, Sequential length Marking by printing in each meter interval
33	Drum Marking (Information shall be stencilled on each drum)	:	As per TS	As per TS	As per TS	As per TS

**Signature with Designation & Seal  
With Name of the Firm**

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