LT POWER AND CONTROL CABLE

March 2026

Engineering Department

WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED
পশ্চিমবঙ্গ রাজ্য বিদ্যুৎ সংবহন কোম্পানি লিমিটেড
(পশ্চিমবঙ্গ সরকারের একটি উদ্যোগ)

Regd. Office: Vidyut Bhawan, Block – DJ, Sector-II, Bidhannagar, Kolkata – 700091.

CIN: U40101WB2007SGC113474; Website: www.wbsetcl.in

Updates for WBSETCL/Tech. Spec./ Rev.4.1

Clause no.	Detail
4(d) & 5	"XLPE may be used for 240 mm^2 and above" insulation is added in **CRITERIA FOR SELECTION OF POWER AND CONTROL CABLES**
4(b)	This point added" XLPE insulated armoured power cables of 1.1 KV grade may be accepted for 240 mm^2 and above."
6(d)	This point is added "The PVC (XLPE may be used for 240 mm^2 and above) insulated 1100V grade power cables shall extruded [R4.1]. The thickness of insulation, tolerance on thickness of insulation and insulation resistance of the material shall conform to IS:7098 Part-I"
----	This point is removed from the heading "(OTHER THAN XLPE)
GUARANTEED TECHNICAL PARTICULARS OF POWER AND CONTROL CABLE	Added in GTP Insulation column "XLPE may be used for 240 mm^2 and above"

Updates for WBSETCL/Tech. Spec./ Rev.4.2

COMMUNICATION STRANDED CABLE	Follow Annex-1

TECHNICAL SPECIFICATION OF LT POWER AND CONTROL CABLES ~~(OTHER THAN XLPE)~~ [R4.1]

1. **SCOPE:**

This specification covers, design, manufacture, testing at manufacturer's works, supply and delivery of 1.1 KV grade PVC insulated armoured stranded power and control cables.

2. **STANDARD:**

The cables covered by this specification shall be designed, manufactured and tested in accordance with latest edition of Indian Standards as well as relevant IEC's.

Sl. No.	**Standards**	**Title**
i.	IS: 5831	PVC Insulation and sheath of electric cables.
ii.	IS: 3961 (Part 2)	Recommended current ratings for cables of PVC insulated and PVC sheathed heavy duty cable.
iii.	IS: 8130	Conductor for insulated electric cables and flexible cord.
iv.	IS: 3975	Mild steel wire, formed wires and tapes for armouring of cables.
v.	IS: 1554 (Part-I)	PVC Insulated (Heavy duty) electric cables.
vi.	IS: 10810	Methods of test for cables.
vii.	IS: 10418	Cable Drums for Electric Cables.

3. **DEVIATION:**

Normally the offer should be as per Technical Specification without any deviation. If any modification felt necessary to improve performance, efficiency and quality of equipment, the same must be mentioned in the 'Modification schedule' with reasons duly supported by documentary evidences and advantages. Such modifications suggested may or may not be accepted, but the same must be

submitted along with Pre-Bid Queries. The modifications not mentioned in Schedule will not be considered.

4. **CRITERIA FOR SELECTION OF POWER, CONTROL AND COMMUNICATION CABLES:**

a) PVC insulated armoured power cables of 1.1 KV grade shall be used for various applications in switchyard area/control room.

b) XLPE insulated armoured power cables of 1.1 KV grade may be accepted for 240 mm^2 and above. [R4.1]

c) For all control/protection/instrumentation purposes PVC insulated armoured control cables of minimum 2.5 sq.mm. size with **stranded copper conductor** shall be used.

d) AC input Cable to the Battery Charger shall be of PVC (XLPE may be used for 240 mm^2 and above) [R4.1] insulated, armoured, stranded Copper Cable. DC output Cables from the Charger as well as from the battery shall be of PVC (XLPE may be used for 240 mm^2 and above) [R4.1] insulated, armoured, stranded Copper Cable.

e) All connections for D.C. Circuit to control and relay panel shall be made with not less than 2.5 sq. mm. copper control cable.

f) All connections of CT, PT & CVT circuits to control and relay panel shall be made with not less than 4 sq. mm. copper control cable.

g) Separate cable shall be used for AC and DC.

h) **Separate cable shall be used for DC-1 and DC-2.**

i) **Cables used for annunciator input circuit shall be completely separate from other cables.**

j) **Separate cable shall be used for each transducer output.**

k) **For different cores of CT and PT separate cables shall be used.**

l) However, if required from voltage/VA burden consideration additional cores or higher size shall be used.

m) Sizing of power cables shall be done keeping in view continuous current, voltage drop and short circuit current consideration. Relevant calculation shall be submitted along with Guaranteed Technical Particulars for approval of WBSETCL.

n) At least one (1) core shall be kept as spare in each copper control cable of 4C, 5C or 7C size, whereas minimum no. of spare cores shall be two (2) for control cables of 10 core or higher size (maximum 19 core can be used).

o) **For up to 5C cable, cores shall be color coded and identified as per IS:1554(Part-I).**

p) **Cable with more than 5C, the color should be grey and identification of cores shall be by printing legible Hindu Arabic Numerals (Black printing) as per clause no .10.3 of IS:1554(Part-I) and its amendments.**

q) **FOR COMMUNICATION STRANDED CABLE THE FOLLOW ANNEX -1 : - R[4.2]**

5. TECHNICAL REQUIREMENTS / DESIGN CRITERIA:

The Cables will be used for control protection and instrumentation, auxiliary Power Supply connections of the various equipment and various applications in substation etc. All such purposes PVC insulated armoured cable with stranded conductor shall be used.

The material of PVC (XLPE may be used for 240 mm^2 and above) [R4.1] insulated Al conductor to be used for 1.1KV Power Cable shall consists of plain annealed aluminum of high conductivity H2 grade (Tensile strength above 100 and up to and including 150 N/mm^2).

The material of PVC insulated copper conductor shall be made from high conductivity copper rods complying with IS: 613and its amendments. The conductors shall consist of tinned annealed copper.

Wire before stranding shall be approximately circular in cross section, smooth, uniform in quality and free from scale, spills, splits and other defects. The conductor shall be clean; reasonably uniform in size, shape and its surface shall be free from sharp edges. Manufacturer should ensure that not more than two joints are provided in any one of the single wires forming every complete length of conductor and no joints shall be within 330 mm. of any other joints in the same layer. Joints shall be brazed, silver soldered or electric or gas welded. No joints shall be made in the conductor after it has been stranded.

For Control cable, the nominal cross-sectional area of the conductor portion of the cable after stranding shall be 2.5 sq mm or 4 sq mm as the case may be.

Cables shall be suitable for laying in racks, ducts, trenches and underground.

Cables shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operating condition.

The normal current rating of all PVC insulated cables shall be as per IS: 3961.

The Cable will be laid in ground or on ladder type trays or drawn in conduit in a hot, humid and tropical atmosphere. The trays may be over head, suspended or run in concrete trenches with removable covers. The tenderer shall indicate clearly the de rating factor for the above conditions.

6. INSULATION:

The insulation of sheath shall consist of a compound based on one of the followings.

(a) Polyvinyl Chloride (PVC).

(b) Suitable co-polymers of which the major constituent shall be Vinyl Chloride.

(c) The PVC insulated 1100V grade control cables shall extruded PVC to Type-C of IS:5831. The thickness of insulation, tolerance on thickness of insulation and insulation resistance of the material shall conform to IS:1554 Part-I.

(d) The PVC (XLPE may be used for 240 mm^2 and above) insulated 1100V grade power cables shall extruded [R4.1]. The thickness of insulation, tolerance on thickness of insulation and insulation resistance of the material shall conform to IS:7098 Part-I [R4.1]

7. OUTER SHEATH:

An outer sheath shall be provided over armouring. The outer sheath shall be applied by extrusion. The outer sheath shall be so applied that it fits closely over armouring.

The outer sheath shall be of Type ST2, PVC compounds conforming to IS: 5831. Outer sheath shall be **Fire retardant type (FR), Low Smoke type (LS).** Minimum thickness of PVC outer sheath, Standard Colour and tolerance on thickness of armoured cables shall conform to Clause 14.4.2 of IS:1554 (Part-I).

8. INNER SHEATH:

For multi core armoured cables, the inner sheath shall be of extruded PVC. The inner sheath for common covering shall be of non-hygroscopes, **FR-LS** type ST2 material and shall be softer than insulation.

The inner sheath shall be so applied that fits closely on the laid-up cores. Thickness of the inner sheath shall conform to Clause 12.3 of IS: 1554 (Part-I).

9. ARMOURING:

Armouring shall be applied over the inner sheath in case of multi core cables. The armour shall be galvanized round steel wires for cable with calculated diameter less than 13 mm under armour. And for other cables both round wire and strips are acceptable. Nominal diameter of steel wires shall conform to Clause No.13.3 of IS:1554(Part-I).

10. GUARANTEE:

Electrical characteristics shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, WBSETCL shall have right to reject the material. Guaranteed Technical Particulars are to be submitted during detailed engineering along with all drawings/documents.

11. CONTRACT DRAWINGS, MANUALS AND GTP:

The contractor shall submit GTP for all type and sizes of cables, drawings and manuals in for approval.

After approval four (4) sets of approved GTP, operating and maintenance manual including instruction manual both in hard and soft copy for each sub-station shall be submitted by the Contractor for our record and distribution to site.

12. TESTS AT MANUFACTURER'S WORKS AND TEST CERTIFICATES:

(i) Each type and size of cable shall comply with the requirements of routine test as per relevant Indian Standard.

(ii) All routine and Acceptance tests shall be carried out at the manufacturer's works on every lot of offered different type and sizes of cables as per relevant Indian Standards. Selection of samples for acceptance test as well as rejection and retesting shall be guided by relevant IS. The entire cost of acceptance and routine tests that are to be carried out as per relevant IS shall be treated as included in quoted price of control and power cable. Routine test reports shall be submitted before inspection. The contractor shall give advance notice intimating the actual date of inspection and details of all tests that are to be carried out.

13. TEST REPORTS AND TYPE TESTS:

Only type tested Power & Control Cables are to be offered conforming to our technical specification, and relevant IS and IEC. Power & Control Cables offered should be similar with ones on which type testing has been carried out as per relevant IS and IEC. Complete type test reports carried out in Govt. recognized Test House or Laboratory /NABL accredited laboratory shall have to be submitted.

13. PACKING AND MARKING

The Cables shall be wound on a drum (Ref. IS: 10418 latest amendment) of suitable size and packed. The ends of cable shall be sealed by means of non-hygroscopic sealing material. The Cables shall be packed in non-returnable wooden drums. The wooden drums should be bearing distinguishing number with following information duly stencilled on the outer side of one flange.

1. Name of the Manufacturer.
2. Reference Indian Standard of Cable.
3. Normal sectional area of the Conductor of the Cable.
4. Number of Cores.
5. Type of Cable & Voltage for which it is suitable.
6. Length of Cable in this drum.
7. Direction of rotation of Drum (by means of arrow).
8. Gross Weight.
9. Colour code (in case of single core cable).
10. Purchase Order No. & Date.
11. Year of Manufacture.
12. Property of WBSETCL.

Embossing on the outer sheath of the Cable with marking "WBSETCL" and length of the Cable in meters at suitable intermittent distance should be done.

GUARANTEED TECHNICAL PARTICULARS OF POWER AND CONTROL CABLE

(To be filled in and signed by the Bidder)

1	**Rated Voltage**	1.1KV
2	**Standard Referred**	
3	**Conductor**	
	i) Material	
	ii) Nominal Area of Cross-section (sq. mm)	
	iii) Total no. of Conductor/ Core	
	iv) Shape of conductor	
4	**Insulation**	
	i) Material	HR PVC Type C (XLPE may be used for 240 mm^2 and above) [R4.1]
	ii) Nom. Thickness (mm)	
	iii) Suitable by with regard to temperature, moisture, acid, oil and alkaline surrounding	
5	**Inner sheath**	
	i) Material	FRLS, HR PVC Type ST-2
	ii) Minimum thickness of sheath (mm)	
6	**Armouring**	
	a) Material & Type	
	b) Nom. dia of armour wires in mm	
7	**Outer sheath**	
	i) Material	FR LS. Black HR PVC ST-2
	ii) Minimum thickness of sheath (mm)	
8	**Approx. overall dia of cable (in mm)**	
9	**Method of core identification**	
10	**Electrical Properties: -**	
	i) Maximum D.C. resistance of conductor at 20º C (Ohm/Km)	
	ii) Maximum permissible conductor temperature(°C) under full load	
	iii) Rated voltage (KV)	
	iv) Maximum operating voltage	
	v) Permissible voltage variation	
	vi) Rated frequency	
	vii) Permitted frequency variation	
	viii) Minimum voltage resistivity at 27ºC/ 85ºC (Ohm/Cm)	

Annex-1
(COMMUNICATION STRANDED CABLE)

1) Twisted Pair cable: (for outdoor applications)

Shielded (screened) cables shall be used for external Cabling from the RTU/ SIC and SAS panels. Cables shall be suitable for laying in racks, ducts, trenches and underground. Multi core armoured cables with the inner sheath and outer sheath over armouring are to be used. The inner sheath, armouring and outer sheath shall be as per relevant IS/IEC standard.

Technical Particulars of external cables (from transducer at switchyard to indoor panels)

Sl no.	Description	Value
3	Core cross-section for Digital Status Inputs and transducer current	1.5 mm^2
4	Materials	Electrolyte grade standard tinned annealed copper class 2 as per IS 8130-2013 latest
5	Minimum number of conductor cores	As per IS/IEC
6	**Individual Screening**	
6.1	Shielding	Aluminium Backed Mylar tape
6.2	Shielding: Min. Overlapping/coverage	20% overlap and 100% coverage with drain wire of annealed copper
7	**Overall Screening**	
7.1	Shielding	Aluminium Backed Mylar tape
7.2	Shielding: Min. Overlapping/coverage	20% overlap and 100% coverage with drain wire of annealed copper
8	No of pair	8 (if not specified)
9	Insulation	1.1KV PVC as per type-C of IS 5831
10	Inner Sheath	Extruded PVC as per IS 1554
11	Armouring	Galvanized round steel wires as per CL.13.3 of IS 1554 (Part-1)
12	Outer Sheath	As per cl. 14.4.2 of IS 1554 (Part-1)
13	DC resistance at 20^0C	As per IS 8130
14	Oxygen Index	29
15	Temperature index	not less than 250
13	Dielectric withstand	3 kV (rms) at 50 Hz for 5 minutes
16	External Marking	Manufacture's name, type, core quantity, cross- section, and year of manufacture are to be marked

2) Twisted Pair cable: (for indoor applications)

The cable shall be used for transferring analog values from Multi Finctional Transducers (MFT) to Remote Terminal Unit (RTU) .The twisted pair cables to be used for this purpose shall be suitable for being laid directly to the ground or in trenches or in ducts, however; cable is to be laid through HDPE duct pipe. The quantity of HDPE pipe required for this purpose is to be provided by the contractor along with the cable.. Only Shielded cable are to be used. The capacitance of the cable shall be low so as to minimize attenuation at the desired frequency range.

Technical Particulars of Twisted Pair cable:

Sl no.	Description	Value
1	Reference Standard	IS 1554, IS 5831 , IS 8130
2	Materials	Stranded tinned annealed copper of electrolyte grade class-2 of non compacted circular shape

3	Minimum number of conductor cores	As per IS/IEC
4	Nominal cross Sectional Area	0.22 sq.mm
5	Insulation	HDPE
6	Shielding	Aluminium Backed Mylar tape
7	Shielding: Minimum Overlapping/coverage	20% overlap and 100% coverage with drain wire of annealed copper
8	Outer Sheath	Extruded PVC as per type-C of IS 5831
9	Nominal Thickness of outer Sheath	1.8 mm
10	Oxygen Index	29
11	Temperature index	not less than 250
12	Dielectric withstand	3 kV (rms) at 50 Hz for 5 minutes
13	External Marking	Manufacture's name, type, pair quantity, cross-section, and year of manufacture are to be marked

3) LAN Cable :

The cable shall be used for effective data communication by transferring data/ information from Ethernet Port of Remote Terminal Unit (RTU). The cables to be used for this purpose shall be suitable for being laid directly to the ground or in trenches or in ducts, however; cable is to be laid through HDPE duct pipe. The quantity of HDPE pipe required for this purpose is to be provided by the contractor along with the cable. Only Shielded cable are to be used. The capacitance of the cable shall be low so as to minimize attenuation at the desired frequency range.

Technical Particulars of LAN cable (Balanced) :

Sl no.	Description	Value
1	Materials	Annealed tinned Bare copper
2	No. of Strand	1
3	Nominal dia of conductor	0.54mm -0.58mm
4	Nominal cross Sectional Area	0.22 sq.mm
5	Insulation	HDPE
6	No. of twisted Pairs	4
7	Return Loss (RL)	≥ 20 dB (1–250 MHz)
8	NEXT (Near-End Crosstalk)	≥ 35 dB @ 100 MHz
9	PSNEXT	≥ 32 dB @ 100 MHz
10	Shielding	Aluminium Backed Mylar tape
11	Shielding: Minimum Overlapping/coverage	20% overlap and 100% coverage with drain wire of annealed copper
12	Outer Sheath	Extruded PVC as per type-C of IS 5831
13	Nominal Thickness of outer Sheath	1.8 mm
14	Oxygen Index	29
15	Temperature index	not less than 250
16	Dielectric withstand	3 kV (rms) at 50 Hz for 5 minutes
17	Minimum Distance coverage	100mtr
18	Operating Temperature	-20°C to +75°C
19	UV resistant	Yes
20	Charecterstic Impedance	120Ω
	External Marking	Manufacture's name, type, pair quantity, cross-section, and year of manufacture are to be marked

4) 75 Ω High Frequency Cable

High frequency cable shall be offered to connect Teleprotection coupler with Fiber Optic Terminal Equipment (FOTE). The high frequency cable to be offered by the bidders shall be suitable for being laid directly to the ground or in trenches or in ducts. cable is to be laid through HDPE duct pipe. The quantity of HDPE pipe required for this purpose is to be provided by the contractor along with the cable. Only Shielded cable are to be used. The capacitance

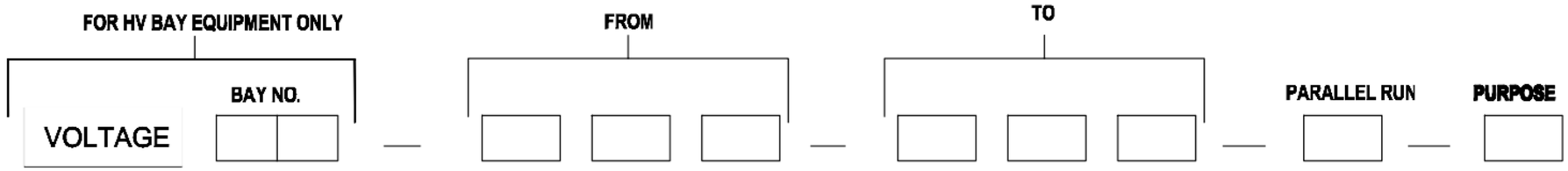
of the cable shall be low so as to minimize attenuation at the desired frequency range. The impedance of the cable shall be so as to match with the output impedance of the Teleprotection coupler and E1 port impedance of Fiber Optic Terminal Equipment (FOTE).

Technical Particulars of 75 Ω High Frequency Cable (unbalanced):

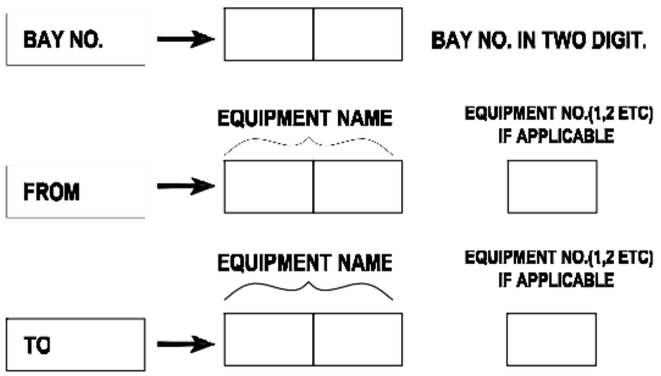
Sl no.	Description	Value
1	Materials	Bare copper
2	No. of Strand	1
3	Nominal dia of conductor	1.22mm ±0.03
4	Die Electric Core	Solid Polyethelene
	Inner conductor	Single braid, 0'20 mm tinned copper wire Minimum coverage : 90%
5	Insulation	Foam HDPE
6	Outer Shield	Al. Alloy of 0.1 mm dia with minimum 60% coverage
7	Outer Sheath	Extruded PVC with minimum thickness 0.7 mm
8	Charecterstic Impedance	75Ω ± 3
9	Capacitance (pf/mtr)	53± 3
10	Max conductor resistance at 20°C (ohm/km)	16
11	Operating Temperature	-15°C to +85°C
12	Attenuation at 20°C (dB/100mtr)	29.5 at 1GHz
13	Insulation Resistance	10000MΩ/Km min
14	Dielectric Strength	4.5KV rms
15	Minimum Distance coverage	100mtr
16	External Marking	Manufacture's name, type, quantity, cross-section, and year of manufacture are to be marked

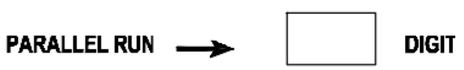
***All cables must be armoured if otherwise not specified in the BOQ.**

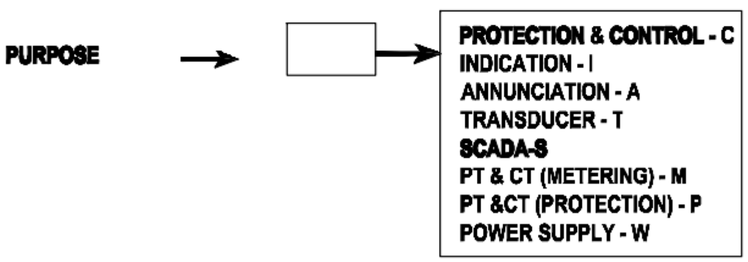
CABLE IDENTIFICATION TAG



VOLTAGE →			
	0 → 11 KV	1 → 132 KV	4 → 400 KV
	3 → 33 KV	2 → 220 KV	5 → OTHER







EQUIPMENT NAME

PP → PROTECTION PANEL
CP → CONTROL PANEL
RP → RELAY PANEL
BM → BAY MARSHALLING KIOSK
TM → TRANSFORMER MARSHALLING KIOSK
DM → TRANSFORMER DRIVE MECHANISM
RT → REMOTE TAP CHANGING CUBICALE
CT → CT JUNCTION BOX
PT → PT JUNCTION BOX
CB → CIRCUIT BREAKER
ST → STATION SERVICE TRANSFORMER
ET → EARTHING TRANSFOROMER
AD → AC DISTRIBUTION BOX
DD → DC DISTRIBUTION BOX
BI → MAIN BUS ISOLATOR
LI → LINE ISOLATOR
TI → TRANSFER BUS ISOLATOR
1B → 110V BATTERY
2B → 220V BATTERY
4B → 48V BATTERY
1C → 110V CHARGER
2C → 220V CHARGER
4C → 48V CHARGER
LC → LCC FOR GIS
SW → INDOOR SWITCHGEAR
IS → INDOOR SUB-ACDB/MLDB
OS → OUTDOOR SUB-DB
XX → OTHER

FERRULE NUMBERING SCHEME :-

1. **ALL WIRES, IF CONNECTED TO CRP WILL HAVE WIRE / FERRULE NOS. OF CRP TERMINAL AT BOTH ENDS THEY WILLL HAVE THE TB NOS. OF RESPECTIVE ENDS WHERE THEY WILL BE CONNECTED TO.**

2. **FOR OTHER WIRES LIKE BMK ETC, WIRE / FERRULE NOS. OF MAIN EQUIPMENT WILLL BE AT BOTH END APART FROM TB NOS. OF RESPEVTIVE END.**





