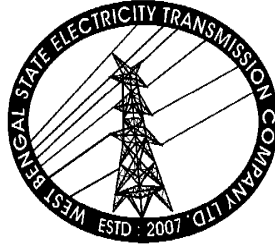


# POWER AND CONTROL CABLE

---



**March 2015**

*Engineering Department*

**WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED**

পশ্চিমবঙ্গ রাজ্য বিদ্যুৎ সংবহন কোম্পানি লিমিটেড  
( পশ্চিমবঙ্গ সরকারের একটি উদ্যোগ )

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

CIN: U40101WB2007SGC113474; Website: [www.wbsetcl.in](http://www.wbsetcl.in)

**TECHNICAL SPECIFICATION OF POWER AND CONTROL CABLES  
(OTHER THAN XLPE)**

**1. SCOPE :**

This specification covers, design, manufacture, testing at manufacturer's works, supply, delivery of 1.1KV grade PVC insulated armoured stranded power and control cables as specified in quantity schedule to be used at new 400/220/132/33KV, 220/132/33KV, 132/33KV sub-station as well as existing 400KV, 220KV & 132KV S/stn..

**2. STANDARD :**

The cables covered by this specification shall be designed, manufactured and tested in accordance with following 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 : 1885	Electric Cables.
v.	IS : 3975	Mild steel wire, formed wires and tapes for armouring of cables.
vi.	IS : 1554 (Part-I)	PVC Insulated (Heavy duty) electric cables.
vii.	IS : 10810	Methods of test for cables.
viii.	IS : 7098(Part-II)	Specification for cross-linked polyethylene insulated PVC sheathed cables for working voltages from 3.3KV to and including 33KV.
ix.	IS : 10418	Cable Drums for Electric Cables.

**3. I) DEVIATION :**

Normally the offer should be as per Technical Specification without any deviation.

**II) MODIFICATION :**

If any modification felt necessary to improve performance, efficiency and utility 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 AND CONTROL CABLES :**

- a) Aluminium Conductor PVC insulated armoured power cables of 1.1 KV grade shall be used for various applications in switchyard area/control room.
- b) 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.
- c) AC input Cable to the Battery Charger shall be of PVC insulated, armoured, stranded Copper Cable. DC output Cables from the Charger as well as from the battery shall be of PVC insulated, armoured, stranded Copper Cable.
- d) All connections for PT and D.C. Circuit to control and relay panel shall be made with not less than 2.5 sq. mm. copper control cable.
- e) All connections of CT circuits to control and relay panel shall be made with not less than 4 sq. mm. copper control cable.
- f) Separate cable shall be used for AC and DC.
- g) For different cores of CT and PT separate cables shall be used.
- h) However, if required from voltage/VA burden consideration additional cores or higher size shall be used.
- i) Sizing of power cables shall be done keeping in view continuous current, voltage drop and short circuit current consideration. Relevant calculation shall be submitted by the successful bidder along with submission of Guaranteed Technical Particulars for approval of WBSETCL. Cable size shall be such that the voltage drop between the current consuming devices and supply distribution board shall not exceed 3% of supply voltage.
- j) 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). However for control cable to be used in CT circuits shall be colour coded.

## **5. TECHNICAL REQUIREMENTS / DESIGN CRITERIA :**

The material of PVC insulated Al conductor to be used for 1.1KV Power Cable shall consist of plain annealed aluminium of high conductivity H2 grade (Tensile strength above 100 and up to and including 150 N/mm<sup>2</sup>).

### **The material of PVC insulated copper conductor shall be made from high conductivity copper rods complying with IS: 613**

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.

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.

## **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 power and control cables shall be suitable for a maximum rated conductor temperature of 70<sup>0</sup>C. The Insulation shall be extruded PVC to Type-A 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.

## **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 STI, PVC compounds conforming to IS: 5831. Outer sheath shall be Fire retardant type FR, CI. 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-hygroscopic, fire retardant 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 galvanised round steel wires.

Nominal diameter of round 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 by successful bidder during detailed engineering along with submitted drawings/documents. However format for submission of GTP shall be handed over to intending bidders at the time of sale of tender documents.

## **11. CONTRACT DRAWINGS, MANUALS AND GTP :**

In the event of placement of Letter of Award, contractor shall submit GTP for all type and sizes of cables, drawings and manuals in six copies to the Chief Engineer, Engg. Deptt., WBSETCL, VidyutBhawan (9<sup>th</sup> floor), Kolkata – 700 091 for approval.

After approval ten (10) sets of approved GTP, operating and maintenance manual including instruction manual 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. Three (3) copies of test reports shall be submitted to the Chief Engineer, Engg. Deptt., WBSETCL, VidyutBhawan (9<sup>th</sup> floor), Kolkata – 700 091 for approval and distribution to site. The contractor shall give at least 15 (fifteen) days advance notice to the Chief Engineer, Engg. Deptt. 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. Three sets of complete type test reports carried out in Govt. recognized Test House or Laboratory /NABL accredited laboratory shall have to be submitted by successful bidder positively along with submission of drawings during detailed Engineering. The submitted type test report shall prove that the type test have been carried out within five years from the date of submission of bid. Successful bidder may require to produce original copies of type test reports at the time of detail Engineering if asked by WBSETCL.

Each type test report shall comply the following information with test result

- i) Complete identification, date and serial no.
- ii) Method of application ,Where applied , duration and interpretation of each test

## **GUARANTEED TECHNICAL PARTICULARS OF POWER AND CONTROL CABLE**

*(To be filled in and signed by the Bidder)*

### **A. POWER CABLE 1.1 KV GRADE**

1	<b>General</b>	
1.01	Name and address of the Manufacturer	
1.02	Location of factory	
1.03	Cable Type :	
1.04	Type and size of cable	
1.05	Standard applicable	
1.06	Voltage rating	
1.07	Conductor and its Hardness	
1.08	Material copper/aluminium (indicating grade)	
1.09	Nominal cross sectional area	
1.10	Form of conductor - circular/shaped	
1.11	Minimum No. of strands	
1.12	Nominal dia. of each strand	
1.13	Whether strands are tinned or not	
1.14	Temperature co-efficient of resistance at 20oC per Oc	
2	<b>Mechanical Data</b>	
2.01	Overall dia of the cable	
2.02	Dia of the cable under the sheath	
2.03	Diameter over the stranded cores	
2.04	Weight of cable per Km.	
2.05	Total volume of non-metallic material cm <sup>3</sup> /m	

2.06	Total weight of non-metallic material in Kg/m	
2.07	Drum length	
2.08	Tolerance on drum length	
2.09	Total weight of the drum	
2.1	Dimensions of the drum	
2.11	Recommended minimum installation radius	
2.12	Maximum safe pulling force	
3	<b>Insulation :</b>	
3.01	Material (mention type)	
3.02	Minimum average thickness	
3.03	Tolerance on the smallest of the measured values of thickness of insulation	
3.04	Dia. of core over insulation	
3.05	Min.volume resistivity at 27°C	
3.06	Min.volume resistivity at 70°C	
3.07	Colour scheme of identification of cores:	
3.08	Average dielectric strength	
4	<b>Inner Sheath</b>	
4.01	Material (mention type of sheathing and type designation as per IS:5831)	
4.02	Whether extruded	
4.03	Minimum thickness of inner sheath and tolerance on measured value	
4.04	Calculated diameter over stranded cores of the cables	
4.05	Whether the inner sheath and the filling material are suitable for the operating temperature of the cable	



5	<b>Outer Sheath / Overall Covering</b>	
5.01	Material (mention type of sheathing and type designation as per IS:5831)	
5.02	Whether extruded (Yes / No)	
5.03	Minimum average thickness	
5.04	Tolerance on the smallest of the measured values of thickness of outer sheath	
5.05	Calculated dia under sheath	
5.06	Whether anti-termite treatment has been given in the outer sheath	
<b>6</b>	<b>Electrical Properties</b>	
6.01	Maximum DC conductor resistance at 20°C	
6.02	Maximum permissible conductor temperature	
6.03	Under continuous full load	
6.04	Under transient conditions	
6.05	Loss tangent at normal frequency	
6.06	Reactance at 50 C/S per Km at 50°C	
6.07	Capacitance at 50 C/S per Km.	
7	<b>Current rating</b>	
7.01	In air (continuous)	
7.02	Reference ambient temperature for the above	
7.03	Short circuit current rating for 1 sec. duration	
7.04	Derating factor for an ambient temperature of 50°C	

**B. CONTROL CABLE**

1	Name of manufacturer and location of factory	
2	Standards to which conform	
3	Type and size of cables	
4	Voltage Rating	
5	Thickness of insulation (mm)	
6	No. of cores	
7	Thickness of inner sheath (mm)	
8	Material for inner sheath	
9	Thickness of outer sheath (mm)	
10	Material for outer sheath	
11	Overall dia. of cable (mm)	
12	Armour	
13	Material	
14	Shape	
15	Dimension	
16	No. of strands and wire dia.	
17	Cross-section of the conductor (sq.mm)	
18	Maximum continuous current (amps.)	
19	In ground at 32°C	
20	In duct	
21	In air/trench at 40°C	
22	Maximum short circuit current (amps.)	
23	Conductor resistance at 20°C	
24	Approx. net weight per 100 m. length (Kg)	
25	Standard drum length (m)	