

CHAPTER 16.3

TECHNICAL SPECIFICATION FOR LT CONTROL CABLES

1.00.00 **CODES & STANDARDS**

1.01.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

- | | |
|------------------|--|
| IS :1554 | PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V. |
| IS : 3961 | Recommended current ratings for cables |
| IS : 3975 | Low carbon galvanised steel wires, formed wires and tapes for armouring of cables. |
| IS : 5831 | PVC insulation and sheath of electrical cables. |
| IS : 8130 | Conductors for insulated electrical cables and flexible cords. |
| IS : 10418 | Specification for drums for electric cables. |
| IS : 10810 | Methods of tests for cables. |
| ASTM-D -2843 | Standard test method for density of smoke from the burning or decomposition of plastics. |
| IEC-754 (Part-I) | Tests on gases evolved during combustion of electric cables. |
| IEC-332 | Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B). |

2.00.00 **TECHNICAL REQUIREMENTS**

2.01.00 The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.

2.02.00 All cables including EPR cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop

under steady state and transient operating conditions as specified elsewhere in this specification.

- 2.03.00 Conductor of control cables shall be made of stranded, plain annealed copper.
- 2.04.00 PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.
- 2.05.00 The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS: 5831.
- 2.06.00 For multicore armoured cables, the armouring shall be of galvanised steel as follows:

Calculated nominal dia of cable under armour	Size and Type of armour
Upto 13 mm	1.4mm dia GS wire
Above 13 upto 25 mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
Above 25 upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
Above 40 upto 55mm	1.4 mm thick GS formed wire/2.5mm dia GS wire
Above 55 upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire
Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire

The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface.

- 2.07.00 Outer sheath shall be of PVC as per IS: 5831 and grey in colour. In addition to meeting all the requirements of Indian Standards referred to, outer sheath of all the cables shall have the following FRLS properties.

- (a.) Oxygen index of min. 29. (As per IS 10810 Part-58)
- (b.) Acid gas emission of max. 20% (As per IEC-754-I)

- (c.) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTM D-2843.

2.08.00 Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted.

1 core - Red, Black, Yellow or Blue

2 core - Red & Black

3 core - Red, Yellow & Blue

4 core - Red, Yellow, Blue and Black

5 core - Red, Yellow, Blue, Black and Grey

2.09.00 For cables having more than 5 cores, core identification shall be done by numbering the insulation of cores sequentially, starting by number 1 in the inner layer (e.g. say for 10 core cable, core numbering shall be from 1 to 10). The number shall be printed in Hindu- Arabic numerals on the outer surfaces of the cores. All the numbers shall be of the same colour, which shall contrast with the colour of insulation. The colour of insulation for all the cores shall be grey only. The numerals shall be legible and indelible. The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed underneath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecutive numbers shall not exceed 50 mm.

2.10.00 In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath:

- (a.) Cable size and voltage grade - To be embossed
- (b.) Word 'FRLS' at every 5 metre - To be embossed
- (c.) Sequential marking of length of the cable in metres at every one metre - To be embossed / printed.

The embossing / printing shall be progressive, automatic, in line and marking shall be legible and indelible. For EPR cables identification shall be printed on outer sheath.

2.11.00 All cables shall meet the fire resistance requirement as per Category-B of IEC-332 Part-3.

2.12.00 Allowable tolerances on the overall diameter of the cables shall be ± 2 mm maximum over the declared value in the technical data sheets.

2.13.00 In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.

2.14.00 Cable selection & sizing

Control cables shall be sized based on the following considerations:

(a) The minimum conductor cross-section shall be 1.5 sq.mm.

(b) The minimum number of spare cores in control cables shall be as follows:

No. of cores in cable	Min. No. of spare cores
2C, 3C	NIL
5C	1
7C-12C	2
14C & above	3

2.14.01 Cable lengths shall be considered in such a way that straight through cable joints are avoided.

2.14.02 Cables shall be armoured type if laid in switchyard area, CHP area or directly buried.

3.00.00

CONSTRUCTIONAL FEATURES

3.01.00

1.1 KV Grade Control Cables shall have stranded copper conductor and shall be multicore PVC insulated, PVC inner sheathed, armoured / unarmoured, FRLS PVC outer sheathed conforming to IS: 1554. (Part-I).

3.02.00

1.1 KV grade Trailing cables shall have tinned copper(class 5)conductor, insulated with heat resistant elastomeric compound based on Ethylene Propylene Rubber(EPR) suitable for withstanding 90 deg.C continuous conductor temperature and 250deg C during short circuit, inner-sheathed with heat resistant elastomeric compound, nylon cord reinforced, outersheathed with heat resistant,

oil resistant and flame retardant heavy duty elastomeric compound conforming to IS 9968. Minimum conductor size shall be 2.5 sqmm.

4.00.00

CABLE DRUMS

- (a.) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.
- (b.) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stenciled on both the sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.
- (c.) The standard drum length for control cables shall not be less than 1000 metres. The length per drum shall be subjected to a maximum tolerance of $\pm 5\%$ of the standard drum length. The Owner shall have the option of rejecting cable drums with shorter lengths.

5.00.00

TESTS

All equipments to be supplied shall be of type tested design. During detailed engineering, the bidder shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

However if the bidder is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the bidder shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval.

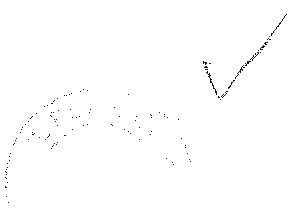
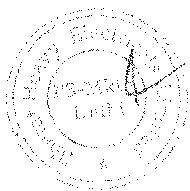
All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NSPCL, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

5.01.00 TYPE TESTS

5.01.01 The reports for the following type tests shall be submitted for one size of control cables. Size shall be decided by the owner during detailed engineering

S. No.	Type Test	Remarks
	For Conductor	
1.	Resistance test	
	For Armour Wires / Formed Wires (If applicable)	
2.	Measurement of Dimensions	
3.	Tensile Test	
4.	Elongation test	
5.	Torsion test	For round wire only
6.	Wrapping test	For aluminium wires / formed wires only.
7.	Resistance test	
8(a).	Mass of zinc Coating test	For GS wires/formed wires only
8(b).	Uniformity of zinc coating	For GS wires/formed wires only
9.	Adhesion test	For GS wires/formed wires only
	For PVC insulation & PVC Sheath	
10.	Test for thickness	
11.	Tensile strength and elongation test before ageing and after ageing	
12.	Ageing in air oven	
13.	Loss of mass test	For PVC insulation and sheath only
14.	Hot deformation test	For PVC insulation and sheath only
15.	Heat shock test	For PVC insulation and sheath only



16.	Shrinkage test	
17.	Thermal stability test	For PVC insulation and sheath only
18.	Oxygen index test	For outer sheath only
19.	Smoke density test	For outer sheath only
20.	Acid gas generation test	For outer sheath only
	For completed cables	
21.	Insulation resistance test (Volume resistivity method)	
22.	High voltage test	
23.	Flammability test as per IEC-332 Part-3 (Category-B)	

5.02.00

Indicative list of tests/checks, Routine and Acceptance tests shall be as per Quality Assurance & Inspection table of Control Cables enclosed.