TITLE : TECHNICAL SPECIFICATION FOR BOUGHT OUT ITEMS FOR ESP

ITEM : POWER AND CONTROL CABLES.

CUSTOMER : NATIONAL THERMAL POWER CORPORATION LTD (NTPC)

	NAME	DESIGNATION	SIGNATURE	DATE
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ISSUED BY

EDC – ECI

REVISION NO: 01 - XLPE SPECIFICATION ADDED **INITIAL RELEASE: 09.03.2009**

1.0.0 **SCOPE:**

1.1.0 The scope of supply of cables includes, design, manufacture, inspection, testing, packing and delivery.

2.0.0 **APPLICATION:**

2.1.0 The cables to be supplied under this specification are intended to be used for the interconnection of various electrical equipments of Electrostatic Precipitator (ESP), such as Transformer Rectifier, Electronic Controller, Auxiliary Control panel, Rapping Motors, Heaters etc.

3.0.0 **APPLICABLE STANDARDS**

3.1.0 The cable shall be manufactured, tested and packed as per the following standards (latest issues and their amendments if any). In case of any conflict between these standards and this technical specification, the latter shall prevail to the extent of such difference.

3.1.1 IS 1554 (Part I) – For PVC insulated (heavy duty) electric cables for working voltage upto and including 1100 V.

3.1.2 IS 7098 (Part - I) - For cross linked polyethylene (XLPE) insulated cables, for working voltages upto and including 1100V

3.1.3 IS 3961 - Recommended current ratings for cables.

3.1.4 IS 5831 - PVC insulation and sheath of electrical cables

3.1.5 IS 8130 - Conductors for insulated electric cables and flexible cords

3.1.6 IS 9938 - Recommended colours for PVC insulation for LF wires and cables

3.1.7 IS 10418 - Specification for drums for electric cables.

3.1.8 IS 10462 (Part-I) - Fictitious calculation method for determination of dimensions of protective coverings of cables

3.1.9 IS 10810 - Methods of test for cables.

3.1.10 IEEE 383 - Standard for type test of Class II electric cables, field splices and connections for Nuclear Power Generation stations.

3.1.11 ASTMD 2843 - Standard test method for density of smoke from the burning or decomposition of plastics.

3.1.12 ASTMD 2863 - Standard test method for measuring the minimum oxygen concentration to support candle like construction of plastics.

3.1.13 IEC 754 (Part-I). - Test on gases evolved during combustion of electric cables

3.1.14 SS 4241475 - Flammability testing of cables. (F3 CATEGORY)

3.1.15 IEC 332 (part 3) (category B) - Test on electric cables under fire condition.

4.0.0 **SITE ENVIRONMENT:**

4.1.1	Ambient Temperature	:	5 deg.C to 50 deg.C
4.1.2	Relative Humidity	:	100 %
4.1.3	Design Ambient Temp.	:	50 deg.C
4.1.4	Fault Level	:	50 KA for 1 sec.

5.0.0 **SPECIFICATION OF CABLE:**

5.1.0 **CONDUCTOR**

5.1.1	Material	:	i. Stranded Aluminium - H2 grade as per IS 8130. ii. Copper - Annealed bare copper of electrolytic grade as per IS 8130. Bare/tinned copper as per enquiry/purchase order
5.1.2	Construction	:	Multi stranded for any cross section for both ALUMINIUM and COPPER conductor cables.
5.1.3	Number of strands	:	Minimum 7 strands.
5.1.4	Shape	:	Compacted type for sizes above 10 Sq.mm
5.1.5	Cross section area	:	As per Purchase enquiry / purchase order. The specified area shall be maintained strictly as per enquiry immaterial of DC resistance.
5.1.6	Tensile strength	:	Minimum 100 N/mm^2 for aluminium conductor

5.2.0 **INSULATION**

5.2.1	Material	:	XLPE as per IS 7098 (Part-I) or PVC type A as per IS 5831 as per Enquiry/PO.

5.2.2 Method of application : Extrusion

5.2.3 Thickness : As per IS 1554 (Part-1) for PVC insulated cables as per IS 7098 (Part-1) for XLPE insulated cables.

5.2.4 Colour identification

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

ii)

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

5.2.5 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 number 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 numerals shall not exceed 50 mm.

5.2.6 For reduced neutral conductors, the core shall be black.

5.2.7 Shade of insulation colour : As per IS 9938

5.3.0 FILLERS (if provided) :

5.3.1 Material : Non-hygroscopic, Fire Retardant, suitable for the operating temp. of cable.

5.4.0 **INNER SHEATH:**

5.4.1 Material : PVC type ST-1 as per IS 5831 for PVC insulated cable & PVC type ST-2 as per IS 5831 for XLPE insulated cable.

5.4.2 Method of application : Extrusion

5.4.3 Thickness : As per IS 1554 (Part-I)

5.4.4 Colour : Black for power & control cable

5.5.0 **ARMOURING** : No armouring shall be provided.

5.6.0 **OUTER SHEATH:**

5.6.1	Material	:	FRLS PVC type ST1 as per IS 5831 for PVC insulated cable & FLRS PVC type ST2 as per IS 5831 for XLPE insulated cable.
5.6.2	Method of application	:	Extrusion
5.6.3	Thickness	:	As per IS 1554 (Part-1) for PVC insulated cable & as per IS 7098 (Part-1) for XLPE insulated cable.
5.6.4	Colour		
	i) For power cable	:	Black
	ii) For control cable	:	Grey

5.7.0 **ADDITIONAL REQUIREMENT OF OUTER SHEATH: (REQUIREMENT OF FRLS PROPERTIES)**

5.7.1	i. Oxygen index	:	Minimum 29 (As per ASTMD 2863)
	ii. Temperature index	:	Not less than 250°C at 21 oxygen index (when tested as per ASTMD 2863)
5.7.2	Max. acid gas generation by weight	:	Maximum 20% (when tested as per per IEC 754 – A Part-I)
5.7.3	Light transmission	:	Minimum 40% (when tested as per ASTMD 2843), Smoke density rating shall be max.60%. This is average value and not instantaneous value.
5.7.4	Flammability	:	All cables shall pass the flammability test Per IEC 332 part 3 (category B) and as per IEEE 383.
5.7.5	Flame resistance	:	All cables shall meet the flame resistance requirement as per Category F3 of SS 4241475.

5.8.0 **GENERAL REQUIREMENTS:**

5.8.1 The cable shall be designed to withstand all mechanical, electrical and thermal stresses under the foreseen steady state and transient / fault operation conditions. All cables shall be suitable for high ambient, high humid tropical Indian conditions.

5.8.2 Cable shall be 1100V grade, PVC/XLPE insulated, unarmoured having outer sheath of FRLS (Fire retardant low smoke) PVC ST1/PVC ST2.

5.8.3 All cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour.

5.8.4 The PVC cable shall be designed for a steady state continuous conductor temperature of 70 deg. C and short circuit withstand temperature of 160 deg C.

5.8.5 The XLPE cable shall be designed for a steady state continuous conductor temperature of 90 deg. C and short circuit withstand temperature of 250 deg C.

5.8.6 For outer sheath, polyethylene based halogen free material is not acceptable.

5.8.7 Allowable tolerance on overall diameter of the cable shall be + / - 2 mm maximum over the declared value in the technical data sheet .

5.8.8 The nominal current rating of all PVC insulated cables shall be as per IS 3961.

5.8.9 Repaired cables shall not be offered and the same will not be accepted. Pimples, fish eye, blowholes etc., are not acceptable.

5.8.10 In addition to manufacturer's identification on cables as per IS, following embossing/printing shall also be provided over outer sheath.

1) Cable size & voltage grade - To be embossed
2) Word FRLS at every 5 metre - To be embossed
3) Sequential marking of length of
cables in metres at every one metre – To be embossed / printed

The embossing/printing shall be progressive, automatic, in line and shall be legible and indelible.

5.8.11 The cables shall be supplied in non-returnable wooden or steel drums in coil form of length 1000 metres ±5%.

5.8.12 Progressive markings to read "FRLS" at every 5 metres shall be provided by embossing on the outer sheath of all cables.

5.8.13 The cable cores shall be laid up with fillers between the cores wherever necessary. The fillers should not be stick to insulation and inner sheath.

6.0.0 PACKING AND MARKING:

6.1.0 The cable shall be wound on a non-returnable drum in length of 1000 metres ±5% and packed. Cables of size 1C-240 sq.mm / 2C-185 sq.mm and above sizes can be supplied in 500 mtrs drum length or as mentioned in enquiry/purchase order. The packing shall be suitable for keeping it in outside which shall withstand heavy rain & dusty environment. The remaining length shall be supplied in a single drum. Cut bits or not acceptable. Over all quantity tolerance against each size shall be +0%, -2%.

6.1.1 The wooden drum shall be provided as per IS 10418.

6.1.2 The ends of the cable 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.

6.1.3 The information as detailed in Clause 18.2 of IS 1554 (Part-I) shall be stencilled on each drum.

6.1.4 Non – hygroscopic PVC/ POLYETHYLENE sheet shall be provided on the surface of the barrel of the drum and over outermost layer of the cable.

6.1.5 Wood preservative anti-termite treatment shall be applied to the enter drum.

6.1.6 Each dream shall carry manufacturer's name, Purchaser's name, address, item number, contact number and type, size and length of cable and net gross weight stencilled on both sides of 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.

7.0.0 DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT:

The data sheet shall be submitted in soft media, within 10 days from the date of order, for approval.

8.0.0 INSPECTION AND TESTING:

8.1.0 The cable shall be inspected and tested based on the following documents.

1. NTPC approved Quality Plan
2. BHEL Technical Specification (TEP)
3. BHEL Purchase order
4. BHEL approved suppliers data sheet

9.0.0 This specification meets NTPC contract specification. Hence no deviation shall be taken by the supplier.