

PRODUCT STANDARD
ELECTRICAL C & I
BAP/BHEL/RANIPET – 632 406

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TITLE : TECHNICAL SPECIFICATION FOR BOUGHT OUT ITEMS FOR FGD
ITEM : SCREENED CABLE
PROJECT : DADRI (2X490MW) FGD
CUSTOMER : NATIONAL THERMAL POWER CORPORATION

NAME		DESIGNATION	SIGNATURE	DATE
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1.0.0 SCOPE :

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

2.0.0 APPLICATION:

2.1.0 The cable to be supplied under this specification is intended to use for DADRI FGD plant.

3.0.0 APPLICABLE STANDARDS:

3.1.0 The screened cable shall be manufactured, tested and packed as per the following standards (Latest issues and their amendments). In case of any conflict between these standards and this Technical specification, the later shall prevail to the extent of such difference. In case of any conflict between these standards, the most stringent condition shall prevail

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|--------|------------|---|--|
| 3.1.1 | IS 3961 | - | Recommended current ratings for cables. |
| 3.1.2 | IS 9938 | - | Recommended colours for PVC insulation for LF wires and cables. |
| 3.1.3 | IS 10418 | - | Specification for drums for electric cables. |
| 3.1.4 | IEEE 383 | - | Standard for type test of Class II electric cables, field splices & connections for Nuclear power generating stations. |
| 3.1.5 | ASTMD 2843 | - | Standard test method for density of smoke from the burning or decomposition of plastics |
| 3.1.6 | ASTMD 2863 | - | Standard test method for measuring the min. oxygen concentration to support candle like construction of plastics. |
| 3.1.7 | IEC 754 | - | Test on gases evolved during combustion of Electric cables (Part-I). |
| 3.1.8 | SS 4241475 | - | Flammability testing of cables. |
| 3.1.9 | VDE 0207 | - | Insulation and Sheathing compounds for cables and flexible cords. |
| 3.1.10 | VDE 0472 | - | Rules for testing insulated cables and flexible cords. |
| 3.1.11 | VDE 0815 | - | Wiring cables for telecommunication and data processing system. |

- 3.1.13 IS 1554 (Part-1) PVC insulated (heavy duty) electric cables for working voltage upto and including 1100V.
- 3.1.14 IS 10810 Method of tests for cables.
- 3.1.15 IEC 332 (Part-3 category-B) Test on electric cables under fire conditions.

4.0.0 SITE ENVIRONMENT:

- 4.1.0 Ambient Temperature : 5 deg.C to 50 deg.C.
- 4.1.1 Design Ambient Temperature : 50 deg.C.
- 4.1.2 Relative Humidity : 100 %.

5.0.0 CONSTRUCTION OF SCREENED CABLE:

The conductors shall be formed by multi strands. Such multi strand conductors shall be insulated with PVC. Two such cores shall be twisted with 50mm (MAX) lay, and shall be MELINEX tapped with of thickness 0.028mm (min.) with 100% cover age and min.20% (min) overlap. Such taped pair shall be 100% screened with 20% (min) overlap using 0.06mm thick Aluminium Mylar tape. A drain wire of size 0.5 sq.mm. Annealed Tinned copper conductor formed by 7 strands, shall be provided for individual pair screen touching aluminium and overall shield. Then a POLYSTER TAPE of thickness 0.028mm (min.) shall be provided on such screened pair with 100% coverage and 20% (min.) overlap for screen isolation. Single layer of numbered binder tape on each pair shall be provided. Unit formation of four pairs with printing of no. of unit shall be provided. Conductor / pair identification as per VDE0815 shall be provided.

Such screened pairs shall be laid up, collectively 100% screened with 20%(min) overlap using 0.06mm thick ALUMINIUM MYLAR TAPE. Then a drain wire of 0.5 sq.mm Annealed Tinned Copper conductor formed by 7 strands shall be provided touching aluminium. Individual pair shielding shall be provided for F-type cable with a minimum thicknes of 28 micron. Overall cable assembly shielding shall be provided with a minimum thickness of 55 micron.

Such laid-up cables shall be provided with FRLS-PVC outer sheath.

6.0.0 SPECIFICATION OF SCREENED CABLE:

6.1.0 Common Requirements

Sl. No.	Property	Requirement
1	Voltage grade	225 V (peak value)
2	Codes and standard	All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816,VDE 0472, SEN 4241475, ANSI MC 96.1, IEC 60584,IS-8784, IS-10810 (latest editions) and their amendments read along with

		this specification.
3	Continuous operation suitability	At 205 Deg For Type-C cables & Heat resistant cables, At 70 deg.C for all types of cables
4	Marking :- a.Progressive automatic on-line sequential marking of length in meters to be provided at every one meter on outer sheath. b.Marking to read 'FRLS' to be provided at every 5 meters on outer sheath except for Type-C cable c.Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided on outer sheath.	
5	Progressive automatic on-line sequential marking of length in meters	To be provided at every one meter on outer sheath.
6	Marking to read FRLS	To be provided at every 5 meters on outer sheath except for Type-C cable.
7	Allowable Tolerance on overall diameter	+/-2 mm (maximum) over the declared value in data sheet
8	Variation in diameter	Not more than 1.0mm throughout the length of cable.
9	Ovality at any cross-section	Not more than 1.0 mm
10	Color	The outer sheath shall be of blue color except for KX & SX extension cables. For KX & SX extension cables color of outer sheath shall be as per ANSI MC 96.1/ IEC 60584.
11	Others	a) Durable marking at intervals not exceeding 625mm shall include manufacturers name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacture to be provided. b) Cables shall be suitable for laying in conduits, ducts, trenches, racks and underground-buried installation c) Repaired cables shall not be acceptable.

6.2.0 Specific Requirements

Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	
A. Conductors				
Cross Section area	0.5 sq.mm			
Conductor material	Type KX as per ANSI MC 96.1/ IEC 60584	Type SX as per ANSI MC 96.1/ IEC 60584	Annealed bare copper	

Colour code	Type KX as per ANSI MC 96.1/ IEC 60584	Type SX as per ANSI MC 96.1/ IEC 60584	As per VDE-815	
Conductor Grade	As per ANSI MC 96.1 / IEC 60584		Electrolytic	
No & dia of strands	7 x 0.3 mm (nom)			
No. of Pairs	2	2	2,4,8,12,16,24,48	
Max. Conductor loop resistance per Km (in ohm) at 20 deg.C	As per ANSI MC 96.1		73.4 (loop)	
Reference Standard	As per ANSI MC 96.1/ IEC 60584		VDE 0815	
B. Insulation				
Material	Extruded PVC type YI 3			
Thickness in mm (Min/Max)	0.25/0.35			
Volume Resistivity (Min) in ohm-cm	1 x 10 ¹⁴ at 20 deg.C & 1 x 10 ¹¹ at 70 deg.C			
Voltage Rating	225 V peak operating voltage			
Reference Standard	VDE 0207 Part 4			
Core diameter above insulation	Suitable for cage clamp connector			
C. Pairing and Twisting				
Max. Lay of pairs (mm)	50			
Single layer of Numbered binder tape on each pair provided	Yes			
Unit formation of four pairs with printing of no. of Unit provided	N.A.		Yes	
Conductor / pair identification as per VDE0815	N.A.		To be provided (colour coding attached).	
D. Shielding				
Type of shielding	Al-Mylar tape			
Individual pair shielding	No		To be provided for F-type cable	
Minimum thickness of Individual pair shielding	No		28 micron	
Overall cable assembly shielding	To be provided			
Minimum thickness of Overall cable assembly shielding	55 micron			
Shielding coverage	100% with atleast 20% overlap			

Drain wire provided for individual shield	N.A.	Yes (for F-t ype) Si ze - 0 . 5 sqmm No of st r a n d s - 7 Dia of strands- 0.3mm Annealed Tin coated copper	
Drain wire provided for overall shield	Yes, Size- 0.5 sqmm,No of strands-7,Dia of strands- 0.3mm,Annealed Tin coated copper		
E. FILLERS			
Non-hygroscopic, flame retardant	To be provided		
F. Outer Sheath			
Material	Extruded PVC compound YM1 with FRLS properties		
Minimum Thickness at any point	1.8 mm		
Nominal Thickness at any point	>1.8 mm		
Color	Blue		
Resistant to water, fungus, termite & rodent attack	Required		
Min Oxygen index as per ASTM D-2863	29%		
Min Temperature index as per ASTM D-2863	250 deg.C		
Acid gas generation by weight as IEC-60754-1	Maximum 20%		
Smoke Density Rating as per ASTM D-2843	Maximum 60% (defined as the average area under the curve when the results of smoke density test plotted on a curve indicating light absorption vs. Time as per ASTM D-2843)		
Reference standard	VDE207 Part 5,VDE-816		
G. Electrical parameters			
Mutual capacitance between Conductors at 0.8 KHz (Max.)	200 nF/km	120nF/km for F type 100 nF/km for G-type	
Insulation Resistance (Min.)	100 M Ohm/Km		
Cross Talk Figure (Min.) at 0.8 KHz	60 dB	60 dB	
Characteristic	N.A.	320 Ohm for F-	

Impedence (Max) at 1 Khz		type 340 ohm for G-type	
Attenuation Figure at 1 Khz (Max)	N.A.	1.2 db/km	
H. Complete Cable			
Complete cable assembly	Shall pass Swedish Chimney test as per SEN-SS 4241475 class F3.		
Flammability	Shall pass flammability as per IEEE-383 read in conjunction to this specification.		
I. Cable drum			
Type	Non-returnable wooden drum (wooden drum to be constructed from seasoned wod free from defects with wood preservative applied to the entire drum) or steel drum.		
Outermost layer covered with waterproof paper	Yes		
Painting	Entire surface to be painted		
Length	1000 m +/- 5% for upto & including 12 pairs 500m +/- 5% for above 12 pairs		

7.0.0 GENERAL REQUIREMENTS:

- 7.1.0 The cable shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operation conditions. The cable shall be suitable for laying in wet & dry locations in trays, conduits, ducts, trenches etc.
- 7.1.1 The cable shall be designed for a steady state continuous conductor temperature of 70 deg.C.
- 7.1.2 The cable shall comply with latest edition of VDE 0815, VDE 0207 part 4 & 5 & 6 VDE 0816, VDE 0472 standards including the amendments, read along with this specification. However the voltage grade of the cable shall be 225V peak operating voltage.
- 7.1.3 Allowable tolerance on overall diameter of the cable shall be +/- 2 mm (max.) over the declared value in the technical data sheet . The variation in diameter & the ovality at any cross section shall not be more than 1.0 mm.
- 7.1.4 The cable shall be capable of withstanding a conductor temperature of 160°C during a short circuit.
- 7.1.5 The nominal current rating of all PVC insulated cables shall be as per IS 3961.
- 7.1.6 Repaired cables shall not be offered and the same will not be accepted.
- 7.1.7 Progressive automatic on line sequential marking of the length of cable in metres at every one metre shall be provided on the outer sheath of all cables.

- 7.1.7 Progressive markings to read "FRLS" at every 5 metres shall be provided on the outer sheath of all cables.
- 7.1.8 The cable shall be supplied in Non-returnable drum in coil form of min. length of 1000 meters $\pm 5\%$.
- 7.1.9 The cable shall be provided with markings including manufacturer's name, insulation material, conductor size, number of pairs, voltage rating, type of cable, year of manufacture at intervals not exceeding 625mm.
- 7.1.10 The pairs of cable shall be identified by colour coding. The colour coding and cable identification shall be as per VDE 0815.
- 7.1.11 Non – hygroscopic PVC/ POLYTHELENE sheet shall be provided on the surface of the barrel of the drum & over outermost layer of the cable.
- 7.1.12 Cable accessories such as harnessing components, markers, bedding, binding tape etc. shall also have flame retardant quality.
- 7.1.13 The dielectric strength shall be as follows :

Conductor to conductor	3KV for 5 min.
Conductor to screen	0.5KV for 5 min.

8.0.0 PACKING AND MARKING:

- 8.1.0 The cable shall be wound on a non-returnable drum in length of 1000 metres $\pm 5\%$ and packed. 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%.
- 8.1.1 The drum shall be provided as per IS 10418.
- 8.1.2 The ends of the cable shall be sealed by means of non-hygroscopic sealing material.
- 8.1.3 The information as detailed in Clause 18.2 of IS 1554 (Part-I) shall be stencilled on each drum.

9.0.0 DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT:

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

10.0.0 INSPECTION AND TESTING:

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

1. NTPC Approved Quality Plan (QP) refereed in the Enquiry / P.O.
2. BHEL Technical Specification (TEP).
3. BHEL Purchase order.
4. BHEL approved suppliers data sheet.

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