

NTPC-SAIL POWER COMPANY (P) LIMITED

1 X 250 MW ROURKELA PP-II EXPANSION PROJECT

VOLUME II

TECHNICAL SPECIFICATION

FOR

SCREENED CONTROL CABLE

SPECIFICATION NO. : *PE - TS - 427 - 507 - E016B*

REVISION : 0



BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

NOIDA, UP (INDIA) - 201301



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
SCREENED CONTROL CABLES**

SPECIFICATION NO. PE-TS-427-507-E016B

VOLUME II

SECTION -

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DATE: 06.01.2017

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COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same
2. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations'
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in BOQ-Cum-Price schedule of the specification shall not be considered (i.e., technical description & quantities as per specification shall prevail).

BIDDER'S STAMP & SIGNATURE



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SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS



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1.0 SCOPE

- 1.1 Design, Manufacture, Inspection and testing at manufacture's works, proper packing and delivery to site of **Screened Control cables** conforming to this specification.
- 1.2 General technical requirements of the Screened Control cables are indicated in Section-II. Project specific technical/ quality requirements / changes are listed in Section-I.
- 1.3 The stipulations of Section-I, followed by those of Data Sheet-A shall prevail in case of any conflict between the stipulations of Section-I, Data Sheet - A & Section-II.

2.0 BILL OF QUANTITIES:

- 2.1 Quantity requirements shall be as per BOQ-cum-price schedule enclosed in NIT.

3.0 SPECIFIC TECHNICAL REQUIREMENTS

<u>S.No.</u>	<u>Reference Clause No. of Section- II</u>	<u>Specific Requirement/ Change</u>
1	QP/ Annexure to QP.	Successful vendor to conduct TYPE TEST as per Annexure C to QP.
2	Annexure D to QP (Note1 & 2)	It is further clarified to Note-1 of the Annexure-D to QP that the bidder has to submit the type test reports (including flammability tests as per those listed in Datasheet-A of Section-I) for all sizes irrespective of type of cables mentioned in the BOQ (attached with the NIT). It is further clarified to Note-2 of the Annexure-D to QP that if the bidder is not able to furnish the type test reports for all sizes of cables, then the bidder has to conduct type tests on all sizes of the cables (including flammability tests as per those listed in Datasheet-A of Section-I).

4.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

Following documents/drawings shall be submitted after placement of order for BHEL & customer's approval:-

Sl. No.	Drawings/Document Description	Drawings / Document Number
1.	Technical Data Sheet - Screened control cables	PE-V0-427-507-E141
2.	Cross-sectional Drawings - Screened control cables	PE-V0-427-507-E143
3.	Manufacturing Quality Plan for Screened control cables	PE-V0-427-507-E916 (*)

NOTE: (*)

Standard Quality Plan as enclosed in the technical specification is to be appended with cover sheet bearing document number & description as stated above. The signed & stamped copy for the same shall be submitted to BHEL without making any changes in the contents of the document.



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DATASHEET-A**CABLE DETAILS OF INSTRUMENTATION CABLES (AS PER VDE)**

- 1.0 Voltage grade : 225 V (Peak)
- 2.0 Type of cable : FRLS SCREENED CONTROL CABLES (F & G TYPE INSTRUMENTATION CABLES)
- 3.0 Standards Applicable :

S. No.	STANDARD	APPLICATION
1	VDE 0815, VDE 0816, VDE 0472	General Construction & tests for cables.
2	VDE 0207, Part-4, Part-5, Part-6	For insulation thickness.
3	SEN-SS-424-1475, IEC-60332 Part-3 Cat-B	Flammability Tests
4	ASTMD-2843, ASTMD-2863, IEC-754 Part-1	FRLS Tests

4.0 CONDUCTOR

- a) Material : Annealed bare copper
- b) Grade : Electrolytic
- c) Standard applicable : VDE 0815
- d) Min number of strands, Dia : 7, 0.3 mm (nom), 0.5 sq.mm
and cross sectional area

5.0 INSULATION

- a) Material : Extruded PVC as per VDE 0207 Part 4, compound Y I3
- b) Application : Extruded
- c) Insulation thickness
- Min / Max : 0.25/ 0.35 (for 0.5 sq mm)
- d) Volume resistivity (Min) : 1×10^{14} at 20 deg .C & 1×10^{11} at 70 deg. C in ohm-cm



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6.0 PAIRING & TWISTING

- a) Whether cores are twisted : YES
- b) Min. number of twist per Metre for paired cables. : 20 (For 0.5 Sqmm)
- c) Maximum lay of individual twisted pair : 50 mm (For 0.5 Sqmm)
- d) Cores of the pairs of a bunch provided : As per Annexure-B1 enclosed
- e) Single Layer of Binder Tape on each pair is provided : YES
- f) Unit Formation of four pair polyester binder tape for cables more than 4P is provided : YES
- g) Diameter of core : In accordance with clause 5 (c)

7.0 IDENTIFICATION OF CORES : Band marking**8.0 INDIVIDUALLY & OVERALL SCREENED (F TYPE CABLE)**

- a) Material : Aluminium-Mylar tape
- b) Coverage : 100%
- c) Overlap : Minimum 20%
- d) Min thickness (Micron) : 28
- e) Binder : Polyester tape.

9.0 OVERALL SCREENED (G TYPE CABLE)

- a) Material : Aluminium-Mylar tape
- b) Coverage : 100%
- c) Overlap : Minimum 20%
- d) Min. thickness (Micron) : 55
- e) Binder : Polyester tape.



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10.0 DRAIN WIRE

To be provided separately for individual pair shield and overall shield.

a) Material : Annealed Tin coated copper conductor as per VDE: 0815

b) Min number of strands, Dia : 7, 0.3 mm (nom), 0.5 sq.mm
and cross sectional area

11.0 ACCESSORIES (BEDDING, BINDER, TAPE REQ.)

a) Material : Mylar Tape

12.0 INNER SHEATH (FOR ARMOURED CABLES)

a) Material : Extruded PVC (compound YM1) as per VDE 0207 Part-5

b) Thickness (Min) : 0.3mm

c) Whether FRLS : NO

d) Fillers : Acceptable

e) Material of fillers : Same as inner sheath (With moisture resistant properties & Flame retardant- as applicable)

f) Method of application : Pressure / Vacuum extruded

g) Colour : Black

13.0 ARMOUR

a) Material : Galvanized round steel wire / Formed wire
as per IS-3975 & IS-1554 Part-I

b) Minimum coverage : 90%

c) Breaking load of joints : 95% of normal armour

d) Method of jointing : Welding

14.0 OUTER SHEATH

a) Material : Extruded PVC (compound YM1) as per VDE 0207 Part-5

b) Thickness : As per VDE 0816 and VDE207 Part-5

Minimum Thickness at
any point : 1.8 mm for unarmoured Cable / as per
IS-1554-I for armoured cable



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Nominal Thickness at any point : >1.8 mm for unarmoured Cable / as per IS-1554-I for armoured cable

c) Application : Extruded

d) Colour : Blue (For unarmoured cable)/
Yellow (For armoured cable)

e) Whether FRLS : YES

f) Other : Resistant to water, Fungus, Termite & rodent attack.

15.0 FRLS/ FLAMMABILITY TESTS

a) Oxygen Index : 29% Minimum as per ASTM D 2863

b) Temperature Index : 250 °C Minimum as per ASTM D 2863

c) Acid gas generation : less than 20% by weight (As per IEC-60754-1)

d) Smoke density rating : Not more than 60% (As per ASTM D 2843) Defined as average area under curve when the results of smoke density plotted on a curve indicating light absorption v/s time as ASTM D 2843

e) Flammability Test : As per IEC 332 Part-1, IEC 332 Part-3 Cat-B, SEN-SS-424-1475 (F3) & IEEE-383.

16.0 TOLERANCE ON OVERALL DIAMETER : ± 2 mm max. over the declared value in Technical Data Sheet

17.0 VARIATION IN DIA & OVALITY AT ANY CROSS-SECTION : Maximum 1 mm (Unarmoured Cable)
Maximum 1 mm (armoured Cable)

18.0 CABLE DRUM DETAILS

a) Material Type & Construction: Non-Returnable Wooden as per IS 10418 / Steel

b) Standard drum length : 1000 metres: up to and including 12 Pairs.
500 metres: above 12 pairs

c) Tolerance on drum length : $\pm 5\%$

d) Painting : Entire surface to be painted

e) Outermost Layer : To be covered with waterproof cover

f) Wooden drum : The surface of the drum and the outer most



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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.

- g)** Particular Information on drum: Each drum shall carry manufacturer's name, purchaser's name, address and contract no., item no. & type, size & 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 & suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

19.0 RIP CORD : A non-hygroscopic and non-wicking non metallic cord polyethylene.

20.0 Markings on Outer Sheath

- a) Progressive sequential Length marking to be provided : @ 1000 mm by Printing/ embossing
- b) Marking to read 'FRLS' to be provided at every 5 meters on outer sheath.
- c) Durable marking @ 625 mm (max.): Manufacturers name, type of insulation, cable Size (cross- section & no. of pairs), voltage grade, Type of cable (i.e. Type F/G), year of manufacture by embossing. Customer name i.e. 'BHEL-PEM' & 'NSPCL' shall also be marked @5m.

21.0 TECHNICAL PARAMETERS (C & I) As per Table below

STANDARD CABLE PARAMETERS FOR INSTRUMENTATION CABLE

Parameter	0.5 mm ² (I & OS) type-F	0.5 mm ² (OS) type-G
Mutual Capacitance (max.)at 0.8 kHz, nF/Km	120	100
Conductor Loop Resistance (max.), Ohm/Km	73.4 (Plain)	73.4 (Plain)
Insulation Resistance (min), M Ohm/ Km	100	100
Cross Talk Figure (min) at 0.8kHz, dB	60	60
Characteristic impedance(max.) at 1 kHz	320	340
Attenuation(max.) at 1 kHz db/Km	1.2	1.2



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Note:

1. Cable parameters indicated above are at 20 degC (+/- 3 degC)

22.0 TEST VOLTAGE

Core – Core

Core- shield

- a) High voltage test : 2kV RMS for 1 min 0.5kV RMS for 1 min
- b) Resistance to direct current test: 0.22kV DC for 240 hrs/ 10 days

Note : Repaired Cables shall not be acceptable.



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ANNEXURE: B-I

CORE IDENTIFICATION / PAIR IDENTIFICATION



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ANNEXURE : B-I

The cable cores shall be colour coded as mentioned below:

PAIR	CORE	COLOUR
1 st	1 st	Blue
1 st	2 nd	Red
2 nd	1 st	Grey
2 nd	2 nd	Yellow
3 rd	1 st	Green
3 rd	2 nd	Brown
4 th	1 st	White
4 th	2 nd	Black

Each four pair is laid to form one unit and wound with Mylar tape. The cores of each unit shall then be identified by colour bands for cables of more than 4-pair. eg. All eight cores of the first unit shall have a single band of pink colour (preferably rose pink).

Unit No No.	COLOUR OF BANDS	BAND MARKS
1. 2. 3. 4.	PINK	= === == = === == = === == = === ==
5. 6. 7. 8.	ORANGE	= === == = === == = === == = === ==
9. 10. 11. 12.	VIOLET	= === == = === == = === == = === ==

The dimension L (distance between the marking) shall be limited to 60mm. The bands shall be neat and cover at least 2/3 of the periphery of the core.

eg: A grey wire having 3 orange bands is the first core of the second pair of the seventh unit.



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DATA SHEET-C

S.No.	Particulars	Unit	Description
1	Manufacturer's name	-	
2	Reference design standards	-	
3	Conductor size	sq. mm	
4	Rated Voltage	V	
5	Number of pairs	No.	
6	Cable suitable for both earthed & unearthed system	-	
7	Conductor		
	a) Material	-	
	b) Reference Standard	-	
	c) Grade	-	
	d) No. of strands	No.	
	e) Diameter of strands (nom.)	mm	
	f) Approx. dia of conductor	mm	
	g) Cross Section area	sq. mm	
	h) Maximum conductor resistance per Km at 20°C	ohm	
8	Insulation		
	a) Reference Standard	-	
	b) Material composition	-	
	c) Application	-	
	d) Minimum thickness	mm	
	e) Nom.Thickness	mm	
	f) Max. thickness	mm	
	g) Minimum volume resistivity as per IS 5831	Ohm cm	
	h) Dielectric constant	-	
	i) Maximum conductor temperature withstand capacity	°C	
	j) Core diameter including insulation	mm	
9	Core laying		
	a) Whether cores are twisted.	-	
	b) Maximum lay of twist	mm	
	c) Identification of cores	-	
10	Individual Shield		
	a) Material	-	



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	b) Thickness of tape	micron	
	c) Coverage/ Overlap	%	
	d) Noise interference better than	dB	
11	Drain wire for individual shield		
	a) Reference standard	-	
	b) Size (No. of strands/ dia. of each strand)	sq. mm (no./mm)	
	c) Material	-	
	d) Resistance of drain wire per km at 20 deg.C	ohm	
12	Overall shield		
	a) Material	-	
	b) Thickness of tape	mm	
	c) Coverage/Overlap	%	
	d) Noise interference better than	dB	
13	Drain wire for overall shield		
	a) Reference standard	-	
	b) Size/ No.of strands	sq. mm/ no.	
	c) Material	-	
	d) Resistance per Km (with shield) at 20°C	Ohm/ km	
14	a) Fillers: Material (if applicable)		
	b) Bedding Material		
15	Inner sheath		
	a) Material, type and standard	-	
	b) Whether FRLS	-	
	c) Colour	-	
	d) Method of application	-	
	e) Thickness (min)	mm	
16	Armour		
	a) Material,	-	
	b) Formed wire / round wire		
	c) Minimum Coverage	%	
	d) Method of jointing	-	
	e) Breaking load of joint	-	
	f) Size (approx.)	mm	
	g) Dia of armour	mm	
	h) No. of wires	mm	
17	Outer sheath		
	a) Reference standard	-	
	b) Material	-	
	c) Minimum thickness of sheath	mm	
	d) Calculated dia under outersheath	mm	
	e) Oxygen index (as per ASTM D 2863)	-	



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	f) Temperature index (in deg. C as per ASTM D 2863)	-	
	g) Maximum acid gas generation as per IEC 754-1	%	
	h) Maximum smoke density rating as per ASTM D 2843	%	
	i) Colour of outer sheath	-	
18	Dia over laid-up core	mm	
19	Dia under armour	mm	
20	Dia above armour	mm	
21	Overall diameter of cable	mm	
22	Tolerance on overall diameter	mm	
23	Weight of		
	Copper (conductor & drain wire)	MT. / km	
	PVC (insulation, sheath & fillers)	MT. / km	
	Armour	MT. / km	
	Cable (approx.)	MT. / km	
24	Cable parameters at 20°C (+/- 3 deg. C)		
	a) Conductor resistance (max)	Ohm/ km	
	b) Insulation resistance (min)	M-Ohm	
	c) Mutual capacitance at 0.8 KHz (max)	nF/ km	
	d) Cross talk at 0.8 KHz (min)	dB	
	e) Attenuation at 1 KHz (max)	dB/ km	
	f) Characteristic impedance at 1 KHz (max)	Ohm	
25	Continuous operating temp. (deg.C)	deg. C	
26	(a) Relevant IS standard including Part & category for Flame retardance of complete cable	-	
	(b) Relevant IEC standard including Part & category for Flammability of complete cable		
27	Whether complete cable passes Swedish Chimney test as per SEN 4241475 (F3)	-	
28	Identification		
	a) Length of cable marked at every mtr.	-	
	b) FRLS marked at every 5 mtrs	-	
	c) Each core of the pair numbered	-	
	d) Conductor identification details for pairs	-	
	e) Details of cable markings	-	
29	Test voltage		
	a) High voltage test/ Dielectric Strength		
	i) Voltage (KV), Core - Core	kV	
	ii) Duration	min	
	b) High Voltage test		
	i) Voltage (KV), Core - Screen	V	
	ii) Duration	min	
	c) Resistance to direct current test (applicable for 225 V cable as	-	



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	per VDE)		
	Voltage	V	
	Duration	hrs/days	
30	Min bending radius	mm	
31	Ovality at any cross section	mm	
32	Variation of dia through out cable length		
33	Cable cross-sectional drawings for each type of cable furnished		
34	i) Length of single coil in a drum	M	
	ii) Marking on drum	-	
	iii) Seasoned wood drum provided	-	
	iv) Both ends of cable to be sealed with PVC/ Rubber caps to prevent water/ moisture ingress		
	v) Gross weight (approx.)	kg.	
	vi) Net weight (approx.)	kg	
35	Type test procedures as per BHEL Technical Spec. and other relevant standards enclosed.		
36	Anti termite & rodent test		



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GENERAL TECHNICAL SPECIFICATION



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1.0 TECHNICAL REQUIREMENTS

- 1.1 Technical requirements for SCREENED CONTROL CABLES shall be as indicated in this section, in addition to those specified in Datasheet-A.
- 1.2 It is not the intent to specify herein all the details of design & manufacture. However, the equipment shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation at site conditions.

2.0 CODES & STANDARDS

- 2.1 The design, material, construction, manufacture, inspection and testing of Screened control cables shall conform to the latest revision of relevant standards and codes of practices mentioned in Data Sheet - A.
- 2.2 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

3.0 QUALITY ASSURANCE REQUIREMENTS

- 3.1 Bidder shall confirm compliance with the BHEL Standard Quality Plan (PE-QP-999-507-E004) as attached with the specification without any deviations. At contract stage, the successful bidder shall submit the same QP for BHEL/ ultimate customer's approval. In case bidder has reference QP agreed with ultimate customer, same can be submitted for specific project after award of contract for BHEL/ultimate customer's approval. There shall be no commercial implication to BHEL on account of minor changes in QP during contract stage.
- 3.2 All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved Quality Plan.
- 3.3 Type testing requirements, routine/ acceptance testing and special testing requirements shall be as per Annexure –C to QP. Charges for all these tests for all the equipments & components shall be deemed to be included in the bid price (except UV Radiation & Hydraulic Stability test).
- 3.4 The charges of UV Radiation test & Hydrolytic Stability test (if applicable) shall be reimbursed extra at actual against original money receipt of Govt. Lab. (CPRI/ ERDA etc).
- 3.5 Cost of cables consumed for testing shall be to bidder's account.
- 3.6 Type Test Reports for Tests conducted shall be submitted for BHEL's/ Customer's review/approval.

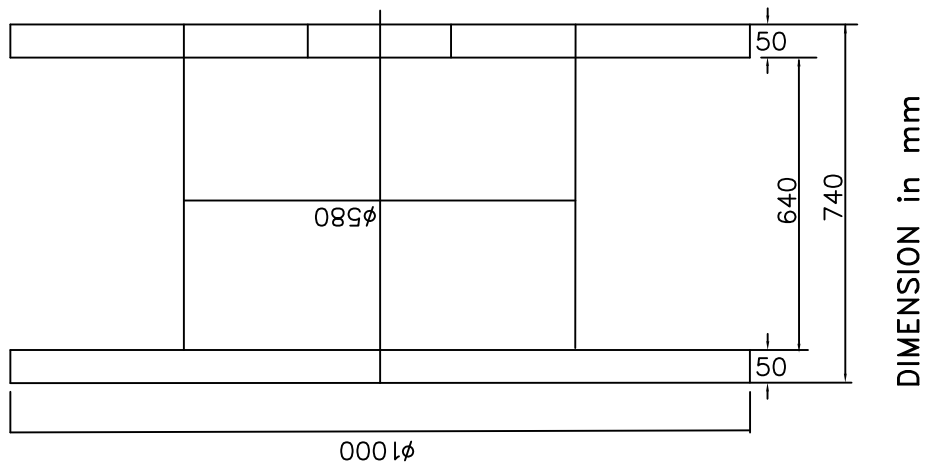
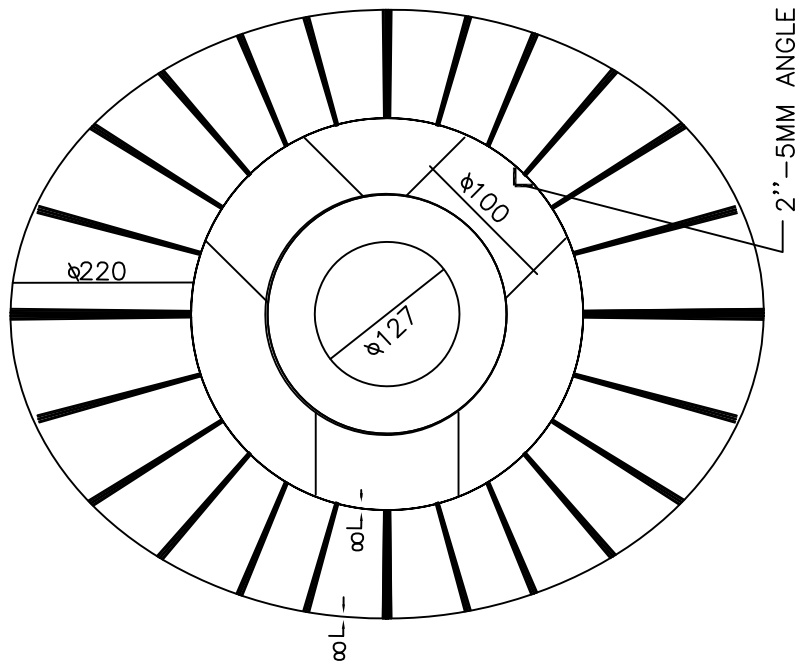
4.0 Packing

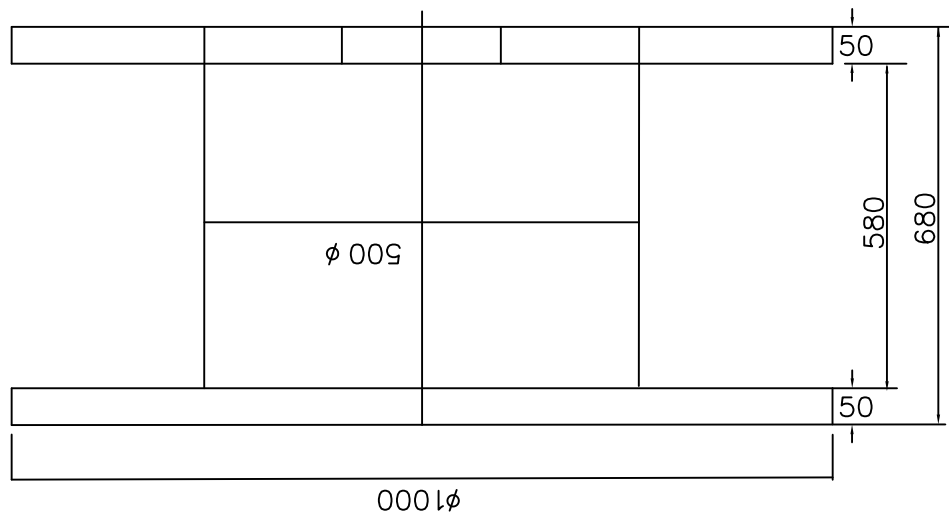
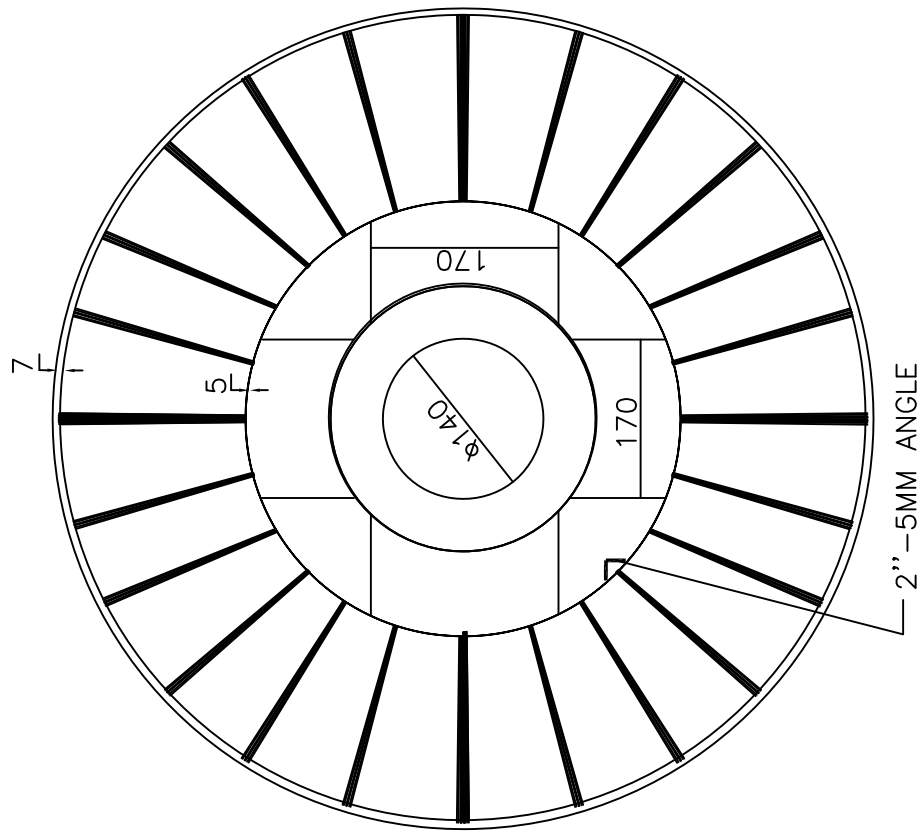
- 4.1 Cables shall be supplied in non-returnable drums. Material of cable drum shall be as specified in Datasheet-A.
- 4.2 In case of wooden drums, all wooden parts shall be manufactured from seasoned wood treated with copper naphthenates/ zinc naphthenates (refer IS: 401). Dimensions of wooden drums shall be as per IS 10418. All ferrous parts shall be treated with suitable rust protective finish or coating to avoid rusting during transit and storage. BIS certification mark shall be stamped on each cable drum. Over the cables polyethylene sheet shall be wrapped and then sealed properly.
- 4.3 In case of Steel drums, new or practically new cable drums made of steel and painted with epoxy resin paint are to be used. Cable ends are carefully protected before packing. Over the cables polyethylene sheet shall be wrapped and then sealed properly. For Typical details of Steel drums, Annexure-B to Section-II, may be referred by the bidder. Bidder may modify, to choose appropriate dimensions of steel drums to suite various sizes/weight/ lengths.

STEEL DRUM DRAWING (TYPICAL)

Annexure-B to Section II

(Sheet 1 of 2)





DIMENSION in mm

		QUALITY PLAN				CUSTOMER : NTPC - SAIL POWER CO. LTD.			PROJECT : 1 X 250 MW ROURKELA PP-II EXPANSION PROJECT			SPECIFICATION : PE-TS-427-507-E016B		
						BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E004, REV 01.			SPECIFICATION TITLE		
		SHEET 1 OF 5				SYSTEM			ITEM : INSTRUMENTATION CABLES			SECTION		VOLUME II
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS		
									P	W	V			
1	2	3	4	5	6	7	8	9	10			11		

Instructions:

1. Cable manufacturer to maintain records to show co-relation of raw materials to finished cables i.e. raw material batch/ lot no. should be traceable to the final cable drum number or batch no.

2. Cable manufacturer to maintain all quality records identified as per all QP stages enumerated below whether it is identified for BHEL verification or witness or not.

1.0	RAW MATERIAL												
1.1	Copper Rods/ Wires (For Conductor & drain wire)	GENERAL : 1. Physical properties 2. Elec.Properties SPECIFIC CHECKS : a) Make b) Grade c) Resistivity	MA	Physical Tests	Sample	Relevant Standard/ Approved datasheet	Relevant Standard/ Approved datasheet	Inspection Report/ Test Cert.	2/3	-	1/2		
			MA	Electrical Tests	Sample	-do-	-do-	-do-	2/3	-	1/2		
			MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2	-	1		
			MA	-do-	-do-	IS 613/ Approved datasheet	IS 613/ Approved datasheet	-do-	3/2	-	1		
			MA	Electrical Tests	Manufacturer	IS 613	IS 613	-do-	3/2	-	1		
1.2	PVC Compound (for insulation)	GENERAL : 1. Physical properties 2. Elec.Properties SPECIFIC CHECKS : a) Make b) Type/ Grade c) Shelf life/ Storage condition	MA	Physical Tests	Sample	Relevant Standard/ Approved datasheet	Relevant Standard/ Approved datasheet	Inspection Report/ Test Cert.	2/3	-	1/2		
			MA	Electrical Tests	Sample	-do-	-do-	-do-	2/3	-	1/2		
			MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.	3/2	-	1		
			MA	-do-	-do-	Approved datasheet	Approved datasheet	-do-	3/2	-	1		
			MA	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	3/2	-	1		
1.3	Screen / Tapes/ Binders	1. Make 2. Dimension 3. T.S. & Elongation 4. Chem. & Phys. Properties	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	TC & IR	3/2	-	1/2		
			MA	Measurement	Manufacturer std.	Manufacturer datasheet/ Approved datasheet	Manufacturer datasheet/ Approved datasheet	TC & IR	3/2	-	1/2		
			MA	Physical Tests	-do-	Manufacturer datasheet	Manufacturer datasheet	-do-	3/2	-	1/2		
			MA	Chemical & Physical Tests	-do-	Manufacturer std.	Manufacturer std.	-do-	3/2	-	1/2		

BHEL		PARTICULARS	BIDDER/VENDOR
		NAME	
		SIGNATURE	
		DATE	
		BIDDER'S/VENDORS COMPANY SEAL	
		CUSTOMER :	PROJECT
		SPECIFICATION :	

						TITLE			NUMBER :				
		QUALITY PLAN		BIDDER/ VENDOR :		QUALITY PLAN			SPECIFICATION :				
		SHEET 2 OF 5		SYSTEM		NUMBER: PE-QP-999-507-E004. REV 0.			TITLE				
						ITEM :INSTRUMENTATION CABLES			SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10				11
1.4	Fillers (as applicable)	1. Type 2. Flame retardant & moisture resistant (as applicable)	MA CR	Verify Chemical/ Environ.	-do- -do-	Approved datasheet -do-	Approved datasheet -do-	-do- -do-	3/2 3/2	- -	1 2		
1.5	Galvanised steel wire/strip for Armour (if applicable)	GENERAL : 1. Make 2. Dimension 3. Phy.and Elec. Properties 3.Galvanization Quality	MA MA MA MA	Verify Measurement Physical & Electrical Tests Galv. Tests	Manufacturer std. -do- Sample* -do-	Manufacturer approved source -do- Relevant Standard/ Appd. Data Sheet/ -do-	Manufacturer approved source -do- Relevant Standard/ Appd. Data Sheet/ -do-	Inspection Report/ Test Cert. -do- -do- -do-	2/3 2/3 2/3 2/3	- - - -	1 2 2 2		* Sample from each size/ Batch/Lot.
1.6	PVC compound for Sheath	GENERAL : 1. Physical properties 2. Elec.Properties 3. FRLS Properties (as applicable) SPECIFIC CHECKS : a) Make b) Type/ Grade c) Shelf life/ Storage condition	MA MA CR MA MA MA	Physical Tests Electrical Tests Chemical/ Environ. Verify -do- -do-	Sample Sample Sample 100% -do- -do-	Relevant Standard/ Approved datasheet -do- -do- Manufacturer approved source Approved datasheet Compound Manufacturer std.	Relevant Standard/ Approved datasheet -do- -do- Manufacturer approved source Approved datasheet Compound Manufacturer std.	Log book/ Test Cert. -do- -do- Log book/ Test Cert. -do- -do-	3/2 3/2 3/2 3/2 3/2 3/2	- - - - - -	1/2 1/2 1/2 1 1 1		
1.7	Wooden drums	1. Phy. & Constructional checks 2. Anti termite treatment	MA MA	Visual Chem.	Mfr's Plant Std. -do-	IS 10418 Mfr's Plant Std.	IS 10418 Mfr's Plant Std.	Log book/ Test Cert. COC	3/2 3/2	- -	1 1		
1.8	Steel drums	1. Dimension 2. Surface finish	MA MA	Meas. Meas.	Mfr's Plant Std. -do-	Mfr's Plant Std. -do-	Mfr's Plant Std. -do-	Log book/ Test Cert. -do-	3/2 3/2	- -	1 1		
2.0 IN PROCESS													
2.1	Wire Drawing & Annealing.	1. Size 2. Surface finish 3. % of Elongation	MA MA MA	Dimensional Visual Mechanical	Mfr's Plant Std. -do- -do-	Approved datasheet Surface shall be smooth IS 8130	Approved datasheet Surface shall be smooth IS 8130	Inspection Report	2	-	1		
2.2	Tinning (Conductor or drain wire)	1. Size 2. % of Elongation	MA MA	Dimensional Mechanical	Plant Mfg. Std. -do-	Approved datasheet IS 8130	Approved datasheet IS 8130	Log Book	2	-	1		(Applicable only for tin-coated copper conductor and drain wire)
2.3	Stranding of wires	1. No.of wires	MA	Counting	Mfr's Plant Std.	IS 8130/ Appd. Data Sheet	IS 8130/ Appd. Data Sheet	-do-	2	-	-		
			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE					BIDDER'S/VENDORS COMPANY SEAL					

		QUALITY PLAN			CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :				
					BIDDER/ VENDOR :		QUALITY PLAN NUMBER: PE-QP-999-507-E004, REV 0.		SPECIFICATION : TITLE				
					SYSTEM		ITEM :INSTRUMENTATION CABLES		SECTION VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P W V			REMARKS	
1	2	3	4	5	6	7	8	9	10	11	11		
2.4	Core Insulation (No repair permitted)	2. Resistance	CR	Electrical	-do-	-do-	-do-	-do-	2	-	-	# To be checked at starting & finish end of Extruded Length	
		3. Sequence, lay length & Direction	MA	Visual, Meas	Sample	BHEL'S/ Vendor's Spec./ Approved datasheet	BHEL'S/ Vendor's Spec./ Approved datasheet	-do-	2	-	-		
		4. Surface Finish	MA	Visual	Sample	-do-	-do-	-do-	2	-	-		
		5.Dimension	MA	Measurement	Sample	Appd. Data Sheet	Appd. Data Sheet	-do-	2	-	-		
		1. Surface finish	MA	Visual	100%	-	Free from bulging burnt particles lumps, cuts & Scratches.	Inpection Report	2	-	-		
		2 Insulation thickness (Min./ Max.)	CR	Measurement	Sample	Appd.data sheet/ Relevant Std.	Appd.data sheet/ Relevant Std.	-do-	2	-	-		
		3. Concentricity #	CR	Measurement	Sample	Mfr's Std./Appd. data sheet	Mfr's Std./Appd. data sheet	Inpection Report	2	-	-		
		4 Dia over insulation	MA	Measurement	Sample	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-		
		5. Core identification	MA	Visual	100%	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-		
		6. TS & % Elongation	MA	Mechanical	100%	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-		
	2.5	Core pairing, screening (provision of drain wire & laying)	1. Pair identification	MA	Visual	100%	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	Log Book	2	-		-
			2.Wire size & tape size	MA	Measurement	100%	-do-	-do-	-do-	2	-		-
			3.Test for capacitance	CR	Elect. Test	100%	-do-	-do-	-do-	2	-		-
			4. Sequence of lay and lay length	MA	Visual meas	Sample	Appd. Data Sheet & MFRs. Std.	Appd. Data Sheet & MFRs. Std.	-do-	2	-		-
		5. Screen overlap & coverage	MA	Measurement	Sample	-do-	-do-	-do-	2	-	-		
		6. Dia over laid up core	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-		
		7. Continuity of drain & drain wire with Screen	MA	Elect. Test	100%	<-----No Discontinuity ----->	-do-	-do-	2	-	-		
			PARTICULARS		BIDDER/VENDOR								
BHEL			NAME										
			SIGNATURE										
			DATE										
							BIDDER'S/VENDORS COMPANY SEAL						

		QUALITY PLAN SHEET 4 OF 5		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :				
				BIDDER/ VENDOR		QUALITY PLAN NUMBER: PE-QP-999-507-E004, REV 0.			SPECIFICATION : TITLE				
				SYSTEM		ITEM :INSTRUMENTATION CABLES			SECTION VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	P	W	V	11
2.6	Inner Sheath Extrusion (if applicable)	1. Surface finish	MA	Visual	100%	--	Free from bulging, burnt particles,lumps cuts & scratches.	-do-	2	-	-		
		2. Sheath thickness	MA	Measurement	Sample			-do-	2	-	-		
		3.Dia over inner sheath	MA	Measurement	Sample	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-		
		4. Colour	MA	Visual	100%	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-		
2.7	Armouring (If Applicable)	1. No.of wires/Strips	MA	Counting	At the start of the process	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-		
		2. Size of wire/ Strip	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-		
		3. Lay Direction	MA	Visual	-do-	-do-	-do-	-do-	2	-	-		
		4. Lay Length	MA	Visual, Meas.	At the start of the process	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	Log Book	2	-	-		
		5. Coverage	MA	Measurement	-do-	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-		
		6. Dia over armouring	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-		
2.8	Outer Sheath Extrusion	1. Surface Finish	MA	Visual	100%	-	Free from Bulging Burnt particles, lumps, cuts & scratches	Log Book	2	-	-		
		2.Sheath thickness	MA	Measurement	Sample	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	Log Book	2	-	-		
		3. Dia over outer sheath	MA	Measurement	Sample	-do-	-do-	-do-	2	-	-		
BHEL			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE						BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN			CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :		
					BIDDER/ VENDOR			QUALITY PLAN NUMBER: PE-QP-999-507-E004, REV 0.			SPECIFICATION : TITLE		
					SYSTEM			ITEM :INSTRUMENTATION CABLES			SECTION VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	P	W	V	11
3.0	Final Inspection	4. Marking/ Colour/ Embossing 5. TS & % Elongation 1. Finish & Length 2. Dimensions 3. Armouring - Coverage No.of Wires/Strips 4. Marking/Colour/ pair identification 5. Test for screening 6. Acceptance Tests 7. Type & FRLS Tests	MA MA MA MA MA MA CR CR CR	Visual Mechanical Visual Measurement Visual & Meas. Visual Elect. Test Phy & Elect. Tests Measurement	100% 100% (See remark) Sample Lengths Sample -do- -do- -do- sample Sample	Appd. Data Sheet Relevant Standard/ Appd. Data Sheet Relevant Standard/ Appd. Data Sheet Appd. Data sheet -do- -do- -do- -do- Appd. Data sheet	Appd. Data Sheet Relevant Standard/ Appd. Data Sheet Free from Bulging Burnt particles, lumps, cuts & scratches Appd. Data sheet -do- -do- -do- -do- Appd. Data sheet	Test Report -do- Inpection Report Inpection Report -do- -do- -do- -do- -do-	2 2 2 2 2 2 2 2 2	- - 1 1 1 1 1 1 1	- - - - - - - -	Sequential marking shall be done by printing One drum in a Lot Refer Annexure to QP for sampling plan.	
NOTES:- (A) JOINTS IN WIRE SHALL BE AS PERMITTED BY REL STD / BHEL SPECIFICATION. VENDOR TO CERTIFY THE SAME. (B) NO REPAIR OF CORE INSULATION PERMITTED (C) CABLE ENDS SHALL BE SEALED AS PER REL. STD./ BHEL SPECIFICATION (D) RECORD OF RAW MATERIAL, PROCESS & ALL STAGES SHALL BE CERTIFIED BY VENDORS QC. AND ARE LIABLE TO AUDIT CHECK BY PURCHASER. (E) FILLERS/DUMMY CORES ETC. SHALL BE AS PER BHEL SPECIFICATION (F) WHEREVER EXTENT OF CHECK FOR STAGE IS MENTIONED AS SAMPLES AND NOT DEFINED IN QP, THE SAME SHALL BE AS PER VENDORS SAMPLING PLAN AGREED BY PURCHASER. (G) VENDOR SHALL FURNISH COMPLIANCE CERTIFICATE TO THE INSPECTION AGENCY CONFIRMING THE PACKING AS PER REL. STD./ BHEL SPECIFICATION. (H) FOR LIST OF TYPE TESTS, ROUTINE TESTS & ACCEPTANCE TESTS; REFER ANNEXURE TO QAP.													
LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER 1- BHEL/CUSTOMER 2-VENDOR 3 SUB VENDOR CHP: CUSTOMER HOLD POINT TC : Test Certificates, Spec. : Specification Mfg. : Manufacturer.													
BHEL			PARTICULARS			BIDDER/VENDOR							
			NAME										
			SIGNATURE										
			DATE						BIDDER'S/VENDORS COMPANY SEAL				

	ANNEXURE C TO QP	CUSTOMER: NTPC - SAIL POWER CO. LTD.	PROJECT TITLE: 1 X 250 MW ROURKELA PP-II EXPANSION PROJECT	SPECIFICATION NUMBER: PE-TS-427-507- E016B
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R0	SPECIFICATION TITLE: TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLE
	SHEET	1 of 4	ITEM: SCREENED CONTROL CABLES (AS PER VDE)	DOC. NO.

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS (AS PER VDE)

A. Type Test Conduction:

- Tests for which "T" is indicated in the 'Test Conduction Required As' column below shall be conducted as Type Test.
- Sampling:
 - Type tests (except for Sl. no. b & c below) to be conducted on one size (2P, 4P etc.) of each type (F or G type)/ lot.
 - Electrical & C&I tests to be conducted on each size of each type of cables /lot.
 - FRLS & Flammability tests to be conducted only on one sample/ lot, irrespective of size/type.

B. Acceptance Test Conduction:

- Tests for which "A" is indicated in the 'Test Conduction Required As' column below shall be conducted as Acceptance tests.
- Sampling:
 - Acceptance tests (except for Sl. no. b & c below) for every lot shall be as per Appendix-B (Clause 15.2.2) of IS: 1554 Part-I.
 - Electrical & C&I tests to be conducted on each size of each type of cables /lot.
 - FRLS & Flammability tests to be conducted only on one sample/ lot, irrespective of size/type.

C. Routine Test Conduction:

- Tests for which "R" is indicated in the 'Test Conduction Required As' column below shall be conducted as Routine tests.
- Sampling:
Routine testing shall be conducted in line with the applicable standards and as per the Manufacturing Quality Plan approved for the project for every lot offered for inspection.

D. ADS: Approved datasheet.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
1.0	Tests for Conductor				
I.	Annealing test	For copper conductor only	T, A	IS 10810 Pt 1	<i>Internal in process Test Report to be furnished for both type & acceptance tests</i>
II.	Tin coating test (for tinned copper)	For copper conductor only	T, A	IS 10810 Pt 4	
III.	Resistance test	For Al/Cu	T, A, R	VDE 0815	

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL

	ANNEXURE C TO QP	CUSTOMER: NTPC - SAIL POWER CO. LTD.	PROJECT TITLE: 1 X 250 MW ROURKELA PP-II EXPANSION PROJECT	SPECIFICATION NUMBER: PE-TS-427-507- E016B
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R0	SPECIFICATION TITLE: TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLE
	SHEET	2 of 4	ITEM: SCREENED CONTROL CABLES (AS PER VDE)	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
IV.	Diameter test	For conductor	T, A	ADS	
2.0	Tests for Armour Wires/Strips				
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	T,A	IS 10810 Pt 36	
II.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	T, A	IS 10810 Pt 37	
III.	Elongation at break test	Applicable for GS wire/Strip only	T, A	IS 10810 Pt 37	
IV.	Torsion test	For GS round wire only	T, A	IS 10810 Pt 38	
V.	Winding test	For GS strip only	T, A	IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Aluminium wire & GS wire	A	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	A	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	A	IS 10810 Pt 41	
IX.	Wrapping Test	For Aluminium wires only	A	IS 10810 Pt 3	
3.0	Physical Tests for PVC Insulation & PVC sheath				
I.	Test for thickness & Eccentricity	Applicable for PVC insulation, PVC inner sheath & PVC outer sheath	T, A	VDE 0472	
II.	Tensile strength and elongation test at break	Applicable for PVC insulation, PVC inner sheath & PVC outer sheath		VDE 0472	
(a)	Before ageing		T, A		
(b)	After ageing		T, A		
III.	Ageing in air oven	Applicable for PVC insulation & PVC outer sheath	T	VDE 0472	
IV.	Loss of mass in air oven test	For PVC insulation, PVC inner & PVC outer sheath	T	VDE 0472	
V.	Hot deformation test	For PVC insulation, PVC inner & PVC outer sheath	T	VDE 0472	
VI.	Heat shock test	For PVC insulation, PVC inner & PVC outer sheath	T	VDE 0472	
VII.	Shrinkage test	For PVC insulation, PVC inner & PVC outer sheath.	T	VDE 0472	
VIII.	Thermal stability test	For PVC insulation, PVC inner & PVC outer sheath	A	VDE 207	
IX.	Bleeding & Blooming Test	For PVC insulation & outer sheath.	T	IS 10810 Pt 19	

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL

	ANNEXURE C TO QP	CUSTOMER: NTPC - SAIL POWER CO. LTD.	PROJECT TITLE: 1 X 250 MW ROURKELA PP-II EXPANSION PROJECT	SPECIFICATION NUMBER: PE-TS-427-507- E016B
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R0	SPECIFICATION TITLE: TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLE
	SHEET	3 of 4	ITEM: SCREENED CONTROL CABLES (AS PER VDE)	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
X.	Cold Bend & Cold Impact test	For PVC inner & outer sheath.	T	VDE 0472	
XI.	Core marking, end sealing	For PVC insulation, PVC inner & PVC outer sheath	A	VDE-207	
4.0	Tests for Al-Mylar Shield				
I.	Continuity test	For Al-Mylar shield	T, A	Plant Standard	
II.	Shield thickness	For Al-Mylar shield	A	ADS	
III	Overlap test	For Al-Mylar shield	A	ADS	
IV	Constructional details, dimensions	For Al-Mylar shield	A	ADS	
V	Visual, surface finish+	For Al-Mylar shield	A	Plant Standard	
VI	Overall coverage	For Al-Mylar shield	A	Plant Standard	
VII	Noise interference test.	For Al-Mylar shield	T,A	ADS	
5.0	Tests for Drain Wire				
I.	Annealing test	For copper conductor only	T, A	IS 10810 Pt 1	<i>Internal in process Test Report to be furnished for both type & acceptance tests</i>
II.	Tin coating test (for tinned copper)	For copper conductor only	T, A	IS 10810 Pt 4	
III.	Resistance test	For Al/Cu	T, A, R	VDE 0815	
IV.	Diameter test	For conductor	T, A	ADS	
V.	Continuity test	For Al-Mylar shield	T, A	Plant Standard	
6.0	FRLS Tests				
I.	Oxygen index test	For PVC outer sheath & Filler	T, A	IS 10810 Pt 58 / ASTMD 2863	<i>Applicable for Inner Sheath if the same is indicated in Datasheet-A</i>
II.	Smoke density test	For PVC outer sheath only	T, A	ASTMD 2843	
III.	Acid gas generation test	For PVC outer sheath only & Filler	T, A	IS 10810 Pt 59 / IEC-754-1	
IV.	Temperature Index Test	For PVC outer sheath only	T	IS 10810 Pt 64 / ASTMD 2863	
7.0	Flammability Tests				

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL

	ANNEXURE C TO QP	CUSTOMER: NTPC - SAIL POWER CO. LTD.	PROJECT TITLE: 1 X 250 MW ROURKELA PP-II EXPANSION PROJECT	SPECIFICATION NUMBER: PE-TS-427-507- E016B
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R0	SPECIFICATION TITLE: TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLE
	SHEET	4 of 4	ITEM: SCREENED CONTROL CABLES (AS PER VDE)	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
I.	Flammability test for bunched cables	For complete cable	T,A	IS 10810 Pt 62/ IEC-60332 (Part- 3-23, CAT A/ CAT B.	Test & Category applicable as indicated in Datasheet-A
II.	Flammability test for single cable	For complete cable	T,A	IS: 10810 Pt 61 / IEC:60332 Part-1	
III.	Swedish chimney test	For complete cable	T,A	SEN SS 424 1475 (Class F3)	
IV.	Flammability test	For complete cable	T,A	IEEE: 383	
8.0	Electrical Tests				
I.	High Voltage Test	For complete cable	T, A, R	VDE 0815	
II.	Insulation Resistance Test (Volume resistivity method)	For complete cable	T, A, R	IS 10810 Pt 43	
III.	Conductor resistance	For complete cable	A,R	VDE 0815	
IV.	Spark test	Insulation	R	VDE 0207	
9.0	C&I Tests				
I.	Cross talk	For complete cable	T, A	ADS	
II.	Attenuation	For complete cable	T, A	ADS	
III.	Characteristic Impedance	For complete cable	T, A	ADS	
IV.	Mutual capacitance	For complete cable	T, A	ADS	
V.	Noise interference	For complete cable	T, A	ADS	
10	Complete Cable				
I.	Visual , surface Finish	Overall Cable	A	Plant Standard	
II.	Volume resistivity at room and elevated temperature	Overall Cable	A	IS 10810 Pt43/ ADS	
III.	Construction details, dimensions	Overall Cable	T, A	ADS	

BHEL	PARTICULARS	BIDDER/ VENDOR	
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	SIGNATURE		
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	ANNEXURE C TO QP	CUSTOMER: NTPC - SAIL POWER CO. LTD.	PROJECT TITLE: 1 X 250 MW ROURKELA PP-II EXPANSION PROJECT	SPECIFICATION NUMBER: PE-TS-427-507- E016B
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R0	SPECIFICATION TITLE: TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLE
	SHEET	5 of 4	ITEM: SCREENED CONTROL CABLES (AS PER VDE)	DOC. NO.

	NSPCL SAIL POWER COMPANY (P) LIMITED 1X250 MW T.P.P. AT ROURKELA TECHNICAL SPECIFICATION FOR POWER PLANT TURNKEY PACKAGE VOLUME : I	
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QUALITY ASSURANCE

INSTRUMENTATION CABLE													
TESTS													
ITEMS	Conductor Resistance ® & (A)	High Voltage ® & (A)	Insulation Resistance ® & (A)	Constructional detail, dimensions (A)	Outer-Sheath/core marking, end sealing (A)	Thermal Stability (A) +	Visual, Surface finish (A) +	Electrical Parameters ** (A) +	Persulphate Test (A) +	Overall/Coverage/Continuity (A)	Swidest chimney Test (SS-4241475) (A) ++	FRLS Test * (A) ++	Tensile & Elongation before & after aging (A) ++
1. Instrument cable twisted and shielded													
Conductor(IS-8130)	Y			Y		Y							
Insulation(VDE-207)				Y	Y	Y	Y						Y
Pairing/Twisting				Y	Y	Y							
Shielding				Y		Y			Y				
Drain wire	Y			Y		Y		Y	Y				
Inner Sheath				Y	Y	Y	Y					Y	Y
Outer Sheath				Y	Y	Y	Y					Y	Y
Over all cable	Y	Y	Y	Y	Y	Y	Y			Y			Y
Cable Drums(IS-10418)				Y		Y							
Note : High Temp. cables shall be subjected to tests as per VDE-207(Part-6) Compensating cables shall be checked for Thermal EMF/Endurance test as per IS 8784. Note : This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating his practice & Procedure along with relevant supporting documents during QP finalization for all item. Note : ® - Routine Test A - Acceptance Test Y - Test Applicable Note : Sampling Plan for Acceptance test shall be as per IS 8784 (As applicable) * FRLS Tests: Oxygen / Temp Index (ASTM D-2863), Smoke Density Rating (ASTM – D 2843), HCL Emission (IEC-754-1) ** Characteristic Impedence, Attenuation, Mutual Capacitance, Cross Talk (As applicable) + Sample size will be One No. of each size/type per lot. ++ Sample size will be One No. sample for complete lot offered irrespective of size/type.													

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		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R0	SPECIFICATION TITLE: TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLE
	SHEET	6 of 4	ITEM: SCREENED CONTROL CABLES (AS PER VDE)	DOC. NO.

Annexure-D to QP

	NTPC SAIL POWER COMPANY (P) LIMITED ROURKELA POWER PROJECT (PP – III : 1X250 MW) TECHNICAL SPECIFICATION FOR EPC PACKAGE	
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11.03.00 TYPE TEST REQUIREMENT FOR C&I SYSTEMS

Sl. No	Item	Test Requirement	Standard		NSPCL's Approval Req. On Test Certificate
Col 1	Col 2	Col 3	Col 4		Col 6

8	Instrumentation Cables Twisted & Shielded*			
-Conductor	Resistance test	VDE-0815		Yes
	Diameter test	IS-10810		Yes
	Tin Coating test (Persulphate test)	IS-8130		Yes
-Insulation	Loss of mass	VDE 0472		Yes
	Ageing in air ovens**	VDE 0472		Yes
	Tensile strength and elongation test before and after ageing**	VDE 0472		Yes
	Heat shock	VDE 0472		Yes
	Hot deformation	VDE 0472		Yes
	Shrinkage	VDE 0472		Yes
	Bleeding & blooming	IS-10810		Yes

Rourkela Power Project (PP – III : 1 x 250 MW) EPC Package	Technical Specification Section – VI, Vol – II D Bid Doc. No. : CC&M-C-347-211	Chapter no. 11 Type test requirement	Page 4 of 8
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BHEL	PARTICULARS	BIDDER/ VENDOR	
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	ANNEXURE C TO QP	CUSTOMER: NTPC - SAIL POWER CO. LTD.	PROJECT TITLE: 1 X 250 MW ROURKELA PP-II EXPANSION PROJECT	SPECIFICATION NUMBER: PE-TS-427-507- E016B
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R0	SPECIFICATION TITLE: TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLE
	SHEET	7 of 4	ITEM: SCREENED CONTROL CABLES (AS PER VDE)	DOC. NO.

	NTPC SAIL POWER COMPANY (P) LIMITED ROURKELA POWER PROJECT (PP – III : 1X250 MW)	
	TECHNICAL SPECIFICATION FOR EPC PACKAGE	

-Inner sheath***	Loss of mass	VDE 0472	Yes
	Heat shock	VDE 0472	Yes
	Cold bend/ cold impact test	VDE 0472	Yes
	Hot deformation	VDE 0472	Yes
	Shrinkage	VDE 0472	Yes
-Outer sheath	Loss of mass	VDE 0472	Yes
	Ageing in air ovens**	VDE 0472	Yes
	Tensile strength and elongation test before and after ageing**	VDE 0472	Yes
	Heat shock	VDE 0472	Yes
	Hot deformation	VDE 0472	Yes
	Shrinkage	VDE 0472	Yes
	Bleeding & blooming	IS-10810	Yes
	Color fastness to water	IS-5831	Yes
	Cold bend/ cold impact test	VDE-0472	Yes
	Oxygen index test	ASTMD-2863	Yes
	Smoke Density Test	ASTMD-2843	Yes
	Acid gas generation test	IEC-60754-1	Yes
-fillers	Oxygen index test	ASTMD-2863	Yes
	Acid gas generation test	IEC-60754-1	Yes
-AL-MYLAR shield	Continuity test		Yes
	Shield thickness		Yes
	Overlap test		Yes
-Over all cable	Flammability Test	IEEE 383	Yes
	Swedish Chimney Test	SEN 4241475	Yes
	Noise interference	IEEE Transactions	Yes

Rourkela Power Project (PP – III : 1 x 250 MW) EPC Package	Technical Specification Section – VI, Vol – II D Bid Doc. No. : CC&M-C-347-211	Chapter no. 11 Type test requirement	Page 5 of 8
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BHEL	PARTICULARS	BIDDER/ VENDOR	
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	ANNEXURE C TO QP	CUSTOMER: NTPC - SAIL POWER CO. LTD.	PROJECT TITLE: 1 X 250 MW ROURKELA PP-II EXPANSION PROJECT	SPECIFICATION NUMBER: PE-TS-427-507- E016B
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R0	SPECIFICATION TITLE: TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLE
	SHEET	8 of 4	ITEM: SCREENED CONTROL CABLES (AS PER VDE)	DOC. NO.

	NTPC SAIL POWER COMPANY (P) LIMITED ROURKELA POWER PROJECT (PP – III : 1X250 MW)	
	TECHNICAL SPECIFICATION FOR EPC PACKAGE	

	Dimensional checks	IS 10810		Yes
	Cross talk	VDE-0472		Yes
	Mutual capacitance	VDE-0472		Yes
	HV test	VDE-0815		Yes
	Drain wire continuity			Yes

NOTE:

- All cables to be supplied shall be of type tested quality. 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 tests 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.
- In case 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 case the type test report(s) are not found to be meeting the specification requirements, the Bidder shall conduct all such tests either in an independent laboratory or at manufacturer's works in presence of Owner's representative under this contract free of cost to the Owner and submit the reports for approval.

These tests shall be carried out as per VDE0207 Part 6 & ASTM-D2116 for TEFLON insulated & outer sheathed cables *Applicable for armored cables only.

Date of Bid Opening : 11 June 2015

Rourkela Power Project (PP – III : 1 x 250 MW) EPC Package	Technical Specification Section – VI, Vol – II D Bid Doc. No. : CC&M-C-347-211	Chapter no. 11 Type test requirement	Page 6 of 8
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