

RAJASTHAN RAJYA VIDYUT UTPADAN NIGAM LIMITED
2 X 660 MW SURATGARH SUPERCRITICAL TPS UNIT # 7 & 8

**TECHNICAL SPECIFICATION FOR
SCREENED CONTROL CABLES**

DOC. NO. PE-TS-392-507-E004
REVISION 0

VOLUME II



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
SCREENED CONTROL CABLES**

SPECIFICATION NO. PE-TS-392-507-E004

VOLUME II-B

SECTION -

REVISION 0

DATE: 06.05.14

SHEET 1 OF 1

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TOTAL NO. OF SHEETS		=41

**IT IS CONFIRMED THAT OUR TECHNICAL OFFER COMPLIES WITH THE SPECIFICATION
IN TOTO, & THAT THERE ARE NO TECHNICAL DEVIATIONS.**

BIDDER'S STAMP & SIGNATURE
(REFER INSTRUCTION NO. 1 OF "INSTRUCTIONS TO BIDDERS")



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INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. Two signed and stamped copies of the following shall be furnished by all bidders as technical offer:
 - a. Unpriced Price Schedule (Annexure-A: BOQ, as enclosed with the specification) with bidder's signature and company stamp.
 - b. A copy of this sheet ("Instructions to Bidders for Preparing Technical Offer"), with bidder's signature and company stamp.
 - c. A copy of previous sheet ("List Of Contents"), with bidder's signature and company stamp.
2. No technical submittal such as copies of type test certificates, data Sheets, write-up, drawing, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.
3. Confirmations/ comments (if any) regarding delivery schedules shall be furnished as part of the commercial offer. Any reference elsewhere/ covering letter of technical offer shall not be considered by BHEL.
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 cable description/ quantities, notes etc. from those given in Annexure-A to Section-C of specification [Bill Of Quantities] shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).

BIDDER'S STAMP & SIGNATURE

	DOCUMENT TITLE TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES	SPECIFICATION NO. PE-TS- 392-507-E004	
		VOLUME II B	
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PREAMBLE

1 The Tender documents contain three (3) volumes. The bidder shall meet the requirements of all three volumes.

1.1 VOLUME - I CONDITIONS OF CONTRACT

This consists of four parts as below:

- Volume – IA** This part contains Instructions to bidders for making bids to BHEL.
- Volume – IB** This part contains General Commercial Conditions of the Tender & includes provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.
- Volume – IC** This part contains Special Conditions of Contract.
- Volume – ID** This part contains Commercial Conditions for Erection & Commissioning site work, as applicable.

1.2 VOLUME – II TECHNICAL SPECIFICATIONS

Technical requirements are stipulated in Volume – II, which comprises of:-

- Volume – IIA** General Technical Conditions.
- Volume – IIB** Technical Specification including Drawings, if any.

1.3 VOLUME – IIB

This volume is sub-divided in to following sections:-

- Section – A:** This section outlines the Intent of Specification.
- Section – B:** This section provides "Projection Information".
- Section – C:** This section indicates Technical Requirements specific to Contract, not covered in Section – D.
- Section – D:** This section comprises of Technical requirements specific to Contract.

Data Sheet-A: Specific data and other requirements pertaining to the equipments.

Data sheet–C: Indicates data / documents to be furnished after the award of Contract as per agreed schedule by the vendor (as applicable)



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SECTION – 'A'

SCOPE OF ENQUIRY



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SECTION A

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SCOPE OF ENQUIRY

- 1.0 This specification covers the design, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to site of **Screened Control Cables** as mentioned in different sections of this specification for **2X660 MW SURATGARH SUPERCRITICAL TPS UNIT #7 & 8**.
- 2.0 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 up to bidder's guarantee.
- 3.0 The general terms and conditions, instructions to bidders and other attachment referred to elsewhere are hereby made part of the Technical Specification.
- 4.0 The bidders shall be responsible for and governed by all requirements stipulated hereinafter.
- 5.0 Requirements of the specification including the QP shall be agreed upon for total compliance by bidders without any deviations. Price offers of only those bidders complying with this requirement shall be acceptable
- 6.0 The documents shall be in English language and MKS system of units.



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**TECHNICAL SPECIFICATION FOR
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DOC. NO. PE-TS-392-507-E004

VOLUME II B

SECTION B

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SHEET

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SECTION – 'B'

PROJECT INFORMATION

SECTION: B

PROJECT INFORMATION

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 1 OF 3

1.0	Owner	Rajasthan Rajya Vidyut Utpadan Nigam Ltd., Jaipur
2.0	Consulting Engineer	TATA Consulting Engineers Ltd. 73/1, St. Marks Road, Bangalore – 560 001 Tel : 080 – 6622 6000 Fax : 080 – 22274874
3.0	Location of the plant	Prabat Nagar, Suratgarh Sriganganagar district, Rajasthan.
4.0	Latitude and longitude	Latitude : 29 deg. 10 min. N Longitude : 74 deg.01 min. E
5.0	Elevation above mean sea level	186 m (approximate)
6.0	Climatic conditions	
6.1	Temperatures : Monthly basis	
	Mean of daily max.	32.8 deg.C (in the month of May)
	Mean of daily min.	17.6 deg.C (in the month of Jan)
6.2	Temperatures : Annual basis	
	Mean of daily max.	32.3 deg.C
	Mean of daily min.	19.6 deg.C
	Highest temperature recorded	50 deg.C
	Lowest temperature recorded	(-) 2.8 deg.C
	Design Ambient Temperature for Electrical Equipment design	50 deg C
6.3	Relative humidity	Varies between 21% and 81%
6.4	Annual average rain fall	312 mm
6.5	Annual mean wind speed :	4 km / hr.
7.0	Wind load	

ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 2 OF 3

	Calculations for wind effect shall be in accordance with IS:875-1987(Part-3) taking into account the following:	
	a) Basic wind speed = 47 m/sec	
	b) Factor K1 = 1.07	
	c) Category of terrain = Category 2	
	d) K3 – as per IS 875	
8.0	Seismic data (As per IS: 1893 latest issue)	
	a) Zone	Zone II
	Designs & design coefficients shall be based on IS 1893:2002	
	Design condenser cooling water inlet temperature	33 Deg C
9.0	Auxiliary power supply:	
	Auxiliary electrical equipment to be supplied against this specification shall be suitable for operation on the following system:	
	a) For motors rated 160 kW and below.	415V AC, 3-phase, 3-wire effectively earthed.
	b) For motors rated above 160 kW and up to 1500 kW	6600V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	c) For motors rated above 1500kW	11000V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	d) For motor control centres	415V AC, 3-phase, 3/4-wire effectively earthed.
	e) DC motor starters, DC solenoids, DC alarm control and protection	220 V DC, 2-wire unearthed
	f) AC control & protective devices	110 V 1 phase, 50Hz, 2 wire AC supply. The single phase 110V AC supply shall be derived by VENDOR by providing 415V / 110 V Control transformers of adequate rating with MCCB / MCB on both the primary and secondary sides.
	g) Uninterrupted power supply	230 V, 1-phase, 50 Hz, 2-wire, AC

ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 3 OF 3

		supply (For all instrumentation and control system equipment and solenoid valves)
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g) Lighting fixtures and space heaters 240 V, 1 phase, 2 wire, 50Hz, solidly earthed system

h) Construction supply 415 V, 3 phase, 4 wire, 50Hz AC supply with neutral lead solidly earthed.

i) The above voltages may vary as follows :

All devices shall be suitable for continuous operation over the entire range of voltage and frequency indicated below without any change in their performance.

AC supply	Voltage variation $\pm 10\%$ Frequency variation $\pm 5\%$
DC supply	Combined voltage & frequency variation 10% Voltage variation $+10\%$, -15%

j) For instrument and control system of steam generator and steam turbine generator. 230 V $\pm 5\%$ AC UPS, 1-phase, 50 Hz, 2-wire. The 24 V DC required for control system shall be generated from this UPS.

10.0 All the electrical equipment shall be designed for 50° C reference ambient temperature.

ISSUE
R1



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VOLUME II-B

SECTION - C

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SECTION – 'C'

SPECIFIC TECHNICAL REQUIREMENTS



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
SCREENED CONTROL CABLES**

SPECIFICATION NO. PE-TS-392-507-E004

VOLUME II-B

SECTION - C

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1.0 SCOPE OF ENQUIRY

- 1.1 This enquiry covers the supply of the **screened control cables** conforming to this specification.
- 1.2 General technical requirements of the cables are indicated in Section-D and Datasheet-A. Project specific technical/ quality requirements/ changes are listed below.
- 1.3 Cables shall conform in all respects to the requirements stipulated in all the above parts of the specification.
- 1.4 The stipulations of Section-C, followed by those of Datasheet-A shall prevail in case of any conflict between the stipulations of Section-C, Datasheet-A and Section-D.

2.0 BILL OF QUANTITIES:

- 2.1 Quantity requirements shall be as per Annexure-A enclosed with this section.
- 2.2 The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ enclosed with this specification. The unit prices shall apply for adjustment of variation in quantity as stipulated above. (Type Test charges to be included in price of cable.)
- 2.3 The cable quantities will be released for manufacture in more than one lot. Ordered quantities, which are indicated in the Bill of Quantities, shall be released for manufacture along with LOI. Manufacturing of Lot-I cables shall be done after the approval of technical and quality documentation and supplies shall be completed within delivery time as per NIT. Subsequent lots shall be cleared for manufacture based on progress of engineering and site requirements.
- 2.4 Delivery schedule for the package shall be given separately to the bidders for compliance.
- 2.5 Bidder's offer shall be for complete scope as per specification. Part offers are not acceptable.

3.0 SPECIFIC TECHNICAL REQUIREMENTS

- 3.1 Specific technical requirements shall be as listed below:

3.1.1 Technical:

S. No.	Reference Clause No. of Section D (if any)	Specific Requirement/ Change
1	2.4.1 b, c & d	May be read as - 2.4.1 (b). Additionally "The type tests are required to be conducted as indicated in Annexure to QAP and the same shall be offered for inspection (conduction of type tests shall be witnessed by BHEL). Bidder to indicate unit price of cables inclusive of type test charges. No separate charges shall be payable for type tests.
2	2.4.1 e	Refer S. No. 1 above.
3	4.1	Two signed and stamped copies of the following shall be furnished by all bidders as technical offer : (i) Un-priced Price Schedule Annexure-A as enclosed with the specification) with bidder's signature and company stamp. (ii) A copy of "Instruction to Bidders for Preparing Technical Offer" sheet, with bidder's



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		signature and company stamp. (iii) A copy of "List Of Contents" sheet, with bidder's signature and company stamp. <u>No other documentation is required to be submitted as technical offer. Any information contained in other parts of the offer (e.g. covering letter, annexure, etc.) which is deviating from specification requirements in any way shall not be considered by BHEL as part of offer.</u>
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3.1.2: Quality/ Inspection:

S. No.	Reference Clause No. of Section D (if any)	Specific Requirement/ Change
1	2.2	QP (Including Annexure to QAP) enclosed with spec. shall be stamped and signed by bidders as token of acceptance. The QP shall be submitted during contract stage for customer/BHEL approval without any commercial implications to BHEL.
2	2.4.1(d)	All Tests shall be conducted as per contract. Conduction of Testing requirements mentioned in datasheet-A & Annexure to QAP.

3.1.3 : A label shall be securely attached to each end of the reel indicating the length, type, voltage grade, conductor size and number of core of the cable. Also Weight of cable drum with and without cables and type of end sealing to be indicated. A tag containing the same information shall be attached to the leading end of the cable inside. An arrow and necessary instructions shall be marked on the drum indicating the direction in which it should be rolled.

4.0 SPECIFIC QUALITY ASSURANCE REQUIREMENTS

4.1 Quality Plan applicable for project:

BHEL Standard Quality Plan no. PED-507-00-Q-004/01A (Enclosed with specification).

4.2 Cables supplied shall be subjected to type tests, routine tests and acceptance tests as specified below and according to relevant standards.

4.3 Type, Acceptance & Routine Test Requirements:

- Refer Quality Plan and Annexure-I of Quality plan for Type tests, Acceptance tests & Routine tests requirement.
- Minor changes in the final Type Test Procedures (which shall be to BHEL approval during contract stage) shall be acceptable to Vendor without any commercial implication.

5.0 Bidders shall confirm total compliance to specification without any deviations from the technical/ quality assurance requirements.

6.0 TECHNICAL AND QUALITY DOCUMENTATION TO BE SUBMITTED

By Successful Bidder (for approval during contract stage) [Document No. & title as given below]

SCREENED CONTROL CABLES



DOCUMENT TITLE

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SL. No.	DOCUMENT TITLE	DWG. / DOCUMENT No.	SUBMISSION SCHEDULE
1	Data Sheet for Screened Control Cables	PE-V0-392-507-E501	Within Two weeks from the date of LOI
2	Cross-sectional Drawings for Screened Control Cables	PE-V0-392-507-E502	Within Two weeks from the date of LOI
3	Type Test Procedure for Screened Control Cables	PE-V0-392-507-E503	Within Two weeks from the date of LOI
4	Quality Plan for Screened Control Cables	PE-V0-392-507-E506	Within Two weeks from the date of LOI
5	Type Test Reports for Tests conducted in last five years	PE-V0-392-507-E504	Within Two weeks from the date of LOI
6	Type Test Reports for Tests conducted for this contract	PE-V0-392-507-E505	Within a week from the date of conduction of Type Test

7.0 Document distribution schedule for the project shall be as below



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S. NO.	DESCRIPTION	No. hard /soft copies	No. of CD-ROMs	REMARKS
1	Docs. /drgs. for approval (First submission)	PDF File + 2 Hard copies	NIL	
2	Drgs. / docs. for approval (Second & subsequent submission till approval)	PDF File + 2 Hard copies	NIL	
3	Final approval drgs. / docs. for Distribution after CAT-1.	PDF File + 5 Hard Copies	NIL	
4	As Built drgs./doc.	6 Hard Copies	4 CD-ROMS	
5	Operation, Erection & Maintenance manual for approval	PDF File + 2 Hard Copies	NIL	
6	Approved Operation & Maintenance Manual for distribution	PDF File + 6 Hard Copies	4 CD-ROMS	
7	Type Test Certificates/ Reports for approval	PDF+ 2 hard Copies	NIL	
8	Type Test Certificates/ Reports for distribution	6 hard Copies	6 CD-ROMS	

2 X 660 MW SURATGARH SUPERCRITICAL TPS UNIT # 7 & 8

**ANNEXURE - A
BOQ-CUM-PRICE SCHEDULE FOR SCREENED CONTROL CABLE**

1.0) MAIN SUPPLY

1.1) Individual & Overall Screened Cable (Type-F)

1100V grade twisted paired cable with stranded high conductivity annealed, tinned copper extruded PVC insulation (Type-A), individual & overall screened with Aluminium Mylar tape & drain wire, extruded PVC inner sheath (Type ST1), Galvanised steel round wire(if dia under armour is upto 13 mm) or formed wire(if dia under armour is more than 13 mm) armour as per IS 3975 and IS 1554 part-I, with overall FRLS PVC outer sheath (Type ST1), generally conforming to IS:1554 Part-I (latest)

S.No.	Item Code	Item Description	UOM	Order Quantity	LOT-1 Quantity	Unit Price (Ex-Works) Rs	Total Price (Ex-Works) Rs
1.1.1	507-31120-A	1.1kV TYPE F(IO) 2P - 0.5 ARMoured	KM	45	32		
1.1.2	507-31009-A	1.1kV TYPE F(IO) 4P - 0.5 ARMoured	KM	110	77		
1.1.3	507-31013-A	1.1kV TYPE F(IO) 8P - 0.5 ARMoured	KM	41	29		
1.1.4	507-31001-A	1.1kV TYPE F(IO) 12P - 0.5 ARMoured	KM	26	18		
1.1.5	507-31005-A	1.1kV TYPE F(IO) 20P - 0.5 ARMoured	KM	20	14		

1.2) Overall Screened Cable (Type-G)

1100V grade twisted paired cable with stranded high conductivity annealed, tinned copper extruded PVC insulation (Type-A), overall screened with Aluminium Mylar tape & drain wire, extruded PVC inner sheath (Type ST1), Galvanised steel round wire(if dia under armour is upto 13 mm) or formed wire(if dia under armour is more than 13 mm) armour as per IS 3975 and IS 1554 part-I, with overall FRLS PVC outer sheath (Type ST1), generally conforming to IS:1554 Part-I (latest).

S.No.	Item code	Item Description	UOM	Order Quantity	LOT-1 Quantity	Unit Price (Ex-Works) Rs	Total Price (Ex-Works) Rs
1.2.1	507-31025-A	1.1kV TYPE G(O) 2P - 0.5 ARMoured	KM	26	18		
1.2.2	507-31029-A	1.1kV TYPE G(O) 4P - 0.5 ARMoured	KM	210	147		
1.2.3	507-31033-A	1.1kV TYPE G(O) 8P - 0.5 ARMoured	KM	186	130		
1.2.4	507-31017-A	1.1kV TYPE G(O) 12P - 0.5 ARMoured	KM	91	64		
1.2.5	507-31118-A	1.1kV TYPE G(O) 2P - 0.75 ARMoured (CONDUCTOR , STRAND DIAMETER 0.193mm)	KM	5	3		
1.2.6	507-31119-A	1.1kV TYPE G(O) 4P - 0.5 ARMoured (CONDUCTOR , STRAND DIAMETER 0.193mm)	KM	47	33		

Notes : (Applicable for main supply)

- Quantities indicated above at **S. No. 1.1 & 1.2** shall be known as Order Quantities. The variation in quantities of all sizes for **Main supply (S. No. 1.1 & 1.2)** put together shall be limited to (-) 30% to (+) 30% of the total contract value derived on the basis of the Ordered quantities for this very project.
- The quantities will be released for manufacture in more than one lot.
- The LOT-1 quantities, which are indicated above, shall be released for manufacture along with LOI. However, manufacturing of LOT-1 quantities shall be done after the approval of technical and quality documentation. Subsequent lots shall be cleared for manufacture based on progress of engineering and site requirements.
- Delivery schedule of LOT-1 and subsequent lots shall be as per NIT.
- The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ in the Price Schedule. The unit price shall apply for adjustment of variation in quantity as stipulated above.
- Overall variation on dispatched quantity of each size shall be (-) 2% and (+) 0%. Cables consumed for testing and inspection shall be to bidder's account.
- The tolerance of drum length shall be +/- 5%. Short lengths of individual cable size not less than 300m may be accepted only in the final drum length to complete the supply within the overall variation limits stipulated above.
- In case of the quantities of any one lot cleared by BHEL for manufacturing are manufactured and offered for inspection by successful bidder in more than one batch, BHEL reserves the right to witness type testing on all batches without any price implications.
- Type Test charges are deemed to be included in price of cables. No separate Type Test charges to be quoted by bidder.
- The charges of Hydrolytic Stability test, if asked to perform shall be reimbursed extra at actual against original money receipt of Govt. lab (CPRI/ERDA).

ANNEXURE - A
BOQ-CUM-PRICE SCHEDULE FOR SCREENED CONTROL CABLE

2.0) MANDATORY SPARES**2.1) Individual & Overall Screened Cable (Type-F)**

1100V grade twisted paired cable with stranded high conductivity annealed, tinned copper extruded PVC insulation (Type-A), individual & overall screened with Aluminium Mylar tape & drain wire, extruded PVC inner sheath (Type ST1), Galvanised steel round wire(if dia under armour is upto 13 mm) or formed wire(if dia under armour is more than 13 mm) armour as per IS 3975 and IS 1554 part-I, with overall FRLS PVC outer sheath (Type ST1), generally conforming to IS:1554 Part-I (latest)

S.No.	Item Code	Item Description	UOM	Order Quantity	Unit Price (Ex-Works) Rs	Total Price (Ex-Works) Rs
2.1.1	507-31000-B	1.1kV TYPE F(IO) 2P - 0.5 ARMoured	KM	1		
2.1.2		1.1kV TYPE F(IO) 4P - 0.5 ARMoured	KM	1		
2.1.3		1.1kV TYPE F(IO) 8P - 0.5 ARMoured	KM	1		
2.1.4		1.1kV TYPE F(IO) 12P - 0.5 ARMoured	KM	1		
2.1.5		1.1kV TYPE F(IO) 20P - 0.5 ARMoured	KM	0.5		

2.2) Overall Screened Cable (Type-G)

1100V grade twisted paired cable with stranded high conductivity annealed, tinned copper extruded PVC insulation (Type-A), overall screened with Aluminium Mylar tape & drain wire, extruded PVC inner sheath (Type ST1), Galvanised steel round wire(if dia under armour is upto 13 mm) or formed wire(if dia under armour is more than 13 mm) armour as per IS 3975 and IS 1554 part-I, with overall FRLS PVC outer sheath (Type ST1), generally conforming to IS:1554 Part-I (latest).

S.No.	Item code	Item Description	UOM	Order Quantity	Unit Price (Ex-Works) Rs	Total Price (Ex-Works) Rs
2.2.1	507-31000-B	1.1kV TYPE G(O) 2P - 0.5 ARMoured	KM	1		
2.2.2		1.1kV TYPE G(O) 4P - 0.5 ARMoured	KM	1		
2.2.3		1.1kV TYPE G(O) 8P - 0.5 ARMoured	KM	1		
2.2.4		1.1kV TYPE G(O) 12P - 0.5 ARMoured	KM	1		
2.2.5		1.1kV TYPE G(O) 2P - 0.75 ARMoured (CONDUCTOR , STRAND DIAMETER 0.193mm)	KM	1		
2.2.6		1.1kV TYPE G(O) 4P - 0.5 ARMoured (CONDUCTOR , STRAND DIAMETER 0.193mm)	KM	1		

Notes : (Applicable for mandatory spares only)

- Quantities indicated above at **S. No. 2.1 & 2.2(mandatory spares)** shall be known as Order Quantities(**mandatory spares**). The quantities are firm & there is no variation in the ordered quantities.
- Quantity of mandatory spares indicated above shall be released alongwith Lot-1 of Main supply at BOQ S.No.-1.0 after approval of technical and quality documentation. One drum of each type & size from the total quantities released (Lot-1 of Main Supply at BOQ S.No.-1.0 + Mandatory spares at BOQ S.No.-2.0) will be declared as mandatory spares and shall be clearly identified.
- Delivery schedule shall be as per NIT.
- The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ in the Price Schedule.
- No negative tolerance is allowed on drum length of mandatory spare.

ANNEXURE-B1

ANNEXURE FOR PAIR / UNIT IDENTIFICATION AS PER IEC-60189-2 - REV 0

PAIR	a-wire	b-wire	
1	White	Blue	First unit
2	White	Orange	
3	White	Green	
4	White	Brown	
5	Red	Blue	2nd unit
6	Red	Orange	
7	Red	Green	
8	Red	Brown	
9	Black	Blue	3rd unit
10	Black	Orange	
11	Black	Green	
12	Black	Brown	
13	Yellow	Blue	4th unit
14	Yellow	Orange	
15	Yellow	Green	
16	Yellow	Brown	
17	WHITE-blue	Blue	5th unit
18	WHITE-blue	Orange	
19	WHITE-blue	Green	
20	WHITE-blue	Brown	

For 2P and 4P - Pairs shall be colour coded as given above. Also, cores of each pair shall be numbered for pair

For 8P, 12P, 16P and 20P - 4 pairs shall be twisted together to form a unit and pairs of each unit shall be colour coded as given above. Also, each unit of the cable shall be identified by an open helical lapping of non-hygroscopic and non-wicking material (polyester tape) of distinctive colour as per Table-1 given below.

TABLE -1
Unit Identification

Unit no.	1	2
Colour of lapping	Blue	Orange
Unit no.	3	4
Colour of lapping	Green	Brown
Unit no.	5	
Colour of lapping	Grey	



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
SCREENED CONTROL CABLES**

SPECIFICATION NO. PE-TS- 392-507-E004

VOLUME II B

SECTION D

REVISION 0

DATE: 06.05.14

SHEET 1 OF 3

SECTION – 'D'

STANDARD TECHNICAL SPECIFICATION



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
SCREENED CONTROL CABLES**

SPECIFICATION NO. PE-TS- 392-507-E004

VOLUME II B

SECTION D

REVISION 0

DATE: 06.05.14

SHEET 2 OF 3

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 Section- C and Datasheet-A as attached for project specific requirements.

2.0 QUALITY ASSURANCE REQUIREMENTS

- 2.1 Bidder shall confirm compliance with the BHEL Quality Plan as attached with the specification without any deviations.
- 2.2 In the event of BHEL Quality Plan not being applicable for a project (as indicated in section-C of the project specification), the successful bidder shall submit the Manufacturing Quality Plan (MQP) for approval by BHEL/ Owner (as applicable) during detailed engineering stage without any commercial implications.
- 2.3 Bidders shall submit their list of proven sub-vendors for raw materials, which will be subject to BHEL/ Customer approval.
- 2.4 Type testing requirements and routine/ acceptance testing requirements shall be as detailed below.

2.4.1 Type Tests on Cables

- a. All cables to be supplied shall conform to type tests as per relevant standards and proven type.
- b. The bidder shall furnish the reports of all the type tests carried out in within last five years of the date of bid opening. These reports should be for the tests conducted either in government approved third party laboratory or witnessed by client (such as major utilities/ industries) on identical/ similar cables to those ordered under this contract.
- c. In case bidder is not able to submit report of type test(s) conducted in last five years, or in case type tests report(s) are not found to be meeting the specification/ relevant standard requirements, then all such tests shall be conducted under this contract by the bidder free of cost to BHEL, and reports shall be submitted for approval. No charges shall be paid for testing under such circumstances.
- d. Irrespective of the bidder furnishing type test report as indicated above, BHEL may get type tests conducted on the lots offered for inspection. Separate price shall be quoted for the conduction of type testing per lot, which shall be used for cost comparison. A maximum of three lots shall be considered for price comparison purposes on account of type testing. However, type-testing charges shall be paid as per type test conducted.
- e. Minor changes in the final Type Test Procedures (which shall be to approval during contract stage) shall be without any commercial implication.

2.4.2 Routine and Acceptance Tests

- a. 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.
- b. Acceptance tests shall be conducted on every lot offered for inspection as per details indicated in Datasheet A.
- c. Cost of conduction of routine and acceptance testing shall be deemed to have been included in the quoted supply prices.

2.4.3 Cost of cables consumed for testing shall be to bidder's account.



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3.0 Packing

- 3.1 Cables shall be supplied in non-returnable heavy construction drums. All wooden parts shall be manufactured from seasoned wood treated with copper naphthenates/ zinc naphthenates (refer IS: 401). 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.

4.0 PROJECT SPECIFIC TECHNICAL AND QUALITY DOCUMENTATION TO BE SUBMITTED**4.1 By All Bidders (PLEASE REFER CLAUSE 6.1, SECTION-C OF TECHNICAL SPECIFICATION)**


As technical offer:

- a. A copy of Section B (Project Information) as enclosed with enquiry with bidder's signature and company seal.
- b. A copy of Section C (Project Specific Technical Requirements) as enclosed with enquiry with bidder's signature and company seal.
- c. A copy of Annexure-A to Section-C, Bill of Quantities as enclosed with enquiry with bidder's signature and company seal.
- d. A copy of Datasheet-A as enclosed with enquiry with bidder's signature and company seal.

No other documentation is required to be submitted as technical offer. Any information contained in other parts of the offer (e.g. covering letter, annexures, etc.) which is deviating from specification requirements in any way shall not be considered by BHEL as part of offer.

4.2 By Successful Bidder (for approval during contract stage)**(PLEASE REFER CLAUSE 6.2, SECTION-C OF TECHNICAL SPECIFICATION)**

- a. Datasheet C in the format provided to the successful bidder along with LOI.
 - b. Cross-section drawings of the cables
 - c. Manufacturing Quality Plan in case BHEL SQP is not applicable.
 - d. List of sub-vendors/ suppliers of raw materials
 - e. Type test procedure
 - f. Field Quality Plan
 - g. Technical catalogues/ literature for the cables.
- 4.3 Two copies of the above documentation shall be submitted for first review. Number of copies to be submitted for second and subsequent submissions (till Cat-I approval is accorded), and those for final distribution prints of approved documentation and test certificates shall be as indicated separately in section C.
- 4.4 Wherever required, soft copy of all approved technical/ quality documentation shall be submitted as specified without any additional commercial implication. Soft copies may be required both in native file format (e.g. MS Word/ MS Excel) as well as PDF files.

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		VOLUME II-B	
		SECTION - Data sheet- A	
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DATA SHEET-A
SPECIFIC TECHNICAL REQUIREMENTS

1.0 Type of cable : FRLS SCREENED CONTROL CABLES

2.0 Standards Applicable :

S. No.	STANDARD	APPLICATION
1	IS-1554-I	General Construction & tests for cables.
2	IS-694	For insulation thickness.
3	Class F3 of Swedish standard SEN-SS-424-1475, IEC-60332 Part 1, IEEE 383, IS-10810 Part-53, IS 10810 Part-61 & 62 (Category-A),	Flammability Tests
4	ASTMD-2843, ASTMD-2863, IEC-60754 Part-1	FRLS Tests

3.0 Voltage grade : 1.1 Kv


4.0 CONDUCTOR

a) Material : High conductivity multi stranded
Annealed tinned Copper

b) Conductor size : 1) 0.5 sq. mm. (7 Strands of 0.3 mm. dia) applicable for all 0.5sqmm cable of BOQ(Annexure-A) except for Item S.No.-1.2.6 & 2.2.6 of BOQ(Annexure-A) for which Clause-2 below shall be applicable.

2) 0.5 sq. mm. (Strand diameter 0.193 mm., No. of Strands to be decided by Vendor) applicable for Item S.No.-1.2.6 & 2.2.6 of BOQ (Annexure-A)

3) 0.75 sq. mm. (Strand diameter 0.193 mm., No. of Strands to be decided by Vendor) applicable for Item S.No. 1.2.5 & 2.2.5 of BOQ(Annexure-A)

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5.0 INSULATION

- a) Material : PVC Type A as per IS- 1554 Part-I & IS- 5831
- b) Application : Extruded
- c) Insulation thickness : 0.6mm

6.0 ARMOURING

- a) Material : Galvanized steel round wire/ stripped 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

7.0 LAYING OF CORES


- a) Min. number of twist per Metre for paired cables. : 20
- b) Maximum lay of individual twisted pair : 50 mm

- 8.0 IDENTIFICATION OF CORES : As per IEC-60189 Part-2(Annexure-B1 to Section-C)

- 9.0 CABLING ELEMENT : A "Pair" of two insulated conductors twisted together designated by alphabet "p" printed on binding tape at 200mm intervals.

10.0 INDIVIDUALLY SCREENED

- a) Material : Aluminium-Mylar tape
- b) Coverage : 100%

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c) Overlap : Minimum 20%

11.0 OVERALL SCREENED

a) Material : Aluminium-Mylar tape
b) Coverage : 100%
c) Over lap : Minimum 20%

12.0 RIP CORD : Non-metallic rip cord shall be provided under the core wrapping.

13.0 DRAIN WIRE

To be provided separately for individual pair shield (wherever applicable) and overall shield.


a) Material : Annealed tinned copper drain wire
b) Size : 0.5 sq. mm.

14.0 BEDDING

a) Material : Mylar tape

15.0 INNER SHEATH

a) Material : Extruded PVC Type ST1 as per IS- 5831
b) Whether FRLS : No
c) Fillers : Acceptable
d) Material of fillers : Same as inner sheath
e) Method of application
i) With fillers : Pressure / Vacuum Extrusion
ii) With out fillers : Pressure Extrusion
f) Inner sheath Thickness: As per IS-1554 Part-1
g) Colour : Black

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16.0 FILLERS


- a) Fillers : Acceptable, only if Flame Retardant & Moisture Resistant

17.0 OUTER SHEATH

- a) Material : Extruded PVC Type ST1 as per IS- 5831
- b) Thickness : As per IS-1554 Part-1
- c) Application : Extruded
- d) Colour : Black
- e) Whether FRLS : YES
- f) Other Properties : The sheath shall be resistant to Water, UV radiation, fungus, termite & rodent attack.

18.0 FRLS/ FLAMMABILITY TESTS

- a) Oxygen Index : 29% Minimum when tested at 27 +/- 2 deg. C as per ASTM D 2863
- b) Temperature Index : 250 °C Minimum at Oxygen index value of 21 as per ASTM D 2863
- c) Acid gas generation : less than 20% by weight (As per IEC-754-1)
- d) Average area under curve (Smoke density rating) : Not more than 60% (As per ASTM D 2843)
- e) Flammability Test : (a) As per IEC-60332-1 (b) IEEE-383 (c) Swedish Chimney SS-424-1475, class F3 (d) IS-10810(Part-53) (e) IS10810 Part-61 & 62(Category group-A)
- f) Ultraviolet radiation Test : As per BS EN ISO 4892-2 (Duration of UV radiation test shall be 14 days)

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19.0 TOLERANCE ON OVERALL : $\pm 2\text{mm}$ max. over the declared value in
DIAMETER Technical Data Sheet

20.0 VARIATION IN DIA & : Not more than 1 mm.
OVALITY AT ANY
CROSS-SECTION

21.0 DRUM LENGTH

a) Standard drum length : 1000 metres upto 12P
500 metres above 12P

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

22.0 MARKING


a) Marking to be provided
On outer sheath

Cable size (cross section area and no. of cores)
and voltage grade, @ 1m (by embossing)
Type of insulation, Type of inner & outer sheath
e.g. "FRLS" etc, @ 1m (by embossing)
Manufacturer's name and/ or trade name, and
year of manufacture @ 1m (by embossing)
'BHEL-PEM' and 'RRVUNL' @1m (by embossing)
Progressive sequential marking @ 1m (by embossing)

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

STANDARD CABLE PARAMETERS FOR INSTRUMENTATION CABLE

Parameter	0.5 mm ² (IS & OS) type-F	0.5 mm ² (OS) type-G (Strand Dia-0.3mm) / 0.5 mm ² (OS) type-G (Strand Dia-0.193mm)	0.75 mm ² (OS) type-G
Mutual Capacitance (max.) at 0.8 kHz, nF/Km	120	100/100	100
Conductor Loop Resistance (max.), Ohm/Km	73.4	73.4/80.2	53.4
Insulation Resistance (min), M Ohm/ Km	500	500/500	500

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Cross Talk attenuation (min) at 0.8kHz, dB	60	60/60	60
Characteristic impedance (max.) at 1 kHz	320	340/340	340
Attenuation (max.) at 1 kHz db/Km	1.2	1.2/1.2	1.2
Maximum Capacitance unbalance b/w any two pairs for 500m length of cable (pF)	400	400/400	400

Note :

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

24.0 Test voltage & duration

- (a) High Voltage Test, AC & DC Tests
Core to core & Core to shield : As per IS-1554 (Part-1)



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DATA SHEET-C

STANDARD SPECIFICATION - DATASHEET-C(FOR SCREENED CONTROL CABLES)
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)

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/	
	Cross Section area	sq. mm	
	g) Maximum conductor resistance per Km at 20°C	ohm	
8	Insulation		
	a) Reference Standard	-	
	b) Material composition	-	
	c) Minimum thickness	mm	
	d) Nom. Thickness	mm	
	e) Max. thickness	mm	
	f) Minimum volume resistivity as per IS 5831	Ohm cm	
	g) Dielectric constant	-	
	h) The insulation will withstand conductor operating temp. of 85°C	-	
	i) Core diameter including insulation	mm	

VENDORS DOCUMENT NO:
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SHEET OF 5

STANDARD SPECIFICATION - DATASHEET-C(FOR SCREENED CONTROL CABLES)
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)

S.No.	Particulars	Unit	Description
9	Core laying		
	a) Whether cores are twisted.	-	
	b) Maximum lay of twist	mm	
10	Individual Shield		
	a) Material	-	
	b) Thickness of tape	mm	
	c) Coverage/ Overlap	%	
	d) Noise interference better than	dB	
11	Drain wire for individual shield		
	a) Reference standard	-	
	b) Size/ No. of strands	sq. mm/ no.	
	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 at 20°C	Ohm/ km	
14	Fillers if applicable		
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) Minimum Coverage	%	
	c) Method of jointing	-	
	d) Breaking load of joint	-	
	e) Size (approx.)	mm	
	f) Dia of armour	mm	
	g) 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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STANDARD SPECIFICATION - DATASHEET-C(FOR SCREENED CONTROL CABLES)
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)

S.No.	Particulars	Unit	Description
	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 conductor	Kgs. / km	
	PVC (insulation, sheath & fillers)	Kgs. / km	
	Armour	Kgs. / km	
	Cable (approx.)	Kgs. / 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 0.8KHz (max)	nF/ km	
	d) Cross talk at 0.8KHz (min)	dB	
	e) Attenuation at 1 KHz (max)	dB/ km	
	f) Characteristic impedance max.	Ohm	
25	Continuous operating temp. (deg.C)	deg. C	
26	Whether complete cable Flame retardant as per IS-10810 Part-62 (Category-B)	-	
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	-	
	Voltage	V	
	Duration	hrs/days	
28	Min bending radius	mm	
29	Ovality at any cross section	mm	
30	Variation of dia through out cable length		
31	Cable cross-sectional drawings for each type of cable furnished		

STANDARD SPECIFICATION - DATASHEET-C

(FOR SCREENED CONTROL CABLES)
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)





S.No.	Particulars	Unit	Description
32	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	
33	Type test procedures as per BHEL Technical Spec. and other relevant standards enclosed.		
34	Anti termite & rodent test		


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		QUALITY PLAN SHEET 1 OF 5		CUSTOMER :		PROJECT			SPECIFICATION : PE-TS-392-507-E004			
				BIDDER/ VENDOR :		TITLE			NUMBER :			
				SYSTEM		QUALITY PLAN NUMBER PED-507-00-Q-004/01A			SPECIFICATION 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			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL											
1.1	PVC Compound(for insulation and sheath)	1. Physical properties	MA	Physical Tests	Sample	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Log Book/ Test Cert.	3/2	-	2	
		2. Elec.Properties (INSULATION)	MA	Electrical Tests	Sample	-do-	-do-	-do-	3/2	-	2	
		3. FRLS Properties (outer sheath)	CR	Environmental	Sample	-do-	-do-	-do-	3/2	-	2	
1.2	Galvanised steel wire/strip	1. Phy.and Elec. Properties	MA	Physical & Electrical Tests	Sample*	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	3/2	-	2	* Sample from each Batch/Lot.
		2. Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	-	2	
		3.Galvanization Quality	MA	Galv.Tests	-do-	-do-	-do-	-do-	3/2	-	2	
1.3	Copper Rods/ Wires (For conductor/ drain wire)	1. Physical Properties	MA	Physical Tests	-do-	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	3/2	-	2	
		2.Electrical properties	CR	Electrical Tests	-do-	-do-	-do-	-do-	3/2	-	2	
1.4	Fillers	1. FRLS Properties	CR	Chemical/ Environ. test	-do-	-do-	-do-	-do-	3/2	-	2	
1.5	Screen	1. Dimension	MA	Measurement	-do-	Appd. Data Sheet	Appd. Data Sheet	TC & IR	3/2	-	2	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN SHEET 2 OF 5		CUSTOMER :		PROJECT			SPECIFICATION : PE-TS-392-507-E004			
				BIDDER/		TITLE			NUMBER :			
				VENDOR		QUALITY PLAN			SPECIFICATION :			
				SYSTEM		NUMBER PED-507-00-Q-004/01			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			REMARKS
1	2	3	4	5	6	7	8	9	10	P	W	V
2.0	IN PROCESS	2.. Mech. Prop.	MA	Mech test	-do-	MFRS. STD.	MFRS. STD.	TC & IR	3/2	-	2	(Applicable only for drain wire in case of un-tinned conductor)
2.1	Wire Drawing , Tinning and Annealing	1. Physical, Electrical, surface finish & dimension	CR	Phy.&Elect. Tests Visual & Meas.	Sample	Relevant Std./ BHEL Specn.	Relevant Std./ BHEL Specn.	Log Book	2	-	1	
		2. Chemical test for Tinning	CR	Chemical Test (Persulphate test)	Sample	-do-	-do-	-do-	2	-	-	
2.2	Stranding of wires	1. No.of wires	MA	Counting	Sample	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	2	-	-	
		2. Sequence, lay length & Direction	MA	Visual, Meas	Sample	Relevant Standard/ Vendor's Spec.	Relevant Standard/ Vendor's Spec.	-do-	2	-	-	
		3 Surface Finish	MA	Visual	Sample	-do-	-do-	-do-	2	-	-	
		4.Dimension	MA	Measurement	Sample	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	2	-	-	
2.3	Core Insulation (No repair permitted)	1. Surface finish	MA	Visual	100%	-	Free from bulging burnt particles lumps, cuts & Scratches.	-do-	2	-	1	
		2 Insulation thickness	CR	Measurement	Sample	Appd.data sheet/ Relevant Std.	Appd.data sheet/ Relevant Std.	-do-	2	-	-	
			PARTICULARS			BIDDER/VENDOR						
BHEL			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 3 OF 5		CUSTOMER :		PROJECT TITLE			SPECIFICATION : PE-TS-392-507-E004				
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-507-00-Q-004/01			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
2.4	Core pairing, screening (provision of drain wire & laying)	3. Concentricity #	CR	Measurement	Sample	Mfr's Std./Appd. data sheet	Mfr's Std./Appd. data sheet	Log Book	2	-	1	# To be checked at starting & finish end of Extruded Length	
		4 Dia over insulation	MA	Measurement	Sample	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	2	-	-		
		5. Spark Test or Water Immersion test	CR	Electrical	100%	Mfr's Std.	Mfr's Std.	-do-	2	-	1		
		6. Core identification	MA	Visual	100%	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	2	-	-		
		1. Pair identification	MA	Visual	100%	BHEL Spec. & appd. Data sheet	BHEL Spec. & 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	-	1		
		4. Sequence of lay and lay length	MA	Visual meas	Sample	BHEL Spec. & MFRs. Std.	BHEL Spec. & MFRs. Std.	-do-	2	-	1		
		5. Screen overlap & coverage	MA	Measurement	Sample	BHEL Spec.	BHEL Spec.	-do-	2	-	-		
		6. Dia over laid up core	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-		
2.5	InnerSheath Extrusion	7. Continuity of drain & drain wire with Screen	MA	Elect. Test	100%	<-----No Discontinuity ----->		-do-	2	-	-		
		1. Surface finish	MA	Visual	100%	--	Free from bulging, burnt particles, lumps cuts & scratches.	-do-	2	-	-	(Applicable for armoured cables)	
		2. Sheath thickness	MA	Measurement	Sample	BHEL Spec. & appd. Data sheet	BHEL Spec. & appd. Data sheet	-do-	2	-	-		
			PARTICULARS			BIDDER/VENDOR							
BHEL			NAME										
			SIGNATURE										
			DATE						BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN SHEET 4 OF 5		CUSTOMER :		PROJECT			SPECIFICATION : PE-TS-392-507-E004			
				BIDDER/ VENDOR :		TITLE			NUMBER :			
				SYSTEM		QUALITY PLAN NUMBER PED-507-00-Q-004/01			SPECIFICATION : 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			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.6	Armouring	3.Dia over inner sheath	MA	Measurement	Sample	BHEL Spec. & appd. Data sheet	BHEL Spec. & appd. Data sheet	-do-	2	-	-	
		1. No.of wires/Strips	MA	Counting	At the start of the process	BHEL Specn./ Appd. Data sheet	BHEL Specn./ Appd. Data sheet	-do-	2	-	-	
		2. Lay Direction	MA	Visual	-do-	-do-	-do-	-do-	2	-	-	
		3. Lay Length	MA	Visual, Meas.	At the start of the process	Rel. Std./ BHEL Specn./Appd. Data sheet	Rel. Std./ BHEL Specn./Appd. Data sheet	Log Book	2	-	-	
		4. Coverage	MA	Measurement	-do-	BHEL Specn./Appd. Data sheet	BHEL Specn./Appd. Data sheet	-do-	2	-	-	
		5. Dia over armouring	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
2.7	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	BHEL Specn./Appd. Data sheet	BHEL Specn./Appd. Data sheet	Log Book	2	-	-	
		3. Dia over outer sheath	MA	Measurement	Sample	-do-	-do-	-do-	2	-	-	
		4. Marking	MA	Visual	100%	BHEL Specn./Appd. Data sheet	BHEL Specn./Appd. Data sheet	Test Report	2	-	-	Sequential marking shall be done by printing
2.8	Finished Cable	1. Routine Test	CR	Elec. & Meas.	100%	BHEL Specn./Appd. Data sheet	BHEL Specn./Appd. Data sheet	Test Report	2	-	1	
		2. Type & FRLS Tests	CR	Elec., Phy & Meas.	Sample *	BHEL Specn./Appd. Data sheet	BHEL Specn./Appd. Data sheet	Test Report	2	-	1	* One Drum/Size/Lot
			PARTICULARS			BIDDER/VENDOR						
BHEL			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : PE-TS-392-507-E004				
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-507-00-Q-004/01			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	
									P	W	V		
1	2	3	4	5	6	7	8	9	10			11	
3.0	Final Inspection	1. Finish & Length	MA	Visual	(See remark)	BHEL specn./ Relevant Std	Free from Bulging Burnt particles, lumps, cuts & scratches	Test Report	2	1	-	One drum in a Lot <	

ANNEXURE-I TO QUALITY PLAN

TYPE, ACCEPTANCE & ROUTINE TEST PROCEDURE

S.No.	Test Description	Reference documents for test procedure	Test conduction required as
Test for Conductor			
1	Annealing test (Before stranding)*	IS: 10810 Part-1 & IS: 8130	T, A (*)
2	Resistance test at 20 Deg.C	IS: 10810 Part-5& IS: 8130	T, A, R
3	Tin Coating test (for tinned copper)	IS: 10810 Part-4& IS: 8130	T
4	Diameter test	Approved Data-sheet	T
Physical test for PVC insulation & PVC Sheath			
1	Test for thickness	IS: 10810 Part-6, IS: 1554 Part-1, IS-694 & BHEL Spec. as per Approved Data-sheet	T, A
2	Tensile strength & Elongation test	IS: 10810 Part-7 & IS: 1554 Part-1	T, A
3	Ageing in air oven	IS: 10810 Part-11 & IS: 5831	T
4	Loss of mass in air oven	IS: 10810 Part-10& IS: 5831	T(**)
5	Hot deformation test	IS: 10810 Part-15& IS: 5831	T(**)
6	Heat Shock test	IS: 10810 Part-14& IS: 5831	T
7	Shrinkage test	IS: 10810 Part-12& IS: 5831	T
8	Thermal Stability test	IS: 10810 Part-60& IS: 5831	T
9	Bleeding & Blooming test	IS: 10810 Part-19& IS: 5831	T
10	Volume resistivity	IS: 10810 Part-43& IS: 5831	T
11	Cold bend test	IS: 10810 Part-20& IS: 5831	T
12	Cold Impact test	IS: 10810 Part-21& IS: 5831	T
13	Colour fastness to daylight	IS: 10810 Part-18& IS: 5831	T
14	Colour fastness to water	IS: 5831	T
15	Oxygen index test	ASTM-D-2863 & IS: 10810 Part-58	T, A
16	Smoke density test	ASTM-D-2843 & IS: 10810 Part-63	T, A
17	Acid gas generation test	IEC-60754 Part-1 & IS: 10810 Part-59	T, A
18	Temperature index test	ASTM-D-2863 & IS: 10810 Part-58	T, A
Tests for filler (Applicable incase of (i) Unarmoured cable and (ii) Innersheath FRLS cable)			
1	Oxygen index test	ASTM-D-2863 & IS: 10810 Part-58	T
2	Temperature index test	ASTM-D-2863 & IS: 10810 Part-64	T
3.	Acid gas generation test	IEC-60754 Part-1 & IS: 10810 Part-59	T
Tests for Al.mylar screen			
1	Continuity test	Plant Standard	T, A (*)
2	Shield thickness	Approved Data-sheet	T
3	Minimum Overlap	Approved Data-sheet	T
4	Noise interference test	Approved Data-sheet	T
Tests for Drain Wire			
1	Annealing test (Before	IS: 10810 Part-1 & IS: 8130	T, A

ANNEXURE-I TO QUALITY PLAN

TYPE, ACCEPTANCE & ROUTINE TEST PROCEDURE

	stranding)		
2	Drain wire resistance with Shield at 20 Deg.C	Approved Data-sheet	T, A, R
3	Tin Coating test (for tinned copper)	IS: 10810 Part-4& IS: 8130	T, A
4	Diameter test	Approved Data-sheet	T
5	Continuity test	Plant standard.	T
	Tests for Armour		
1	Dimensions of armour wire	IS: 3975 & IS-10810 Part-36	T, A
2	Tensile strength & % Elongation test	IS: 3975 & IS-10810 Part-37	T, A
3	Torsion test	IS: 3975 & IS-10810 Part-38	T, A
4	Winding test	IS: 3975 & IS-10810 Part-39	T, A
5	Uniformity of zinc coating test	IS: 3975 & IS-10810 Part-40	T, A
6	Mass of zinc coating test	IS: 3975 & IS-10810 Part-41	T, A
7	Armour wire resistivity at 20 Deg.C	IS: 3975 & IS-10810 Part-42	T, A
	Tests for finished cable		
1	Insulation resistance constant	IS-10810 Part-43 & IS: 5831, BS: 5308	T, A
2	High Voltage test	IS: 1554-1, IS: 10810 Part-45 & Approved Data-sheet	T,R,A
3	Flame retardance test	Approved Data-sheet	T,A
4	Flammability Test	As per Swedish Chimney SS-424-1475(class F3), IS-10810(Part-53), IS10810 Part-61 & 62(Category group-A), IEC-60332-1, IEEE-383,	T
5	Noise interference test	Approved Data-sheet	T
6	Outer Diameter check	IS: 10810 Part-6 & Approved Data-sheet	T,A
7	Mutual capacitance check	Approved Data-sheet	T, A
8	Conductor loop resistance	Approved Data-sheet	T, A
9	Cross talk test	Approved Data-sheet	T, A
10	Attenuation test	Approved Data-sheet	T, A
11	Characteristic impedance	Approved Data-sheet	T, A
12	Maximum capacitance unbalance	Approved Data-sheet	T,A

ANNEXURE-I TO QUALITY PLAN

TYPE, ACCEPTANCE & ROUTINE TEST PROCEDURE

13	Drain wire continuity test	Plant standard.	T
14	Rodent & Termite Repulsion test for outer sheath	Approved Data-sheet/ As per plant standard	T
15	Anti-Fungal Test	Approved Data-sheet/ As per plant standard	T
16	<u>UV radiation test</u>	<u>BS EN ISO 4892-2</u>	<u>T (***)</u>

Legends :

T = Type test.

A = Acceptance test.

R = Routine test.

* Internal in process Test Report to be furnished.

** Applicable for Outer Sheath only.

*** This test shall be conducted on one sample for the entire contract and duration of these tests shall be 14 days.

Sampling plan for type test shall be as per Quality plan.

Note-

1) Hydrolytic test if asked to perform shall be conducted as per ASTM D 3137.