ODISHA POWER GENERATION COMPANY LIMITED
2x660 MW IB TPP BANHARPALLI UNITS 3 & 4

VOLUME – IIB

TECHNICAL SPECIFICATION
FOR

SCREENED CONTROL CABLES

SPECIFICATION NO: *PE-TS-391-507-E004*
REVISION: *0*

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UP (INDIA) – 201301

CONTENTS

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")

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	SPECIFICATION NO. PE-TS- 391-507-E004	
	TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES	VOLUME II B	
		SECTION	
		REVISION 0	DATE: 06.09.14
		SHEET 1 OF 1	

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)

SECTION – 'A'

SCOPE OF ENQUIRY

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 IB VALLEY, OPGCL TPS.**

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.

SECTION – 'B'

PROJECT INFORMATION

PROJECT INFORMATION

INTRODUCTION

1.	**Owner**	OPGCL
2.	**Project**	2X660 MW OPGCL IB VALLEY BANHARPALLI TPP.
3.	**Owner's consultant**	DCPL KOLKATTA
4.	**Location**	JHARSUGUDA DISTT. OF ORISSA.
5.	**Nearest Airport**	Bhubaneshwar
6.	**Nearest Railway Station**	Belapur (40 kms) Jharsuguda (40 kms)
7.	**Access to site**	From Jharsuguda railway station By bus or taxi
8.	**Site data**	
A	**Altitude**	199.5 M above Mean Sea Level
B	**Ambient Air Temperature**	
1.	Design maximum	48ºC
2.	Design Minimum	04ºC
3.	Design Wet Bulb	38.9/28.0/33.4ºC (summer/ winter/ monsoon)
C	**RELATIVE HUMIDITY**	
	Average Relative Humidity	21/33/87% (summer/ winter/ monsoon)
D	**RAINFALL**	
1.	Average Annual Rainfall	1460 mm
2.	Maximum Recorded in 24 Hrs.	257.8 mm
E	**WIND VELOCITY & PRESSURE [AS PER IS:875]**	
1.	Basic wind speed at 10 m height	In accordance with IS-875 (Part 3) – 1987 (reaffirmed 2003) for a basic wind speed of 44 m/sec.

2.	Average Wind Velocity	Summer: 37 – 45 km/hr Winter: 15 - 26 km/hr Maximum: 259 km/hr (cyclonic)
F	**SEISMIC ZONE**	Zone-3 as per IS-1893 (2002)
9.0	**Power Supply**	
	a) In plant generation	21 kV ± 5%, 3ph, 50 ± 3%Hz
	b) In plant distribution	11 kV ± 10%, 3ph,3 W, 50 Hz (+ 3% to -5%) 3.3 kV ± 10%, 3ph,3 W, 50 Hz (+ 3% to -5%)
	c) Motor rated above 200 kW& up to 1500 kW	3.3 kV ± 10%, 3ph, 3 W, 50 Hz (+ 3% to -5%)
	d) Motor rated above 200W to 200kW	415V ± 10%, 3ph, 50 Hz (+ 3% to -5%)
	e) Motors rated 200 W and below, Lighting and small power	240V ± 10%, 1ph, 50 Hz (+ 3% to -5%)
	f) DC Motors	220V DC ± 10%, 2 wire ungrounded system
	g) Control supply for relay panel/ 6.6kV breakers/415V breakers	110V DC ± 10%, 2 wire ungrounded system
	h) UPS for instrumentation & Control system	415V AC ± 10 %, 3 ph, 50 Hz (+ 3% to -5%)
	i) Control supply for 415V Motor contactors/AC Control circuits [to be generated in MCC /panel by vendor]	240V AC ±10%, 50 Hz (+ 3% to -5%)
	j) Diesel Generator emergency supply	415V ± 10%, 3ph, 3W, 50 Hz (+ 3% to -5%)
	k) DC emergency lighting.	220V DC (+ 10% to -15%), 2 wire ungrounded system
NOTE:	**1. All equipment except generator shall be suitable for any combination of voltage**	

	and frequency variation. 2. **Any other power supply requirement shall be derived by the vendor from the above available power supplies.**	
10.0	**a) Design ambient temperature for electrical equipment in non-air conditioned area**	50ºC
	a) Design ambient temperature for electrical equipment in air conditioned area	During Summer & Monsoon: 23 ± 1°C & RH 50% ± 5% for main control room. During Summer & Monsoon: 24 ± 1°C & RH 50% ± 5% for non critical areas.
11.0	**Fault levels**	
	a) 400 kV	50 kA rms for 1 sec.
	b) 21 kV	145 kA rms for 1 sec.
	c) 11 kV	40 kA rms for 1 sec.
	d) 3.3 kV	40 kA rms for 1 sec.
	e) 415 V	50 kA rms for 1 sec.

SECTION – 'C'

SPECIFIC TECHNICAL REQUIREMENTS

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-A1 for Main supply & Annexure-A2 for mandatory spares, 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-A1 and Annexure-A2 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 signature and company

		stamp. (iii) A copy of "List of Contents" sheet, with bidder's signature and company stamp. 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.

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. Non-returnable wooden drum to be constructed from seasoned wood free from defects with wood preservative applied to the entire drum and Outermost layer covered with waterproof paper. Entire surface of the cable drum shall be painted.

4.0 SPECIFIC QUALITY ASSURANCE REQUIREMENTS

4.1 Quality Plan applicable for project:

BHEL Standard Quality Plan no. PE-QP-999-507-E004, R0 (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:

i. Refer Quality Plan and Annexure-I of Quality plan for Type tests, Acceptance tests & Routine tests requirement.

ii. 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 The list and schedule of deliverables to be submitted by successful bidder shall be as Annexure- B.

7.0 Document distribution schedule for the project shall be as per Annexure-C

ANNEXURE-B

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

SCREENED CONTROL CABLES

SL. No.	DOCUMENT TITLE	DWG. / DOCUMENT No.	SUBMISSION SCHEDULE
1	Data Sheet for Screened Control Cables	PE-V0-391-507-E141	Within Two weeks from the date of LOI
2	Cross-sectional Drawings for Screened Control Cables	PE-V0-391-507-E143	Within Two weeks from the date of LOI
3	Type Test Procedure for Screened Control Cables	PE-V0-391-507-E142	Within Two weeks from the date of LOI
4	Quality Plan for Screened Control Cables	PE-V0-391-507-E916	Within Two weeks from the date of LOI
5	Type Test Reports for Tests conducted in last five years	PE-V0-391-507-E145	Within Two weeks from the date of LOI
6	Type Test Reports for Tests conducted for this contract	PE-V0-391-507-E144	Within a week from the date of conduction of Type Test

ANNEXURE-C

DOCUMENTS / DRAWINGS DISTRIBUTION SCHEDULE

No. of prints to be submitted by vendor after award of contract shall be as under:

S.N.	Drawings and documents	Soft and Hard Prints
1.0	DRAWING FOR APPROVAL	
1.1	For approval	Soft+2 Hard Print
1.2	For customer approval	Soft+2 Hard Print
1.3	For final distribution	Soft+2 CD +5 Hard Print
2.0	DRAWING FOR REFERENCE	
2.1	For reference	Soft+2 Hard Print
2.2	For final distribution	Soft+2 CD+5 Hard Print
3.0	CERTIFICATE, REPORTS ETC.	Soft+2 Hard Print
4.0	AS BUILT DRAWINGS (IF REQUIRED)	Soft+2 CD+8 Hard Print
5.0	O&M MANUAL	
5.1	Draft for approval	Soft +3 CD+ 5 Hard Print
5.2	For final distribution	Soft +3 CD + 8 Hard Print
6.0	QUALITY PLAN / Field quality plan / PG test	Soft + 2 Hard Print

2 X 660 MW IB VALLEY, OPGCL TPS.

ANNEXURE - A1
BOQ-CUM-PRICE SCHEDULE FOR SCREENED CONTROL CABLE

A.0) MAIN SUPPLY

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

Multi pair (twisted) individual & overall shielded instrumentation cables. (Type-F)

S.No.	Item Code	Item Description	UOM	Order Quantity (Kms.)	LOT-1 Quantity (Kms.)	Drum Length (Mtrs.)	Unit Price (Ex-Works) Rs	Total Price (Ex-Works) Rs
1.1.1	507-31045-A	225V TYPE F(IO) 4P - 0.5 ARMOURED	KM	119	83	1000		
1.1.2	507-31049-A	225V TYPE F(IO) 8P - 0.5 ARMOURED	KM	71	50	1000		
1.1.3	507-31037-A	225V TYPE F(IO) 12P - 0.5 ARMOURED	KM	8	6	1000		
1.1.4	507-31041-A	225V TYPE F(IO) 20P - 0.5 ARMOURED	KM	19	13	500		

1.2) Overall Screened Cable (Type-G)

Multi pair (twisted) overall shielded instrumentation cables. (Type-G)

S.No.	Item code	Item Description	UOM	Order Quantity (Kms.)	LOT-1 Quantity (Kms.)	Drum Length (Mtrs.)	Unit Price (Ex-Works) Rs	Total Price (Ex-Works) Rs
1.2.1	507-31061-A	225V TYPE G(O) 2P - 0.5 ARMOURED	KM	96	67	1000		
1.2.2	507-31065-A	225V TYPE G(O) 4P - 0.5 ARMOURED	KM	50	35	1000		
1.2.3	507-31069-A	225V TYPE G(O) 8P - 0.5 ARMOURED	KM	237	166	1000		
1.2.4	507-31053-A	225V TYPE G(O) 12P - 0.5 ARMOURED	KM	27	19	1000		

Notes : (Applicable for main supply)

1 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.

2 The quantities will be released for manufacture in more than one lot.

3 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.

4 Delivery schedule of LOT-1 and subsequent lots shall be as per NIT.

5 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.

6 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.

7 Standard drum length shall be 1000 metres upto 12P & Standard drum length shall be 500 metres above 12P. 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 limit stipulated above.

8 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.

9 Type Test charges are deemed to be included in price of cables. No separate Type Test charges to be quoted by bidder.

2 X 660 MW IB VALLEY, OPGCL TPS.

ANNEXURE - A2

BOQ-CUM-PRICE SCHEDULE FOR SCREENED CONTROL CABLE

B.0) MANDATORY SPARES

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

Multi pair (twisted) individual & overall shielded instrumentation cables. (Type-F)

S.No.	Item Code	Item Description	UOM	Order Quantity (Kms.)	LOT-1 Quantity (Kms.)	Drum Length (Mtrs.)	Unit Price (Ex-Works) Rs	Total Price (Ex-Works) Rs
1.1.1	507-31000-B	225V TYPE F(IO) 4P - 0.5 ARMOURED	KM	2	2	1000		
1.1.2		225V TYPE F(IO) 8P - 0.5 ARMOURED	KM	2	2	1000		
1.1.3		225V TYPE F(IO) 12P - 0.5 ARMOURED	KM	2	2	1000		
1.1.4		225V TYPE F(IO) 20P - 0.5 ARMOURED	KM	2	2	500		

1.2) Overall Screened Cable (Type-G)

Multi pair (twisted) overall shielded instrumentation cables. (Type-G)

S.No.	Item code	Item Description	UOM	Order Quantity (Kms.)	LOT-1 Quantity (Kms.)	Drum Length (Mtrs.)	Unit Price (Ex-Works) Rs	Total Price (Ex-Works) Rs
1.2.1	507-31000-B	225V TYPE G(O) 2P - 0.5 ARMOURED	KM	2	2	1000		
1.2.2		225V TYPE G(O) 4P - 0.5 ARMOURED	KM	2	2	1000		
1.2.3		225V TYPE G(O) 8P - 0.5 ARMOURED	KM	2	2	1000		
1.2.4		225V TYPE G(O) 12P - 0.5 ARMOURED	KM	2	2	1000		

Notes : (Applicable for mandatory supply only)

1. Quantities indicated above for SI. NO. (B) shall be known as Order Quantities. The quantities are firm & there is no variation in the ordered quantities.
2. The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ-Cum-Price Schedule enclosed with this specification.
3. Standard drum length shall be 1000 metres upto 12P; & 500 metres for above 12P. No negative tolerance on drum for mandatory spare (as indicated above) is allowed.
4. Quantity of mandatory spares (indicated in Annexure-A2 above) shall be released alongwith Lot-1 (indicated in Annexure-A1) after approval of technical and quality documentation. The drums supplied against item B shall be clearly identified as "MANDATORY SPARE".
5. Delivery schedule of quantities indicated above shall be as per NIT.

ANNEXURE: B-I

CORE IDENTIFICATION / PAIR IDENTIFICATION

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.	PINK	=|===|==
2.		=||====||==
3.		=|||===|||==
4.		=||||===||||==
5.	ORANGE	=|===|==
6.		=||====||==
7.		=|||===|||==
8.		=||||===||||==
9.	VIOLET	=|===|==
10.		=||====||==
11.		=|||===|||==
12.		=||||===||||==

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 zthe second pair of the seventh unit.

SECTION – 'D'

STANDARD TECHNICAL SPECIFICATION

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.

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 napthenates/ zinc napthenates (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 SPEIFIC TECHNICAL AND QUALITY DOCUMENTATION TO BE SUBMITTED

4.1 By All Bidders (PLEASE REFER CLAUSE 3.1.1 at sl. No. 3, 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 7 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.

DATA SHEET-A
SPECIFIC TECHNICAL REQUIREMENTS

1.0	Type of cable	:	FRLS SCREENED CONTROL CABLES
2.0	Standards Applicable	:	VDE 0815, VDE 0207 Part-4 & Part-5, VDE 0816, VDE 0472, IS 1554-I, IEEE-383, SEN 4241475 class F3, IEC 332 Part-1, IEC 332 Part-3 Cat-B, IS 10810 (latest editions and its amendments).
3.0	Voltage grade	:	225 V (peak value)
4.0	CONDUCTOR		
	a) Material	:	High conductivity multi stranded Annealed Tinned Copper
	b) Grade	:	Electrolytic
	b) Standard applicable	:	VDE 0815
	c) Min number of strands, Dia and cross sectional area	:	7, 0.3 mm (nom), 0.5 sq.mm
5.0	INSULATION		
	a) Material	:	PVC compound Type –YI3, as per VDE 0207 Part 4
	b) Application	:	Extruded
	c) Insulation thickness:		
	Min/ Nom/ Max	:	0.28 / 0.3 / 0.35 (for 0.5 sq. mm)
	d) Volume resistivity (Min) in ohm-cm	:	$1x\ 10^{14}$ at 20 deg .C & $1x\ 10^{11}$ at 70 deg .C
6.0	LAYING OF CORES		
	a) Min. number of twist per Metre for paired cables.	:	20
	b) Maximum lay of individual twisted pair	:	50 mm
	c) Diameter of core	:	In accordance with clause 5 (c)

7.0 IDENTIFICATION OF CORES : Colour coding chart attached

8.0 INDIVIDUALLY SCREENED

a) Material : Aluminium-Mylar tape

b) Coverage : 100%

c) Overlap : Minimum 20%

d) Min thickness (Micron) : 28

9.0 OVERALL SCREENED

a) Material : Aluminium-Mylar tape

b) Coverage : 100%

c) Over lap : Minimum 20%

d) Min. thickness (Micron) : 55

11.0 DRAIN WIRE

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

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

b) Size (sq.mm.) : 7/ 0.51 sq.mm

11.0 ACCESSORIES (BEDDING, BINDER, TAPE REQ.)

a) Material : Flame Retardant Mylar Tape

12.0 INNER SHEATH

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

b) Thickness : As per VDE

b) Whether FRLS : NO

c) Fillers : Acceptable, Non hygroscopic flame retardant (as required for maintaining cable circularity)

d) Material of fillers : Same as inner sheath

e) Colour : BLACK

e) Method of application

i) With fillers : Pressure/ Vacuum extruded

ii) Without fillers : Pressure extruded

13.0 ARMOUR :

a) Material : Galvanised steel round wire, Conforming to IS: 3975

b) Size : As per IS 1554 Part 1

c) Coverage : 90%

d) Breaking load of joint : 95% of normal armour

e) 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

Nominal Thickness at any point : >1.8 mm

c) Application : Extruded

d) Colour : GRAY

e) Whether FRLS : YES

f) Other : Resistant to water, Termite, rodent Attack

15.0 RIP CORD : Non metallic undersheath

16.0 CHARACTERISTICS OF FRLS SHEATH & FLAMMABILITY TESTS

a) Oxygen Index : 29% Minimum as per ASTMD 2863

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

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

d) Smoke density rating : Not more that 60% (As per ASTMD 2843)

Derived as Average area under curve when the results of Smoke density plotted on a curve indicating light absorption v/s time as per ASTMD 2843

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

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

18.0 VARIATION IN DIA : Not more than 1.0 mm throughout the length of cable.

19.0 OVALITY AT ANY CROSS-SECTION : Not more than 1.0 mm.

20.0 DRUM LENGTH/ Material

a) Standard drum length : 1000 metres: upto and including 12 pairs
500 metres: above 12 pairs

b) Tolerance on drum length : ±5%

c) Material : Wooden drums

21.0 Markings on Outer Sheath

a) Progressive sequential Length marking to be provided : YES @ 1000 mm (max.) by Printing/ embossing

b) Progressive marking @ 5M : Manufacturers name, type of insulation, FRLS, 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' & 'OPGCL' shall also be marked @5m.

22.0 TECHNICAL PARAMETERS : Refer Table –1 attached

23.0 TEST VOLTAGE

		Core – Core	Core- shield
a)	High voltage test	: 1.5 kV RMS for 1 min	1.0 kV RMS for 1 min
b)	Resistance to direct current test	: 0.22 kV DC for 240 hrs/ 10 days	

24.0 RODENT & TERMITE REPULSION TEST : **Presence of lead shall be confirmed.** The test shall be carried out to also note the

presence of rodent and termite repelling chemical in PVC compound. Normal procedure is that a few chippings of the PVC compound are slowly ignited in a porcelain dish or crucible in a muffle furnace at about 600°C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). A drop of aqueous sodium-sulphide solution is placed on a thick filter paper and it is allowed to soak. The spot is touched with a drop of above extract. A black spot indicates the presence of anti-termite & rodent compound.

TABLE-1

Parameter	0.5 mm2 (I & OS) type-F	0.5 mm2 (OS) type-G
Mutual Capacitance (max.)at 0.8 kHz, nF/Km	**120**	**100**
Conductor Loop Resistance (max.), Ohm/Km	**73.4**	**73.4**
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**

Notes:

1. The voltage grade of instrumentation cable shall be 225 V (Peak).
2. Cable parameters indicated above are at 20 deg C (+/- 3 deg)

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 pre IS 5831	Ohm cm	
	g) Dielectric constant	-	
	h) The insulation will withstand conductor operating temp. of 85°C	-	
	i) Core diameter including insulation	mm	

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 ASTMD 2863)	-	

S.No.	Particulars	Unit	Description
	f) Temperature index (in deg. C as per ASTMD 2863)	-	
	g) Maximum acid gas generation as per IEC754-1	%	
	h) Maximum smoke density rating as per ASTMD 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 impedence 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		

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		

	QUALITY PLAN	CUSTOMER : OPGCL			PROJECT : 2X660 MW IB TPS TITLE			SPECIFICATION NUMBER PE-TS-391-507-E004				
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E004, REV 0.			SPECIFICATION TITLE				
	SHEET 1 OF 5	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	AGENCY W	AGENCY V	REMARKS
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	MA	Physical Tests	Sample	Relevant Standard/ Approved datasheet	Relevant Standard/ Approved datasheet	Log book/ Test Cert.	3/2	-	1/2	
		2. Elec.Properties	MA	Electrical Tests	Sample	-do-	-do-	-do-	3/2	-	1/2	
		SPECIFIC CHECKS :										
		a) Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2	-	1	
		b) Grade	MA	-do-	-do-	IS 613/ Approved datasheet	IS 613/ Approved datasheet	-do-	3/2	-	1	
		c) Resistivity	MA	Electrical Tests	Manufacturer	IS 613	IS 613	-do-	3/2	-	1	
1.2	PVC Compound (for insulation)	**GENERAL :**										
		1. Physical properties	MA	Physical Tests	Sample	Relevant Standard/ Approved datasheet	Relevant Standard/ Approved datasheet	Log book/ Test Cert.	3/2	-	1/2	
		2. Elec.Properties	MA	Electrical Tests	Sample	-do-	-do-	-do-	3/2	-	1/2	
		SPECIFIC CHECKS :										
		a) Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2	-	1	
		b) Type/ Grade	MA	-do-	-do-	Approved datasheet	Approved datasheet	-do-	3/2	-	1	
		c) Shelf life/ Storage condition	MA	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	3/2	-	1	
1.3	Screen / Tapes/ Binders	1. Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	TC & IR	3/2	-	1/2	
		2. Dimension	MA	Measurement	Manufacturer std.	Manufacturer datasheet/ Approved datasheet	Manufacturer datasheet/ Approved datasheet	TC & IR	3/2	-	1/2	
		3. T.S. & Elongation	MA	Physical Tests	-do-	Manufacturer datasheet	Manufacturer datasheet	-do-	3/2		1/2	
		4. Chem. & Phys. Properties	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			

		QUALITY PLAN	CUSTOMER : OPGCL			PROJECT : 2X660 MW IB TPS TITLE			SPECIFICATION NUMBER PE-TS-391-507-E004				
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E004, REV 0.			SPECIFICATION : TITLE				
		SHEET 2 OF 5	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**	
1.4	Fillers (as applicable)	1. Type	MA	Verify	-do-	Approved datasheet	Approved datasheet	-do-	3/2	-	1		
		2. Flame retardant & moisture resistant (as applicable)	CR	Chemical/ Environ.	-do-	-do-	-do-	-do-	3/2	-	2		
1.5	Galvanised steel wire/strip for Armour (if applicable)	**GENERAL :** 1. Make	MA	Verify	Manufacturer std.	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2	-	1		
		2. Dimension	MA	Measurement	-do-	-do-	-do-	-do-	3/2	-	2		
		3. Phy.and Elec. Properties	MA	Physical & Electrical Tests	Sample*	Relevant Standard/ Appd. Data Sheet/	Relevant Standard/ Appd. Data Sheet/	-do-	3/2	-	2	* Sample from each size/ Batch/Lot.	
		3.Galvanization Quality	MA	Galv.Tests	-do-	-do-	-do-	-do-	3/2	-	2		
1.6	PVC compound for Sheath	**GENERAL :** 1. Physical properties	MA	Physical Tests	Sample	Relevant Standard/ Approved datasheet	Relevant Standard/ Approved datasheet	Log book/ Test Cert.	3/2	-	1/2		
		2. Elec.Properties	MA	Electrical Tests	Sample	-do-	-do-	-do-	3/2	-	1/2		
		3. FRLS Properties (as applicable)	CR	Chemical/ Environ.	Sample	-do-	-do-	-do-	3/2	-	1/2		
		SPECIFIC CHECKS : a) Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2	-	1		
		b) Type/ Grade	MA	-do-	-do-	Approved datasheet	Approved datasheet	-do-	3/2	-	1		
		c) Shelf life/ Storage condition	MA	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	3/2	-	1		
1.7	Wooden drums	1. Phy. & Constructional checks	MA	Visual	Mfr's Plant Std.	IS 10418	IS 10418	Log book/ Test Cert.	3/2	-	1		
		2. Anti termite treatment	MA	Chem.	Mfr's Plant Std.	Mfr's Plant Std.	Mfr's Plant Std.	COC	3/2		1		
1.8	Steel drums	1. Dimension	MA	Meas.	Mfr's Plant Std.	Mfr's Plant Std.	Mfr's Plant Std.	Log book/ Test Cert.	3/2	-	1		
		2. Surface finish	MA	Meas.	-do-	-do-	-do-	-do-	3/2		1		
2.0	**IN PROCESS**												
2.1	Wire Drawing & Annealing.	1. Size	MA	Dimensional	Plant Mfg. Std.	Approved datasheet	Approved datasheet	Log Book	2	-	1		
		2. Surface finish	MA	Visual	-do-	Surface shall be smooth	Surface shall be smooth						
		3. % of Elongation	MA	Mechanical	-do-	IS 8130	IS 8130						
2.2	Tinning (Conductor or	1. Size	MA	Dimensional	Plant Mfg. Std.	Approved datasheet	Approved datasheet	Log Book	2	-	1	(Applicable only for tin-coated copper conductor and drain wire)	
	drain wire)	2. % of Elongation	MA	Mechanical	-do-	IS 8130	IS 8130						
2.3	Stranding of wires	1. No.of wires	MA	Counting	Plant Mfg. Std.	IS 8130/ Appd. Data Sheet	IS 8130/ Appd. Data Sheet	-do-	2	-	-		
			PARTICULARS		**BIDDER/VENDOR**								
	BHEL		**NAME**										
			SIGNATURE										
			DATE						BIDDER'S/VENDORS COMPANY SEAL				

	BHEL	**QUALITY PLAN**		CUSTOMER : OPGCL			PROJECT : 2X660 MW IB TPS TITLE			SPECIFICATION NUMBER PE-TS-391-507-E004			
				BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E004, REV 0.			SPECIFICATION : TITLE			
		SHEET 3 OF 5		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**		
		2. Resistance	CR	Electrical	-do-	-do-	-do-	-do-	2	-	-			
		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	-	-			
2.4	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 (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	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	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	-	1			
		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-	2	-	-			
			PARTICULARS		**BIDDER/VENDOR**									
	BHEL		**NAME**											
			SIGNATURE											
			DATE						BIDDER'S/VENDORS COMPANY SEAL					

		QUALITY PLAN	CUSTOMER : OPGCL			PROJECT : 2X660 MW IB TPS TITLE			SPECIFICATION NUMBER PE-TS-391-507-E004			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER: PE-QP-999-507-E004, REV 0.			SPECIFICATION : TITLE			
		SHEET 4 OF 5	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**
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	-	-	
			PARTICULARS		**BIDDER/VENDOR**							
	BHEL		**NAME**									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

	QUALITY PLAN	CUSTOMER : OPGCL			PROJECT : 2X660 MW IB TPS TITLE			SPECIFICATION NUMBER PE-TS-391-507-E004			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E004, REV 0.			SPECIFICATION : TITLE			
	SHEET 5 OF 5	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**
		4. Marking/ Colour/ Embossing	MA	Visual	100%	Appd. Data Sheet	Appd. Data Sheet	Test Report	2	-	-	Sequential marking shall be done by printing
		5. TS & % Elongation	MA	Mechanical	100%	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-		
3.0	Final Inspection	1. Finish & Length	MA	Visual	(See remark)	Relevant Standard/ Appd. Data Sheet	Free from Bulging Burnt particles, lumps, cuts & scratches	Test Report	2	1	-	One drum in a Lot
		2. Dimensions	MA	Measurement	Sample Lengths	Appd. Data sheet	Appd. Data sheet	Test Report	2	1	-	
		3. Armouring - Coverage No.of Wires/Strips	MA	Visual & Meas.	Sample	-do-	-do-	-do-	2	1	-	
		4. Marking/Colour/ pair identification	MA	Visual	-do-	-do-	-do-	-do-	2	1	-	
		5. Test for screening	CR	Elect. Test	-do-	-do-	-do-	-do-	2	1	-	
		6. Acceptance Tests	CR	Phy & Elect. Tests	sample	-do-	-do-	-do-	2	1		Refer Annexure to QAP for sampling plan.
		7. Type & FRLS Tests	CR	Measurement	Sample#	Appd. Data sheet	Appd. Data sheet	-do-	2	1	-	Refer Annexure to QAP 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.

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

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

A. Type Test Conduction:

1. Tests for which "T" is indicated in the 'Test Conduction Required As' column below shall be conducted as Type Test.

2. Sampling:
   a) Type test to be conducted on one size of each type/ lot.
   b) FRLS test & Electrical tests to be conducted on every size & type of cables.
   c) Flammability Test to be conducted only on one sample/ lot.

B. Acceptance Test Conduction:

1. Tests for which "A" is indicated in the 'Test Conduction Required As' column below shall be conducted as Acceptance tests.

2. Sampling:
   a) Sampling for acceptance tests shall be as per Appendix-B (Clause 15.2.2) of IS: 1554 Part-I.
   b) FRLS test & Electrical tests to be conducted on every size & type of cables.
   c) Flammability Test to be conducted only on one sample/ lot.

C. Routine Test Conduction:

1. Tests for which "R" is indicated in the 'Test Conduction Required As' column below shall be conducted as Routine tests.

D. C&I Tests listed in S.No-9.0 shall be conducted only one size/ type / lot.
E. 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	*Internal in process Test Report to be furnished for acceptance test*
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/ IS 10810	
2.0	Tests for Armour Wires/Strips				
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	T,A	IS 10810 Pt 36	

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
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 outer sheath	T, A	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 & outer sheath.	T	VDE 0472	
V.	Hot deformation test	For PVC Insulation, PVC Inner & outer sheath.	T	VDE 0472	
VI.	Heat shock test	For PVC Insulation, PVC Inner & 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 outer sheath only	T	VDE 207	
IX.	Hot set test	For PVC insulation only	T, A	IS 10810 Pt 30	
X.	Bleeding & Blooming test	For PVC Insulation, PVC Inner & outer sheath.	T	IS 10810 Pt 19	
XI.	Cold bend & Cold impact test	For PVC Inner & outer sheath.	T	VDE 0472/ IS 5831	
XII.	Colour Fastness to water	For PVC Outer sheath only.	T	IS 5831	
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	

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
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	A	ADS	
5.0	Tests for Drain Wire				
I.	Annealing test	For copper conductor only	T, A	IS 10810 Pt 1	*Internal in process Test Report to be furnished for acceptance test*
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.	Drain wire continuity test	For conductor	T, A	Plant Standard	
6.0	FRLS Tests				
I.	Oxygen index test	For PVC outer sheath & Fillers.	T, A	ASTMD 2863	Applicable for Inner Sheath if the same is indicated in Datasheet-A
II.	Smoke density test	For PVC outer sheath.	T, A	ASTMD 2843	
III.	Acid gas generation test	For PVC outer sheath.	T, A	IEC-754-1	
IV.	Temperature Index Test	For PVC outer sheath & Fillers.	T	ASTMD 2863	
7.0	Flammability Tests				
I.	Flammability test for single cable	For complete cable	T,A	IEC:60332 Part-1	Test & Category applicable as indicated in Datasheet-A
II.	Flammability test for bunched cable	For complete cable	A	IEC:60332 Part-3, CAT-B	
III.	Swedish chimney test	For complete cable	A	SEN SS 424 1475 (Class F3)	
IV.	Flammability test	For complete cable	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	IS 10810 Pt 43	
III.	Thermal ageing test	For complete cable	T	IS 1554-I	

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
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	
10.0	Anti-rodent and Termite Repulsion test	For PVC outer sheath only	A	ADS	Test applicable as indicated in Datasheet-A
11.0	Dimensional checks	For complete cable	T, A	ADS & IS 10810	