

**TELANGANA STATE POWER GENERATION
CORPORATION LIMITED**

1X800MW KOTHAGUDEM, TPS, STAGE-VII, UNIT#12

VOLUME – IIB

**TECHNICAL SPECIFICATION
FOR**

LT FRLSH HRPVC CONTROL CABLES

**SPECIFICATION NO : *PE-TS-410-507-E003*
REVISION : 0**



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



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
1.1 kV FRLSH HRPVC CONTROL
CABLES**

SPECIFICATION NO. PE-TS-410-507-E003

VOLUME II B

SECTION

REVISION 0

DATE: 15.05.2015

SHEET 1 OF 1

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TOTAL NO. OF SHEETS (including cover sheet) = **34**

**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')

	DOCUMENT TITLE	SPECIFICATION NO. PE-TS-410-507-E003	
	TECHNICAL SPECIFICATION FOR 1.1 kV FRLSH HRPVC CONTROL CABLES	VOLUME II B	
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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 BOQ-cum-Price Schedule (Annexure-A , writing 'Quoted' against items) 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 ("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 [BOQ-cum-Price Schedule] shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).
6. Vendor should have manufactured and supplied as on 24.12.2014:
 - a). At least 300 km of PVC insulated, PVC sheathed stranded copper conductor 1.1 kV grade cables in one single contract.
 - b). AT least one (1) km of Flame retardant low smoke cables.

Vendor to provide supportive document in above 6(a) & (b)

BIDDER'S STAMP & SIGNATURE



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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 Specifications of equipment complete with Data Sheets A and C.

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)

NOTE: This requirements mentioned in Section – C / Data Sheet – A of Section – D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section – D.



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SECTION – 'A'
SCOPE OF ENQUIRY



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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 LT FRLSH HRPVC CONTROL CABLES as mentioned in different sections of this specification for **1 X 800 MW KOTHAGUDEM 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 Bidders shall confirm total compliance to the specification without any deviations from the technical/ quality assurance requirements stipulated.
- 6.0 The documents shall be in English language and MKS system of units.



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SECTION – ‘B’

PROJECT INFORMATION

SECTION - B

PROJECT SYNOPSIS AND GENERAL INFORMATION

1.00.00 INTRODUCTION

The proposed 1x800 MW Kothagudem Thermal Power Station (KTPS), Stage-VII, Unit-12 would be set up by Telangana State Power Corporation Ltd. (TSGENCO) at Kothagudem, Telangana. The proposed Power Plant will be installed adjacent to the existing D colony of Kothagudem Thermal Power Station, at Kothagudem.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on the Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

2.00.00 APPROACH TO SITE

Site is located in the existing D Colony of Kothagudem Thermal Power Station, which is at a distance 30 km from temple town of Bhadrachalam and 300 km from Hyderabad by road. The Nearest railway station is Bhadrachalam Road (Known as Kothagudem) at a distance of 12 km. Kothagudem- Bhadrachalam National Highway branches off to the power station site near village Paloncha.

3.00.00 LAND

Land is primarily required for the main plant & auxiliaries (BTG) and balance of plant (BOP) like ash handling, coal storage, cooling tower, switchyard etc., which is available within the existing plant boundary.

The existing colony is to be dismantled, and the land of about 137 acres will be used for the main plant building, water facilities, switchyard, coal handling etc. The raw water reservoir will be located adjacent to the existing raw water reservoirs.

230 acres of land required for Ash Dyke will be procured. Land is available for staff colony, which is to be constructed by the EPC contractor.

4.00.00 SOURCE OF COAL

100% Imported and Blended coal (50% imported + 50% indigenous) will be used. Indigenous coal shall be sourced from Suliyari coal mines, Madhya Pradesh.

Telangana State Power Generation Corporation Ltd.
1x800 MW Kothagudem TPS

5.00.00 **SOURCE OF WATER**

Source of water (total quantity of water is 2192 m³/hr) is Godavari River near Burgampahad & water will be pumped through existing GRP pipe line (of length approx. 26 km).

6.00.00 **ASH DISPOSAL AREA**

Ash shall be dumped in the ash dump area which will be about 9 km from plant. The ash dyke area of 230 acres is adequate for 1x800 MW unit as per MOEF norms.

7.00.00 **SALIENT DESIGN DATA**

7.01.00 Meteorological data of site is given below:-

Elevation above MSL	:	89 m
Monthly highest temperature	:	44.9 °C
Monthly lowest temperature.	:	12.9 °C
Rainfall		
	Average.:	1031 mm
	Max. :	100 mm/ hr
Mean Wind speed	:	5.8 kmph
Relative Humidity		
	Max :	82%
	Min :	35%
Seismic Zone	:	Zone-III as per IS- 1893 (Part-IV)

[Climatological data of Khammam is attached for reference].



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SECTION – ‘C’

SPECIFIC TECHNICAL REQUIREMENTS



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1.0 SCOPE OF ENQUIRY

- 1.1 This enquiry covers the supply of 1.1 KV FRLSH HRPVC Control cables conforming to this specification as detailed below.
- 1.2 General technical requirements of the cables are indicated in Section-D and Data Sheet-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 Data Sheet-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 (Bill of Quantities (BOQ)) enclosed.
- 2.2 Delivery schedule (i.e. contractual calendar dates) for the package shall be given separately to the bidders for compliance. Supplies shall be completed conforming to the lot requirements stipulated in the BOQ within the overall delivery schedule.
- 2.3 The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ in the unit price schedule enclosed with this specification. The unit prices shall apply for adjustment of variation in quantity as stipulated above.

3.0 SPECIFIC TECHNICAL REQUIREMENTS

3.1 Specific technical requirements shall be as listed below :

3.1.1 Technical:

- (i) Control cables shall be 1100 V grade, multi core, minimum 2.5 sq mm cross section, stranded copper conductor having minimum 7 strands, Extruded HRPVC insulated, HRPVC inner sheathed, galvanised steel wire armoured, overall FRLSH HRPVC outer sheathed generally conforming to IS 1554 part-I.
- (ii) The sheath shall be resistant to water, fungus, termite and rodent attacks.
- (iii) The outer sheath of FRLSH HRPVC compound shall meet the following performance requirements :
- (a) The critical oxygen index value shall be minimum 29 when tested at $27\pm 2^{\circ}\text{C}$ as per ASTM- D- 2863-77 and the temperature index shall be minimum 250°C at oxygen index value of 21 when tested as per ASTM-D-2863
- (b) The maximum acid gas generation as determined by titration method shall be less than 20% by weight when tested as per IEC-60754-1 (1994).
- (c) Flammability
- (i) Cables shall pass tests under fire condition as per IS-10810-Part-53.



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- (ii) Cables shall also pass tests as per IS-10810 Part-61 & Part-62. Category group shall be considered as Category 'A'.
- (d) The smoke generation under fire shall have maximum smoke density rating of 60% when tested as per ASTM-D-2843-77 (1977).
- (g) The finished cable shall pass the flammability tests as per IEC-332-1 (1993) and IEEE-383. In addition, it shall also pass flammability tests as per Class F3 of Swedish Standard SS-424-1475 (1977).

Specific requirement/ change :

(iv)

SL.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 SL. NO. 1 above.

3.1.2 Quality/ Inspection:

SL. 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 implication 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 The successful bidder shall submit the standard list of raw material suppliers/ sub-vendors for approval without any commercial implications. Changes to the same, if proposed by any bidder, shall be to BHEL approval.

3.1.4 Quality Plan applicable for project :

BHEL Standard Quality Plan no. PE-QP-999-507-E003 Rev.00 (Enclosed with specification)

3.1.5 Document distribution schedule for the project shall be as below :



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

S. NO.	DESCRIPTION	No. hard /soft copies	No. of CD-ROMs	REMARKS
1	Drawings / docs. for approval (First submission)	PDF File + 2 Hard copies	NIL	
2	Drawings /docs. for approval (Second & subsequent submission till approval)	PDF File + 2 Hard copies	NIL	
3	Final approval Drawings / docs. for Distribution after CAT-1.	PDF File + 10 Hard Copies	NIL	
4	As Built Drawings/ docs.	6 Hard Copies	4 CD-ROMS	
5	Type Test Certificates/ Reports for approval	PDF+ 2 hard Copies	NIL	
6	Type Test Certificates/ Reports for distribution	6 hard Copies	6 CD-ROMS	

3.1.6 A label shall be securely attached to each end of the reel indicating the Purchaser's order number, length, type voltage grade, conductor size and number of cores of the cable. Also weight of cable drums with and without cables and type of end sealing to be indicated. A tag containing the same information shall be attached to the leading ends of the cable inside. An arrow and necessary instructions shall be marked on the drum indicating the direction in which it should be rolled.

3.2 LIST OF STANDARD DELIVERABLES FOR LT CONTROL CABLES TO BE SUBMITTED BY SUCCESSFUL BIDDER

1.1 KV LT PVC Control Cables			
SL. No.	DOCUMENT TITLE	DWG. / DOCUMENT No.	SUBMISSION SCHEDULE
1	Data Sheet for 1.1KV HRPVC Control Cables	PE-V0-410-507-E206	Within Two weeks from the date of LOI
2	Cross-sectional Drawings for 1.1KV HRPVC Control Cables	PE-V0-410-507-E207	Within Two weeks from the date of LOI
3	Type Test Procedure for 1.1KV HRPVC Control Cables	PE-V0-410-507-E208	Within Two weeks from the date of LOI
4	Quality Plan for HRPVC Control Cables	PE-QP-999-507-E003 Rev.00 (#)	Within Two weeks from the date of LOI
5	Type Test Reports for Tests conducted under this contract (Ref. Cl. 2.4.1.c & 2.4.1.d of section-D)	PE-V0-410-507-E210	Within a week from the date of conduction of Type Test

(#) : Standard Quality Plan for HRPVC Control Cables

1 X 800MW KOTHAGUDEM,TPS,STAGE-VII, UNIT #12
ANNEXURE - A
BOQ-CUM-PRICE SCHEDULE FOR LT HRPVC CONTROL CABLES

1.1 kV control cables with stranded plain annealed copper conductor, HRPVC Type-C insulation, core identification by colour coding and numbering at interval of 100 mm or less (IS : 1554 (Part-I)), distinct extruded inner Extruded HRPVC compound conforming to type ST2 FRLS of IS: 5831 for multicore cables. Single core cables shall have no inner sheath. Filler shall be of same material as of inner sheath i.e. ST2., GS round wire armour as per IS 3975, and extruded HRPVC Type ST2 outer sheath with FRLSH properties, generally conforming to IS:1554 (Part-1) and BHEL specification.

1.1 kV COPPER CONDUCTOR ARMoured CABLES							
SL. NO.	CABLE SIZE (sq. mm)	ORDER QUANTITY (METRES)	LOT-I QUANTITY (METRES)	DRUM LENGTH (METRES)	UNIT PRICE (Ex-Works)	TOTAL PRICE (Ex-Works)	REMARKS
1	5C X 2.5	56000	40000	1000			
2	7C X 2.5	28000	20000	1000			
3	9C X 2.5	24000	17000	1000			
4	12C X 2.5	14000	10000	1000			
5.0	5C X 4	9500	7000	1000			

NOTES:

- 1 Quantities indicated above shall be known as order quantities. The variation in quantities shall be limited from -30% to +30% of the total contract value derived on the basis of the Order 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. The unit prices shall apply for adjustment of variation in quantity as stipulated above.
- 3 Lot-I quantity indicated above shall be cleared for manufacturing along with LOI. However, manufacturing of the cables shall be taken up by the successful bidder only after approval of technical and quality documentation. Subsequent lots if required shall be cleared for manufacturing based on progress of engineering and site requirements.
- 4 Overall tolerance on total dispatched quantity of each size for item shall be (-) 2% and (+) 0%. Cables consumed for testing and inspection shall be to bidder's account.
- 5 The drum length shall be 1000 m (+/- 5%). For each individual cable size, one short lengths of not less than 200m may be accepted only in the final drum length to complete the supply. The overall tolerance limits stipulated above shall continue to apply (in case short lengths are accepted).
- 6 In case of the quantities cleared by BHEL for manufacturing (in a lot) are manufactured and offered for inspection in more than one batch, BHEL reserves the right to witness type testing on all batches without any price implication.
- 7 Bidder shall indicate unit price of cables inclusive of type test charges. No separate type test charges are to be quoted by bidder.
- 8 Bidder shall quote for all sizes/types of cables as per specification, failing which their offer shall be rejected.
- 9 Delivery schedule of Lot-I and subsequent lots shall be as per NIT



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SECTION-D

STANDARD TECHNICAL SPECIFICATION



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1.0 TECHNICAL REQUIREMENTS

1.1 Technical requirements for 1.1kV PVC control cables shall be as indicated in this section, in addition to those specified in Section- C and Data sheet-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 listed in Annexure to QAP (enclosed with quality plan) 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. BHEL reserves the right to witness the testing for which due notice shall be given by the vendor
- d. Irrespective of the bidder furnishing type test report as indicated above, BHEL may get type tests as indicated in Annexure to QAP (enclosed with quality plan) on the lots offered for inspection (conduction of type tests shall be witnessed by BHEL). 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.



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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 Annexure to QAP (enclosed with quality plan)
- 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 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

As technical offer signed and stamped copy of following:

- a. Section B (Project Information)
- b. Section C (Specific Technical Requirements)
- c. Annexure-A to Section-C, (Bill of Quantities)
- d. Data Sheet-A

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)

- a. Data sheet C and derating factors 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.



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- 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.

		QUALITY PLAN			CUSTOMER :		PROJECT TITLE		SPECIFICATION :			
					BIDDER/ VENDOR :		1X800MW KOTHAGUDAM TPS		NUMBER : PE-TS-410-507-E003			
		SHEET 1 OF 8			SYSTEM		QUALITY PLAN NUMBER PE-QP-999-507-E003, R-0		SPECIFICATION TITLE			
SL NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY			VOLUME III REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
Instructions: 1. Cable manufacturer to maintain records to show co-relation of raw materials to finished cables i.e. raw material batch/ lot no. should be traceable to the final cable drum number or batch no. 2. Cable manufacturer to maintain all quality records identified as per all QP stages enumerated below whether it is identified for BHEL verification or witness or not.												
1.0 RAW MATERIAL												
1.1 Copper Rods/ Aluminum Rod/ Wires												
(Al- For Conductor & Armour) (Cu- For Conductor)												
		GENERAL :										
		1. Physical properties										
		MA Physical Tests Sample per Batch IS 1554 Pt-1/ IS 613/ IS 5082 & Approved datasheet IS 1554 Pt-1/ IS 613/ IS 5082 & Approved datasheet Log book/ Test Cert. 3/2 - 1/2										
		2. Elec.Properties										
		MA Electrical Tests Sample per Batch IS 1554 Pt-1/ IS 613/ IS 5082 & Approved datasheet IS 1554 Pt-1/ IS 613/ IS 5082 & Approved datasheet Log book/ Test Cert. 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/IS 5082 & Approved datasheet IS 613/ IS 5082 & Approved datasheet Log book/ Test Cert. 3/2 - 1										
		c) Resistivity										
		MA Electrical Tests Manufacturer std. IS 613/ IS 5082 IS 613/ IS 5082 Log book/ Test Cert. 3/2 - 1										
1.2 PVC Compound (for insulation)												
		GENERAL :										
		1. Physical properties										
		MA Physical Tests Sample per batch IS 1554 Pt-1/ IS 5831 & Approved datasheet IS 1554 Pt-1/ IS 5831 & Approved datasheet Log book/ Test Cert. 3/2 - 1/2										
		2. Elec.Properties										
		MA Electrical Tests Sample per batch IS 1554 Pt-1/ IS 5831 & Approved datasheet IS 1554 Pt-1/ IS 5831 & Approved datasheet Log book/ Test Cert. 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 Verify 100% Mfrs std./ Approved datasheet Mfrs std./ Approved datasheet Log book/ Test Cert. 3/2 - 1										
		c) Shelf life/ Storage condition										
		MA Verify 100% Compound Manufacturer std. Compound Manufacturer std. Log book/ Test Cert. 3/2 - 1										
1.3 Fillers (as applicable)												
		1. Make										
		MA Verify 100% Manufacturer approved source Manufacturer approved source Log book/ Test Cert. 3/2 - 1										
		2. Flame retardant & moisture resistant. (as applicable)										
		CR Chemical/ Environ. 100% Approved datasheet Approved datasheet Log book/ Test Cert. 3/2 - 2										
(Fillers material chosen shall be compatible with the temperature rating of the cable and shall have no deleterious effect on any other component of cable)												
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN			CUSTOMER :		PROJECT		SPECIFICATION :			
					BIDDER/ VENDOR		TITLE		NUMBER :		TITLE	
SHEET 2 OF 8		SYSTEM			ITEM :HRPVC/ PVC POWER & CONTROL CABLE		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	P	W	V	11
1.4	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	* Sample from each size/ Batch/ Lot
		2. Dimension	MA	Measurement	Manufacturer std.	IS 1554 Pt-1/ IS 3975	IS 1554 Pt-1/ IS 3975	Log book/ Test Cert.	3/2	-	2	
		3. Phy.and Elec. Properties	MA	Physical & Electrical Tests	Sample*	IS 1554 Pt-1/ IS 3975	IS 1554 Pt-1/ IS 3975	Log book/ Test Cert.	3/2	-	2	
		4.Galvanization Quality	MA	Galv.Tests	Sample*	IS 1554 Pt-1/ IS 3975	IS 1554 Pt-1/ IS 3975	Log book/ Test Cert.	3/2	-	2	
1.5	PVC compound for Sheath	GENERAL : 1. Physical properties	MA	Physical Tests	Sample per batch	IS 1554 Pt-1/ IS 5831 & Approved datasheet	IS 1554 Pt-1/ IS 5831 & Approved datasheet	Log book/ Test Cert.	3/2	-	1/2	
		2. Elec.Properties	MA	Electrical Tests	Sample per batch	IS 1554 Pt-1/ IS 5831	IS 1554 Pt-1/ IS 5831	Log book/ Test Cert.	3/2	-	1/2	
		3. FRLS Properties (as applicable)	CR	Chemical/ Environ.	Sample per batch	IS 1554 Pt-1/ IS 5831 & Approved datasheet	IS 1554 Pt-1/ IS 5831 & Approved datasheet	Log book/ Test Cert.	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	Verify	100%	IS 1554 Pt-1/ IS 5831 & Approved datasheet	IS 1554 Pt-1/ IS 5831 & Approved datasheet	Log book/ Test Cert.	3/2	-	1	
		c) Shelf life/ Storage condition	MA	Verify	100%	Compound Manufacturer std.	Compound Manufacturer std.	Log book/ Test Cert.	3/2	-	1	
		1.6	Wooden drums	1. Phy. & Constructional checks	MA	Visual	Mfr's Plant Std.	IS 10418	IS 10418	Log book/ Test Cert.	3/2	
		2. Anti termite treatment	MA	Chem.	Mfr's Plant Std.	Mfr's Plant Std.	Mfr's Plant Std.	COC	3/2	-	1	
1.7	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	# (if applicable)
		2. Surface finish	MA	Meas.	Mfr's Plant Std.	Mfr's Plant Std.	Mfr's Plant Std.	Log book/ Test Cert.	3/2	-	1	
2.0 IN PROCESS												
2.1	Wire Drawing & Annealing.	1. Size	MA	Dimensional	Plant Mfg. Std.	IS 1554 Pt-1./ IS 8130 & Approved Data Sheet	IS 1554 Pt-1./ IS 8130 & Approved Data Sheet	Log Book	2	-	1	
		2. Surface finish	MA	Visual	Plant Mfg. Std.	Surface shall be smooth	Surface shall be smooth	Log Book	2	-	1	
		3. % of Elongation	MA	Mechanical	Plant Mfg. Std.	IS 1554 Pt-1./ IS 8130	IS 1554 Pt-1./ IS 8130	Log Book	2	-	1	
2.2	Tinning (For Conductor)	1. Size	MA	Dimensional	Plant Mfg. Std.	Approved datasheet	Approved datasheet	Log Book	2	-	1	(Applicable only for tin-coated copper conductor)
		2. Chemical test for Tinning (if applicable)	CR	Chemical Test	Sample	IS 1554 Pt-1/ IS:8130 & Mfrs Std	IS 1554 Pt-1/ IS:8130 & Mfrs Std	Log Book	2	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :				
				BIDDER/ VENDOR		TITLE		NUMBER :				
SHEET 3 OF 8				SYSTEM		ITEM :HRPVC/ PVC POWER & CONTROL CABLE		SECTION				
SL NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	VOLUME III REMARKS			
1	2	3	4	5	6	7	8	9	10			
									P	W	V	
2.3	Stranding of wires	1. No. of wires	MA	Counting	Plant Mfg. Std.	IS 1554 Pt-1./ IS 8130 & Approved Data Sheet	IS 1554 Pt-1./ IS 8130 & Approved Data Sheet	Log Book	2	-	-	# To be checked at starting & finish end of Extruded Length
		2. Resistance	CR	Electrical	Plant Mfg. Std.	IS 1554 Pt-1./ IS 8130 & Approved Data Sheet	IS 1554 Pt-1./ IS 8130 & Approved Data Sheet	Log Book	2	-	-	
		3. Sequence, lay length & Direction	MA	Visual, Measurement	Sample	IS 1554 Pt-1/ Mfrs standard	IS 1554 Pt-1/ Mfrs standard	Log Book	2	-	-	
		4. Surface Finish	MA	Visual	100%	Surface shall be smooth	Surface shall be smooth	Log Book	2	-	-	
		5.Dimension	MA	Measurement	One Sample of each size/ lot	IS 1554 Pt-1/ IS 8130/Appd. Data Sheet	IS 1554 Pt-1/ IS 8130/Appd. Data Sheet	Log Book	2	-	-	
2.4	Core Insulation (No repair permitted)	1. Surface finish	MA	Visual	100%	Free from bulging burnt particles lumps, cuts & Scratches.	Free from bulging burnt particles lumps, cuts & Scratches.	Log Book	2	-	1	
		2. Insulation thickness	CR	Measurement	One Sample of each size/ lot	IS 1554 Pt-1 & Appd.data sheet	IS 1554 Pt-1 & Appd.data sheet	Log Book	2	-	-	
		3. Concentricity #	CR	Measurement	One Sample of each size/ lot	Mfrs Std/ IS 1554 Pt-1/ Approved Data Sheet	Mfrs Std/ IS 1554 Pt-1/ Approved Data Sheet	Log Book	2	-	1	
		4. Dia over insulation	MA	Measurement	One Sample of each size/ lot	IS 1554 Pt-1	IS 1554 Pt-1	Log Book	2	-	-	
		5. Core identification	MA	Visual	100%	IS 1554 Pt-1 & Appd. Data Sheet	IS 1554 Pt-1 & Appd. Data Sheet	Log Book	2	-	-	
		6. Tensile Strength & % Elongation	MA	Mechanical	100%	IS 1554 Pt-1/ IS 5831	IS 1554 Pt-1/ IS 5831	Log Book	2	-	-	
		7. Spark Test or Water Immersion test	CR	Electrical	100%	Mfr's Std.	Mfr's Std.	Log Book	2	-	1	
2.5	Core Laying	1. Dia over laidup core	MA	Measurement	One Sample of each size/ lot	IS 1554 Pt-1	IS 1554 Pt-1	Log Book	2	-	-	
		2. Sequence of lay, Lay length & direction for laid up core	MA	Visual & Meas.	One Sample of each size/ lot	Mfrs Std	Mfrs Std	Log Book	2	-	-	
		3. Core Identification	MA	Visual	One Sample of each size/ lot	IS 1554 Pt-1 & Appd. Data Sheet	IS 1554 Pt-1 & Appd. Data Sheet	Log Book	2	-	-	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE				BIDDER'S/VENDORS COMPANY SEAL					

		QUALITY PLAN			CUSTOMER :		PROJECT		SPECIFICATION :			
					BIDDER/ VENDOR		TITLE		NUMBER :		TITLE	
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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	InnerSheath Extrusion (If applicable)	1. Surface finish	MA	Visual	100%	Surface shall be Smooth	Surface shall be Smooth	Log Book	2	-	-	(Pimple, fish eye, porosity & burnt particles not permitted)
		2. Sheath thickness	CR	Measurement	One Sample of each size/ lot	IS 1554 Pt-1 & Approved Data Sheet	IS 1554 Pt-1 & Approved Data Sheet	Log Book	2	-	-	
		3.Dia over inner sheath	MA	Measurement	One Sample of each size/ lot	IS 1554 Pt-1 & Approved Data Sheet	IS 1554 Pt-1 & Approved Data Sheet	Log Book	2	-	-	
2.7	Armouring (If applicable)	1. No. of wires/Strips	MA	Counting	At the start of the process	IS 1554 Pt-1/ IS 3975	IS 1554 Pt-1/ IS 3975	Log Book	2	-	-	
		2. Lay Direction	MA	Visual	At the start of the process	IS 1554 Pt-1/ IS 3975	IS 1554 Pt-1/ IS 3975	Log Book	2	-	-	
		3. Lay Length	MA	Visual, Meas.	At the start of the process	IS 1554 Pt-1/ IS 3975	IS 1554 Pt-1/ IS 3975	Log Book	2	-	-	
		4. Coverage	MA	Measurement	At the start of the process	IS 1554 Pt-1/ IS 3975 & approved data sheet	IS 1554 Pt-1/ IS 3975 & approved data sheet	Log Book	2	-	-	
		5. Dia over armouring	MA	Measurement	At the start of the process	IS 1554 Pt-1 & Appd. Data Sheet	IS 1554 Pt-1 & Appd. Data Sheet	Log Book	2	-	-	
2.7	Outer Sheath Extrusion	1. Surface Finish	MA	Visual	100%	Surface shall be smooth	Surface shall be smooth	Log Book	2	-	-	(Pimple, fish eye, porosity & burnt particles not permitted)
		2.Sheath thickness	CR	Measurement	One Sample of each size/ lot	IS 1554 Pt-1 & Appd. Data Sheet	IS 1554 Pt-1 & Appd. Data Sheet	Log Book	2	-	-	
		3. Dia over outer sheath	MA	Measurement	One Sample of each size/ lot	IS 1554 Pt-1 & Appd. Data Sheet	IS 1554 Pt-1 & Appd. Data Sheet	Log Book	2	-	-	
		4. Marking/ Color/ Embossing	MA	Visual	One Sample of each size/ lot	Appd. Data Sheet	Appd. Data Sheet	Log Book	2	-	-	
2.8	Finished Cable (INTERNAL)	1. Routine Test (Refer Note-H)	CR	Electrical Tests & Measurement	100%	IS 1554-I & Appd. Datasheet	IS 1554-I & Appd. Datasheet	Test Report	2	-	1	Sequential marking shall be done by printing.
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE				BIDDER'S/VENDORS COMPANY SEAL					

		QUALITY PLAN SHEET 5 OF 8			CUSTOMER :			PROJECT			SPECIFICATION :		
					BIDDER/ VENDOR			TITLE			NUMBER :		
SYSTEM		SYSTEM			ITEM :HRPVC/ PVC POWER & CONTROL CABLE			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	MA	Visual	(See remark)	IS 1554 Pt-1/ Appd. Data Sheet	Free from Porosity, Bulging, Burnt particles, lumps, cuts & scratches	Test Report	2	1	-	One drum each for Power & Control cables in Lot.	
		2. Length	MA	Measurement	(See remark)	IS 1554 Pt-1/ Appd. Data Sheet	BHEL Spec./ Data Sheet	Test Report	2	1	-	Length of each drum shall be as per tolerance given in the data sheet.	
		3. Dimension	MA	Measurement	As per IS	IS 1554 Pt-1/ Appd. Data Sheet	Approved Data Sheet	Test Report	2	1	-		
		4. Armouring - Coverage No. of Wires/Strips	MA	Visual & Meas.	As per IS	IS 1554 Pt-1/ Appd. Data Sheet	Appd. Data Sheet	Test Report	2	1	-		
		4. Marking/Colour Coding	MA	Visual	As per IS	IS 1554 Pt-1/ Appd. Data Sheet	IS 1554 Pt-1/ Appd. Data Sheet	Test Report	2	1	-		
		5. Acceptance Tests (Refer Note-H)	CR	Phy & Elect. Tests FRLS tests	As per IS	IS 1554 Pt-1/ Appd. Data Sheet	IS 1554 Pt-1/ Appd. Data Sheet	Test Report	2	1	-		
4.0	Packing	6. Type & FRLS Tests (Refer Note-H)	CR	Phy & Elect. Tests FRLS Tests	Sample#	BHEL Specn. Apprd. Data Sheet	BHEL Specn. Apprd. Data Sheet	Test Report	2	1	-	Refer Annexure to QAP for Type & Acceptance Tests	
		Sealing Identification	MA	Visual	100%	As per IS	As per IS	Test Report	2	1	-		
NOTES:- (A) JOINTS IN WIRE SHALL BE AS PERMITTED BY MFRS STANDARD. VENDOR TO CERTIFY THE SAME. (B) NO REPAIR OF CORE INSULATION PERMITTED (C) CABLE ENDS SHALL BE SEALED AS PER VENDOR'S 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 APPROVED DATA SHEET (F) WHEREVER EXTENT OF CHECK FOR STAGE IS MENTIONED AS 'SAMPLE' & NOT DEFINED IN QP, THE SAME SHALL BE AS PER VENDORS SAMPLING PLAN. (G) VENDOR SHALL FURNISH COMPLIANCE CERTIFICATE TO THE INSPECTION AGENCY CONFIRMING THE PACKING AS PER IS/ BHEL SPECIFICATION. (H) FOR LISTS OF ROUTINE TESTS, ACCEPTANCE TESTS & TYPE TESTS REFER ANNEXURE TO QAP. LEGEND : P : PERFORMER W : WITNESSER V : VERIFIER 1- BHEL 2- VENDOR 3- SUB VENDOR CHP: CUSTOMER HOLD POINT WHICH WILL BE DECIDED AT CONTRACT STAGE.													
BHEL			PARTICULARS			BIDDER/VENDOR							
			NAME										
			SIGNATURE										
			DATE									BIDDER'S/VENDORS COMPANY SEAL	



DOCUMENT TITLE

**TECHNICAL SPECIFICATION FOR
1.1 kV FRLSH HRPV CONTROL CABLES**

SPECIFICATION NO. PE-TS-410-507-E003

VOLUME II B

SECTION

REVISION 0

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SHEET 4 OF 3

ANNEXURE TO QAP

II. TYPE/ ACCEPTANCE TEST REQUIREMENTS

A. Type Test Conduction:

1. Tests for which an asterisk sign (*) is indicated in the 'Conduction Required as Type Test' column shall be conducted on each size of cable to be selected by purchaser at the time of testing as type tests. The same may be witnessed by BHEL/ Owner, for which due notice shall be given by the vendor.

B. Acceptance Test Conduction:

1. Tests for which a hash sign (#) is indicated in the 'Conduction Required as Acceptance Test' column shall be conducted as acceptance tests.
2. Sampling:
Sampling for acceptance tests shall be as per Appendix-A (Clause 15.2.1) of IS: 1554 Part-I.

S. No.	TEST	APPLICABLE FOR	CONDUCTION REQUIRED AS	
			Type Test	Acceptance Test
1.0	Tests for Conductor			
	Annealing test	Copper conductor	*	#
	Resistance test	Copper conductor	*	#
2.0	Tests for Armour Wires			
	Measurement of dimensions	GS wire	*	#
	Tensile test	GS wire		#
	Elongation test	GS wire	*	#
	Torsion test	GS round wire	*	#
	Resistance test	GS wire	*	#
	Zinc coating test	G. S. wires	*	#
3.0	Physical Tests for PVC Insulation & PVC sheath			
	Test for thickness	PVC insulation, PVC inner sheath & PVC outer sheath	*	#
	Tensile strength and elongation test	PVC insulation & PVC outer sheath	*	
	(a) Before ageing		*	#
	(b) Before & after ageing		*	
	Ageing in air oven	PVC insulation & PVC outer sheath	*	
	Loss of mass test	PVC insulation & PVC outer sheath	*	
	Hot deformation test	PVC insulation & PVC outer sheath	*	
	Heat shock test	PVC insulation & PVC outer sheath	*	



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<u>S. No.</u>	<u>TEST</u>	<u>APPLICABLE FOR</u>	<u>CONDUCTION REQUIRED AS</u>	
			<u>Type Test</u>	<u>Acceptance Test</u>
	Shrinkage test	PVC insulation & PVC outer sheath	*	
	Thermal stability test	PVC insulation & PVC outer sheath	*	
4.0	<u>FRLSH/ Flammability Tests</u>			
	Oxygen index test	PVC outer sheath only	*	#
	Smoke density test	PVC outer sheath only	*	#
	Halogen Acid gas generation test	PVC outer sheath only	*	#
	Flammability test as per IEC-332-1 (1993) and IEEE-383	Complete cable	*	
	Flammability test as per IS-10810-Part-53, Part-61 & Part-62	Complete cable	*	#
	Swedish chimney test to SEN SS 424 1475	Complete cable		#
	Temperature index test	PVC outer sheath only	*	#
5.0	<u>Electrical Tests</u>			
	High Voltage Test (Water Immersion test)	On cores	*	
	High Voltage Test at room temperature	Complete cable	*	#
	Insulation Resistance Test (Volume resistivity method)	Complete cable	*	#
6.0	<u>Fungus, Rodent & Termite Test</u>	Complete cable	*	

NOTE :

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



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DATASHEET A



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DATA SHEET-A

I. SPECIFIC TECHNICAL REQUIREMENTS

1.0	Type of cable	LT CONTROL CABLE OF FRLSH TYPE
2.0	Standard applicable in general	IS:1554 PART (I)
3.0	Voltage Grade	1.1 kV
4.0	Number of cores	As per BOQ (Annexure-A to section-C)
	Minimum size	
5.0	CONDUCTOR	
(a)	Material	Copper
	Grade and Class	Stranded, high conductivity, Class 2
(b)	Standard applicable	IS : 8130
(c)	Shape	Circular as per IS
(d)	Min. number of strands	7
6.0	INSULATION	
(a)	Material	EXTRUDED HRPVC, Type C
(b)	Standard applicable	IS : 5831 & IS : 1554 (PART I)
(c)	Continuous withstand temperature	70° C
(d)	Short circuit withstand temperature	160° C
(e)	Method of Application	By extrusion; sleeve extrusion not permitted
7.0	CORE IDENTIFICATION	
(a)	Control cables	Colour coded and numbering at interval of 100 mm or less (IS : 1554 (Part-I))
8.0	INNER SHEATH	
(a)	Material	Extruded HRPVC compound conforming to type ST2 FRLS of IS: 5831 for multicore cables. Single core cables shall have no inner sheath. Filler shall be of same material as of inner sheath i.e. ST2.
(b)	Colour	Black
(c)	Whether FRLS	yes
(d)	Fillers	Acceptable
(e)	Material of fillers (if permitted)	Same as innersheath
(f)	Method of application	
1	Multi-core cables :	
i)	with fillers	Pressure/Vacuum Extruded
ii)	without fillers	Pressure Extruded
9.0	ARMOUR	
(a)	Material	Galvanised Steel round / formed wire
(b)	Minimum coverage	90%
(c)	Gap between armour wires	Shall not exceed one armour wire space



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		(No cross-over/ over-riding)
(d)	Breaking load of joint	95% of normal armour
10.0	OUTER SHEATH	
(a)	Material	Extruded FRLS HRPVC Type ST-2 as per IS : 5831
(b)	Colour	Black
(c)	Whether FRLS	YES
(d)	Other properties	The sheath shall be resistant to water, UV radiation, fungus, termite and rodent attack
(e)	Method of application	Extruded
(f)	Marking (by embossing)	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 TSGENCO' @1m (by embossing) Progressive sequential marking @ 1m (by embossing)
11.0	FRLSH CHARACTERISTICS	
(a)	Oxygen index test	YES ,(Minimum 29 as per ASTM-D-2863-77)
(b)	Temperature Index test	YES ,(Minimum 250°C at oxygen index value of 21 when tested as per ASTM-D-2863)
(c)	Halogen Acid gas generation test	YES ,(Max. 20% as per IEC-754-1)
(d)	Smoke density rating test	YES ,Max. 60% As per ASTM-D-2843.
(e)	Flammability Test	As per IEC:60332-III CAT-B, IEC :60332-I, IEEE:383 & 424:1475 (Class-F3),IS :10810
(f)	Flame retardance Test	Flame Retardance test on single cable and on bunched cables (both C1 & C2) After the test, there should be no visible damages on the test specimen within 300mm from its upper end. After burning has ceased, the cables should be wiped clean and the charred or affected portion should not have reached a height exceeding 2.5 meter above the bottom edge of the burner, measured at the front and rear of the cable assembly.
12.0	TOLERANCE ON OUTER DIAMETER	Upto 30mm; (+/-) 1.5 mm Above 30mm; (+/-) 5% or (+/-)3 mm whichever is less
13.0	MINIMUM BENDING RADIUS	12 x O.D.
14.0	SAFE PULLING FORCE	50N/ sq. mm
16.0	CABLE DRUMS	
(a)	Type & construction	As per IS 10418 (wooden)
(b)	Standard drum length	1000m (+/-) 5%

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DATASHEET C

GUARANTEED TECHNICAL PARTICULARS (TO BE SUBMITTED BY SUCCESSFUL BIDDER)

1.0 GENERAL

1.1 Name of manufacturer :

1.2 Place of manufacture :

2.0 STANDARDS APPLICABLE

2.1 **IS-1554 (Part-I)** : YES

For general specification of PVC cables

2.2 **IS:8130** : YES

For conductor material

2.3 **IS-5831** : YES

For material of insulation, innersheath & outersheath.

2.4 **IS:3975/ IS:8130** : YES/NO/NA

For armour multi core/ single core cables)

2.5 **IS:10810** : YES

For method of tests

2.6 **IS:10418** : YES


For cable drums

2.7 **ASTMD-2863** : YES


For oxygen index test

2.8 **SS:424-14-75, IEC-332-Part-III and Part-I (Category-A), IEEE 383/74** : YES

For flammability test

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2.9	IEC-754-1	:	YES
	For acid gas generation test		
2.10	ASTMD-2843	:	YES
	For smoke generation test		
2.11	IS:5831	:	YES
	For heat shock test, loss of mass test and thermal heat stability test		
2.12	Current rating of cables conforms to	:	
2.13	Short circuit rating conforms to	:	
3.0	CABLE CONSTRUCTION		
3.1	Conductor :		
	Conductor material to IS:8130 (Class/Grade)		
	a) Control cables	:	
3.2	Insulation		
	a) Material	:	
	b) Dielectric constant at normal frequency	:	KV/mm
	c) Insulation resistance constant (min.)		
	i) at 27 deg. C	:	Mega-ohm km
	ii) at 70/85 deg.C	:	Mega-ohm km
	d) Minimum volume resistivity		
	i) at 27 deg. C	:	Mega-ohm km
	ii) at 70/ 85 deg.C	:	Mega-ohm km
	e) Minimum tensile strength	:	N/mm ²
	f) Minimum % Elongation at rupture	:	
	g) Tolerance on thickness	:	

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3.3 Inner Sheath


- | | | | |
|----|-----------------------------------|---|-------------------|
| a) | PVC Type ST1 to IS: 5831 | : | YES |
| b) | Whether FRLS | : | YES/NO |
| c) | Method of application | | |
| | i) with fillers | | |
| | ii) without fillers | : | Pressure extruded |
| d) | Type & shape of fillers (if used) | : | |
| e) | Colour | | |

3.4 Armour

- | | | | |
|----|---|---|--------|
| a) | Galvanised steel wire/ formed wire conforming to IS:3975 for multi-core cables. | : | YES |
| b) | Hard drawn aluminium wire H4 grade conforming to IS:8130 | : | YES/NA |
| c) | Method of joining | : | |
| d) | Breaking load of joint | : | |

3.5 Outer Sheath

- | | | | |
|----|---|---|-------------------|
| a) | PVC Type ST1 to IS: 5831 | : | YES |
| b) | Whether FRLS | : | YES |
| c) | Method of application | : | |
| d) | Minimum Tensile strength | : | N/mm ² |
| e) | Minimum % elongation at rupture | : | |
| f) | Colour | | |
| g) | Tolerance on thickness | : | |
| h) | Whether progressive sequential length marking provided. | : | |

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4.0 PERMISSIBLE VOLTAGE AND FREQUENCY VARIATION

- a) Voltage : (±) %
- b) Frequency : (±) %
- c) Voltage-frequency combined : |ABS| %
combined

5.0 Permissible Conductor Temp. for

- a) Maximum Continuous Rating : °C
- b) Short Circuit : °C

6.0 Installation Conditions for specified current rating

- a) ambient air temperature in deg. C : °C
- b) ground temperature : °C
- c) depth of laying of cables buried in ground : cm
- d) thermal resistivity of soil : °C cm/W
- e) thermal resistivity of insulation : °C cm/w


7.0 Formula for calculating short circuit current for different durations

8.0 CHARACTERISTICS OF FRLS SHEATH

- a) Oxygen index :
- b) Temperature index :
- c) Acid gas generation :
- d) Smoke density rating :

9.0 CABLE DRUMS

- a) Type & construction :
- b) Standard drum length :
- c) Tolerance on drum length :

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10.0 DOCUMENTATION

Whether following enclosed

- | | | |
|--|---|--------|
| a) X-sectional drawing with construction details | : | YES |
| b) BHEL's Quality Plan with seal of acceptance | : | YES |
| c) Derating factors as stipulated in Section-D | : | YES |
| d) Packing drawing | : | YES/NO |

(TO BE FILLED IN FOR EACH SIZE OF CABLE IN THE FORM OF TABLE)

- | | | | |
|------|--|---|----------|
| 11.0 | No. of cores x size | : | |
| 12.0 | Voltage grade | : | kV |
| 13.0 | Base current ratings (*) based on cl.5.0, cl.6.0 | | |
| | a) In air | : | Amp |
| | b) In ground | : | Amp |
| | c) In ducts | : | Amp |
| 14.0 | Short circuit rating | : | kA, sec. |
| 15.0 | a) D.C. resistance of conductor at 20 °C | : | ohm/km |
| | b) A.C. resistance of conductor at 70 °C/ 85 °C | : | ohm/km |
| | c) Reactance of cable at normal frequency | : | ohm/km |
| 16.0 | CONDUCTOR | | |
| | a) Material, type & grade | : | |
| | b) No & dia of wires in each core before stranding | : | no x mm |

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	c) Shape	:	
17.0	Nominal thickness of insulation	:	mm
18.0	Inner sheath thickness (min.)	:	mm
19.0	Sizes of armour	:	no x mm
20.0	Nominal thickness of outersheath	:	mm
21.0	DIAMETERS		
	a) i) Fictitious diameter of insulated conductor	:	mm
	ii) Approximate cable diameter of insulated conductor	:	mm
	b) i) Fictitious cable diameter of under armour/ over innersheath	:	mm
	ii) Approximate cable diameter under armour/ over innersheath	:	mm
	c) i) Fictitious cable diameter of under armour/ over innersheath	:	mm
	ii) Approximate cable diameter over armour	:	mm
	d) i) Fictitious overall diameter of cable	:	mm
	ii) Approximate overall diameter of cable	:	mm
22.0	Tolerance on overall diameter	:	(±) mm.
23.0	Minimum bending radius	:	x O.D.
24.0	Safe pulling force	:	kg.
25.0	Weight of cable	:	kg./km
26.0	Dimension of drum	:	mm
27.0	Shipping weight	:	kg.
28.0	Identification mark on outersheath	:	
29.0	Identification marks on drum	:	