

4 X 270 MW BHADRADRI TPP


VOLUME : IIB

**TECHNICAL SPECIFICATION FOR
LT PVC CONTROL CABLES**

SPECIFICATION NO.: PE-TS-411-507-E003, Rev. 0



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR, PROJECT ENGINEERING MANAGEMENT
NOIDA 201301**


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TOTAL NO. OF SHEETS		= 37

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

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

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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)

1.4 VOLUME – III **TECHNICAL SCHEDULES (If Applicable)**

This volume contains Technical Schedule and Data Sheets–B, which are to be duly filled by bidder and the same shall be furnished with the technical bid.

2.0 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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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 (“Quoted” words against items”) with bidder’s signature and company stamp.
 - b. A copy of this sheet (“Instructions to Bidders for Preparing Technical Offer”)
 - c. A copy of previous sheet (“List of Contents”), with bidder’s signature and company stamp.
 - d. A copy of “Quality Plan including Annexure to QAP” sheet, 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 cum price schedule] shall not be considered (i.e., technical description, quantities, notes etc. as per specification shall prevail).

BIDDER’S STAMP & SIGNATURE

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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 of **LT CONTROL CABLES** as mentioned in different sections of this specification **for 4 X 270 MW BHADRADRI TPP**.
- 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 & condition, instructions to bidders & other attachment referred to elsewhere are hereby made part of 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 the above requirement shall be acceptable.
- 6.0 The documents shall be in English language and MKS system of units.

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SECTION – B
(PROJECT INFORMATION)

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INTRODUCTION

4x270 MW Bhadradi TPS is being set up by Telangana State Electricity Corporation Limited (TSGENCO) at Manuguru in the district of Khammam, Telangana, India.

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 BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

APPROACH TO SITE


The distance from Manuguru to Major cities in state: Hyderabad-345KM, Warangal-180km, Bhadrachalam-38km, Kothagudem-70km and Khammam-130km, Vijayawada-195km.

District: KHAMMAM

State: TELANGANA

Nearest Airport: The nearest airport is Vijayawada Airport but the most used airport is the Hyderabad International Airport.


Nearest Railway Station: Manuguru railway station is 10KM from nearby town. However Warangal/Vijaywada railway Station is major railway station near to Manuguru.

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1. **Owner** TSGENCO
2. **Owner Consultant** DESEIN PRIVATE LIMITED, NEW DELHI
3. **Project Title** 4X270 MW Bhadradri TPS
4. **Location** 16 Km from Manuguru Railway station
5. **Nearest Railway Stn.** Manuguru
6. **Temperature**
 - a. Mean daily minimum ambient temperature during oldest month of the year=11.5 Deg.C
 - b. Mean daily minimum ambient temperature during hottest month of the year=45.1 Deg.C
7. **Rainfall**

Intensity of rainfall @ 80 mm/hr considering heaviest fall in 24 hrs
8. **Wind Data**
 - a) Basic wind speed at 10m height 44 m/sec
 - b) Wind pressure As per IS: 875 Part III- 1987
9. **Seismic Zone:** Zone III as defined in IS:1893 (part-1)-2002 according to Indian Standard Seismic Zoning Map
10. **Power supply :**


The power supplies for distribution and auxiliaries shall be as under:		
	a) In plant generation	16.5kV $\pm 5\%$, 3ph, 50Hz $\pm 5\%$, high resistance earthed.
	b) MV distribution	6.6kV $\pm 6\%$, 3ph, 3w , 50 Hz, + 5 % to - 5%, Non-effectively earthed
	c) LT distribution	415V $\pm 10\%$, 3ph, 4W, 50Hz + 5% to -5%, Effectively earthed
	d) Motor rated above 160kW	6.6kV $\pm 6\%$, 3 ph 50Hz +5% to -5%.
	e) Motor rated 160kW and below all motorized actuators.	415V $\pm 10\%$, 3 ph, 50Hz +5% to -5%.

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	f) For motors equal and below 30kW winding heating	24V AC ± 10 , 50 Hz %, [to be generated in 415V switchgear by vendor]
	g) DC Motors	220V DC + 10% to - 15%, 2 wire ungrounded system
	h) Control supply for relay panel/ 6.6kV breakers/415V breakers and DC emergency lighting.	220V DC + 10% to - 15%, 2 wire ungrounded system
	i) UPS for instrumentation & Control system	240V AC ± 1 %, 1 ph ,50Hz $\pm 0.5\%$ 2 Wire AC system
	j) Control supply for 415V Motor contactors/AC Control circuits [to be generated in MCC /panel by vendor]	110V AC $\pm 10\%$, 50Hz + 5% to - 5%.
	k) Diesel Generator emergency supply	415V $\pm 10\%$, 3ph,3W, 50Hz +5% to -5%.
11.0	Fault levels	
	a) 400kV	40kA rms for 1 sec
	b) 6.6kV	40 kA rms for 1 sec.
	c) 415V	50 kA rms for 1 sec.
	d) DC Supply	25 kA

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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 LT 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, Data sheet-A and Section-D.


2.0 BILL OF QUANTITIES:

- 2.1 Quantity requirements shall be as per Annexure-A (BOQ cum price schedule) to section C enclosed.
- 2.2 Delivery schedule of LOT-1 and subsequent lots shall be as per NIT.

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) "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	4.1	Two signed and stamped copies of the following shall be furnished by all bidders as technical offer: (i) BOQ cum Unpriced Price Schedule (Annexure-A to Section-C, as enclosed with the specification) with bidder's signature and company stamp. (ii) A copy of "Instructions 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. (iv) A copy of "Quality Plan including Annexure to QAP" sheet, with bidder's signature and company stamp. <u>No other documentation is required to be submitted as technical offer. Any information contained in other parts of the offer (e.g. covering letter, annexures, etc.) which is deviating from</u>

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	<u>specification requirements in any way shall not be considered by BHEL as part of offer.</u>
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3.1.2 Quality/ Inspection:

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

3.1.3 The successful bidder shall submit the standard list of raw material suppliers/ sub-vendors of each bidder for approval without any commercial implications. Changes to the same for specific projects, 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 R00 (enclosed with the specification).

3.1.5 Nos. OF DRAWINGS/ DOCUMENTS REQUIRED FROM VENDOR:


Document distribution schedule for the project shall be as below. No. of prints to be submitted by vendor after award of contract shall be as under :

S. No.	Drawings and documents	Soft and Hard Prints
1.0	DRAWING FOR APPROVAL	
A	For approval	Soft+2 Hard Print
B	For customer approval	Soft+2 Hard Print
C	For final distribution	Soft+2 CD +5 Hard Print
2.0	DRAWING FOR REFERENCE	
A	For reference	Soft+2 Hard Print
B	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	
A	Draft for approval	Soft +3 CD+ 5 Hard Print
B	For final distribution	Soft +3 CD + 8 Hard Print
6.0	QUALITY PLAN / Field quality plan / PG test	Soft + 2 Hard Print


3.1.6 List of drawings / documents required to be furnished by successful bidder after award of contract shall be as below:

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SL. No.	DOCUMENT TITLE	DWG. / DOCUMENT No.	SUBMISSION SCHEDULE
1	Data Sheet for LT Control Cables	PE-V0-411-507-E131	Within Two weeks from the date of LOI
2	Cross-sectional Drawings for LT Control Cables	PE-V0-411-507-E133	--DO--
3	Quality Plan LT PVC Control Cables	PE-V0-411-507-E915	--DO--
4	Type Test Reports for Tests conducted under this contract	PE-V0-411-507-E405	Within a week after conduction of tests

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ANNEXURE-A TO SECTION – C
BOQ-CUM-PRICE SCHEDULE

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ANNEXURE-A TO SECTION C : BOQ-CUM-PRICE SCHEDULE

1.1 kV Copper conductor PVC insulated Armoured Control cables


S.No.	Item name	UOM	Order Quantity	LOT-I Quantity	Drum Length	Remarks
1	5C-1.5-ARMOURED	MTR	72000 (72 drums)	50000 (50 drums)	1000	
2	3C-1.5-ARMOURED	MTR	42000 (42 drums)	30000 (30 drums)	1000	
3	2C-1.5-ARMOURED	MTR	90000 (90 drums)	63000 (63 drums)	1000	
4	7C-1.5-ARMOURED	MTR	94000 (94 drums)	66000 (66 drums)	1000	
5	12C-1.5-ARMOURED	MTR	40000 (40 drums)	28000 (28 drums)	1000	
6	5C-2.5-ARMOURED	MTR	49000 (49 drums)	34000 (34 drums)	1000	

Notes :

- Quantities indicated above shall be known as Order Quantities. The variation in quantities of all sizes put together shall be limited to (+/-)30% of the total contract value till completion of supplies for the project.
- The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ-Cum-Price Schedule. The unit prices shall apply for adjustment of variation in quantity as stipulated above.
- Lot-I quantities indicated above (in case the cable quantities are to be released for manufacture in more than one lot), or Order Quantity (in case the quantities are cleared for manufacture in one lot only) 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 shall be cleared for manufacture based on progress of engineering and site requirements.
- Delivery schedule of LOT-1 and subsequent lots shall be as per NIT.
- The standard drum length for control cables shall not be less than mentioned against each cable size above. The length per drum shall be subjected to a maximum tolerance of +/- 5% of the standard drum length.


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6. Overall tolerance on total dispatched quantity of each size shall be (-) 2% and (+) 0% Cables consumed for testing and inspection shall be to bidder's account.
7. For each individual cable size, one short length 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).
8. Bidder shall indicate unit price of cables inclusive of type test charges. No separate charges shall be payable for type tests.
9. In case the quantities cleared by BHEL for manufacturing (in a lot) 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 implication.

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SECTION – D

(STANDARD TECHNICAL SPECIFICATION)

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1.0 TECHNICAL REQUIREMENTS

1.1 Technical requirements for LT 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 reviewed and made part of the MOU.

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.
- 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. 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 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 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:

- 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. 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.

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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.

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DATA SHEET - A

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DATA SHEET A

I. SPECIFIC TECHNICAL REQUIREMENTS

- 1.0 Type of cable : FRLS
2.0 Standard applicable : IS: 1554 Part-I (in general)
3.0 Voltage designation of cables : 1.1 kV
4.0 Number of cores and cross section area : As per BOQ cum price schedule (Annexure-A to Section-C)

5.0 CONDUCTOR

- a) Material : Annealed Copper
b) Grade, shape & class : Stranded, non-compacted & circular, high conductivity annealed plain copper, class-2
c) Strands : (Min.) 7
d) Applicable standard : IS: 8130

6.0 INSULATION

- a) Material & Standard : PVC, Type A (IS: 5831)
b) Continuous withstand temperature : 70° C
c) Short circuit withstand temperature : 160° C
d) Method of Application : By extrusion (Sleeve extrusion not permitted)

7.0 IDENTIFICATION OF CORES


- a) Control cables upto 5 core : Colour coded as per IS: 1554 (Part-I)
b) Control cables above 5 cores : By numbering as per IS: 1554 (Part-I)
Insulation to have black colour.

8.0 INNER SHEATH

- a) Material & Standard : PVC Type ST 1 (IS: 5831)
b) Colour : Black
c) Whether FRLS : NO
d) Fillers : Acceptable
e) Material of fillers : Same as innersheath
(material to be compatible with innersheath).
f) Method of application :
i) With fillers : Pressure / Vacuum Extruded
ii) Without fillers : Pressure Extruded.

9.0 ARMOUR

- a) Material : Galvanised steel round wire / formed wire
Conforming to IS: 3975
b) Minimum coverage : 90%

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- c) Gap between armour wires : Shall not exceed one armour wire space
(No cross over/ overriding)
- d) Breaking load of joint : 95% of normal armour

10.0 OUTER SHEATH

- a) Material & Standard : PVC Type ST 1 (IS : 5831)
- b) Application : Extruded
- c) Colour : Black
- d) Whether FRLS : YES
- e) Marking : 1) Manufacturer's name,
2) Year of manufacture,
3) Type of cable and the voltage class,
4) Nominal cross sectional area of conductor
and number of cores,
5) Letter PVC for PVC insulated cables, Letter
FRLS for FRLS cables @ 5 metre by embossing.
However, progressive sequential marking @ 1
metre (by printing).
Customer name i.e. 'BHEL-PEM' & 'TSGENCO'
shall also be marked @5m.

11.0 CHARACTERISTICS OF FRLS SHEATH

- a) Oxygen index : Min. 29 (As per ASTM D 2863)
- b) Temperature Index : Min. 250° C
(As per ASTM D 2863)
- c) Acid gas generation : Max. 20% (As per IEC-754-1)
- d) Smoke density rating : Max. 60% (As per ASTM D 2843)
- e) Flammability Test : As per IEC: 60332-III CAT-B, IEC: 60332-I, IEEE:
383 & SS: 424:1475 (Class-F3), IS:10810,
IS 1554 (PART I)

12.0 TOLERANCE ON OUTER DIAMETER


- a) Upto 30 mm O.D. : (+/-) 1.5 mm
- b) Above 30 mm O.D. : (+/-) 5% or (+/-) 2 mm whichever is less.

13.0 MINIMUM BENDING RADIUS


14.0 SAFE PULLING FORCE

15.0 CABLE DRUMS


- a) Type & construction : As per IS 10418
- b) Standard drum length : as specified in BOQ cum price schedule

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- c) Material : (Annexure A to section C)
The cables shall be supplied in non-returnable packing wooden drum.
- d) Marking on Cable drums : Manufacturer's name or trade mark, purchaser's name, address and contract number, item number & type of cable & voltage grade, year of manufacture, type of insulation/sheath, no. of core and size of cables, cable code, length of cable on drum, direction of rotation (by arrow), approx. net gross weight. A tag containing same information shall be attached to the leading end of the cable.

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		Volume IIB	Section	
	SPECIFICATION FOR LT PVC CONTROL CABLES	Rev. : 0	Date : 26/05/15	
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DATASHEET C

	4 x 270 MW BHADRADRI TPP	Doc. No. PE-TS-411-507-E001		
		Volume IIB	Section	
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DATA SHEET C
GUARANTEED TECHNICAL PARTICULARS
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)

1.1 Name of manufacturer :

1.2 Place of manufacture :

2.0 INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE

2.1 No. of cores x size :

2.2 Current rating of cable confirms to :

2.3 Short circuit rating of cable confirms to :

2.4 CONDUCTOR

a) Material type & grade :

b) No. & dia of wires in each core : no x mm
before stranding

2.5 PVC INSULATION

a) Type :

b) Minimum & Nominal thickness of insulation : mm

2.6 PVC ST1 INNERSHEATH

a) Thickness (min.) : mm


b) Method of application

1) Multi-core cables

i) with fillers

ii) without fillers : Pressure extruded

c) Type of fillers (if used) : PVC type ST1 as per IS 5831

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Shape of fillers (if used) :

2.7 ARMOUR

- a) Material :
 - i) Multi-core cables
- b) Size / dimensions :
- c) Minimum no. of wires :
- d) Maximum resistivity of GS wire :
- e) Maximum resistivity of Aluminium round wire :

2.8 PVC ST1 FRLS OUTERSHEATH

- a) Minimum thickness of outer sheath : mm
- b) Colour :


2.9 Diameters

- a) Diameter of insulated conductor : mm
- b) Cable diameter under armour : mm
- c) Cable diameter over armour : mm
- d) Overall diameter of cable : mm

2.10 Weight of cable : kg./km

2.11 Dimension of drum : mm

2.12 Shipping weight : kg.

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QUALITY PLAN

PROJECT : BHADRADRI TPP		CUSTOMER : TSGENCO		SPECIFICATION : PE-TS-411-507-E003							
QUALITY PLAN		TITLE		NUMBER : TECHNICAL SPECIFICATION FOR LIT PVC CONTROL CABLE							
SHEET 30 of 37		QUALITY PLAN NUMBER PE-QP-999-507-E003, R-0		SECTION VOLUME III							
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	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 2. Elec. 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
		SPECIFIC CHECKS : a) Make b) Grade c) Resistivity	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2	-	1
			MA	-do-	-do-	IS 613/ IS 5082 & Approved datasheet	IS 613/ IS 5082 & Approved datasheet	Log book/ Test Cert.	3/2	-	1
			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 2. Elec. 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
		SPECIFIC CHECKS : a) Make b) Type/ Grade c) Shelf life/ Storage condition	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
			MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2	-	1
			MA	Verify	100%	Mfrs std./ Approved datasheet	Mfrs std./ Approved datasheet	Log book/ Test Cert.	3/2	-	1
			MA	Verify	100%	Compound Manufacturer std.	Compound Manufacturer std.	Log book/ Test Cert.	3/2	-	1
1.3	Fillers (as applicable)	1. Make 2. Flame retardant & moisture resistant. (as applicable)	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2	-	1
			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											
NAME											
SIGNATURE											
DATE											
BIDDER/VENDOR											
BIDDER/VENDORS COMPANY SEAL											

SHEET 31 of 37		CUSTOMER : TSGENCO		PROJECT : BHADRADRI TPP		SPECIFICATION :					
QUALITY PLAN		TITLE		NUMBER :		TECHNICAL SPECIFICATION					
BIDDER/ VENDOR SYSTEM		QUALITY PLAN NUMBER PE-QP-999-507-E003, R-0		SPECIFICATION TITLE		FOR LT PVC CONTROL CABLE					
CAT. TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM					
CHARACTERISTICS CHECK		METHOD OF CHECK		DOCUMENT		NORM					
COMONENT/OPERATION		CHECK		CHECK		CHECK					
SL. NO.	2	3	4	5	6	7	8	9	10	11	
1	2	3	4	5	6	7	8	9	10	11	
1	2	3	4	5	6	7	8	9	10	11	
1.4	Galvanised steel wire/strip for Armour (if applicable)	GENERAL : 1. Make 2. Dimension 3. Phy.and Elec. Properties 4. Galvanization Quality	MA	Verify	Manufacturer std.	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2 - 1		
			MA	Measurement	Manufacturer std.	IS 1554 Pt-1/ IS 3975	IS 1554 Pt-1/ IS 3975	Log book/ Test Cert.	3/2 - 2		
			MA	Physical & Electrical Tests	Sample*	IS 1554 Pt-1/ IS 3975	IS 1554 Pt-1/ IS 3975	Log book/ Test Cert.	3/2 - 2	* Sample from each size/ Batch/ Lot	
			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 2. Elec. Properties 3. FRLS Properties (as applicable)	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		
			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		
			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		
			MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2 - 1		
			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		
			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 - 1		
		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										
		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		
		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	

PROJECT : BHADRADRI TPP		CUSTOMER : TSGENCO		SPECIFICATION :								
QUALITY PLAN		TITLE		NUMBER :								
BIDDER/ VENDOR SYSTEM		QUALITY PLAN NUMBER PE-QP-999-507-E003, R-0 ITEM:HRPV/PVC POWER & CONTROL CABLE		TECHNICAL SPECIFICATION FOR LT PVC CONTROL CABLE								
SHEET 32 of 37		ACCEPTANCE NORM		VOLUME III								
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	NORM	FORMAT OF RECORD	AGENCY SECTION			REMARKS
									P	W	V	
1	2	2.3 Stranding of wires	4	5	6	7	8	9	10	11		
		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	-		
		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)	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		# To be checked at starting & finish end of Extruded Length
		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	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	

PROJECT : BHADRADRI TPP		CUSTOMER : TSGENCO		SPECIFICATION :									
BIDDER/ VENDOR SYSTEM		TITLE		NUMBER :									
QUALITY PLAN		QUALITY PLAN NUMBER PE-QP-999-507-E003, R-0		TECHNICAL SPECIFICATION FOR LT PVC CONTROL CABLE									
SHEET 34 of 3		ITEM :HRPVC/ PVC POWER & CONTROL CABLE		VOLUME III									
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY				
									P	W	V		
1	2	3	4	5	6	7	8	9	10				
3.0	Final Inspection	1. Finish 2. Length 3. Dimension 4. Armouring - Coverage No.of Wires/Strips 5. Acceptance Tests (Refer Note-H) 6. Type & FRLS Tests (Refer Note-H)	MA	Visual	(See remark)	IS 1554 Pt-1/ Appd. Data Sheet	Free from Porosity, Bulging,Burnt particles, lumps, cuts & scratches	Test Report	2	1	-	11	One drum each for Power & Control cables in Lot.
			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.
			MA	Measurement	As per IS	IS 1554 Pt-1/ Appd. Data Sheet	Approved Data Sheet	Test Report	2	1	-		
			MA	Visual & Meas.	As per IS	IS 1554 Pt-1/ Appd. Data Sheet	Appd.Data Sheet	Test Report	2	1	-		
			MA	Visual	As per IS	IS 1554 Pt-1/ Appd. Data Sheet	IS 1554 Pt-1/ Appd. Data Sheet	Test Report	2	1	-		
			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	-		
			CR	Phy & Elect. Tests FRLS Tests	Sample#	BHEL Spec. Apprd.Data Sheet	BHEL Spec. Apprd.Data Sheet	Test Report	2	1	-		Refer Annexure to QAP for Type & Acceptance Tests
4.0	Packing	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 OC. 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 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													

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ANNEXURE TO QAP

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS

A. Type Test Conduction:

- a. Tests for which “T” is indicated in the ‘Test Conduction Required As’ column below shall be conducted as Type Test.
- b. Sampling:
 - a) Type test shall be conducted & witnessed on one size (sample) of every lot of control cable.
 - b) Type test shall be conducted & witnessed on one size (sample) per type (Cu/ Al conductor) of every lot for power cable.
 - 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 of IS: 1554 Part-I.
 - b) 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.

<u>S. No.</u>	<u>TEST</u>	<u>APPLICABLE FOR</u>	<u>TEST CONDUCTION REQUIRED AS</u>	<u>REFERENCE STANDARD</u>	<u>REMARKS</u>
1.0	Tests for Conductor				
I.	Annealing test	For copper conductor	T, A	IS 10810 Pt 1	<i>In process records shall be furnished to inspector at the time of inspection.</i>
II.	Tensile Test	For aluminium conductor	T, A	IS 10810 Pt 2	
III.	Wrapping test	For aluminium conductor	T, A	IS 10810 Pt 3	
IV.	Resistance test	For copper/ aluminium conductor	T, A, R	IS 10810 Pt 5	
2.0	Tests for Round Steel Wires/Strips				
I.	Measurement of dimensions	For GS Round wire/Strip	T, A	IS 10810 Pt 36	
II.	Tensile test	For GS Round wire/Strip	T, A	IS 10810 Pt 37	

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<u>S. No.</u>	<u>TEST</u>	<u>APPLICABLE FOR</u>	<u>TEST CONDUCTION REQUIRED AS</u>	<u>REFERENCE STANDARD</u>	<u>REMARKS</u>
III.	Elongation test	For GS Round wire/Strip	T, A	IS 10810 Pt 37	
IV.	Torsion test	For GS Round wire	T, A	IS 10810 Pt 38	
V.	Winding test	For GS Formed wire	T, A	IS 10810 Pt 39	
VI.	Resistivity test	For GS wire/Strip	T, A	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip	T, A	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip	T, A	IS 10810 Pt 41	
3.0	Physical Tests for PVC Insulation & PVC sheath				
I.	Test for thickness	Applicable for PVC insulation, PVC inner sheath & PVC outer sheath	T, A	IS 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for PVC insulation & PVC outer sheath	T, A	IS 10810 Pt 7	
III.	Ageing in air oven	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 11	
IV.	Loss of mass in air oven test	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 10	
V.	Hot deformation test	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 15	
VI.	Heat shock test	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 14	
VII.	Shrinkage test	For PVC insulation & PVC outer sheath only	T	IS 10810 Pt 12	
VIII.	Thermal stability test	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 60	
4.0	Improved Fire performance (FR-LSH) Tests\$				
I.	Oxygen index test	For PVC outer sheath only ^(S)	T, A	ASTMD 2863	
II.	Smoke density test	For PVC outer sheath only ^(S)	T, A	ASTM D2843	
III.	Acid gas generation test	For PVC outer sheath only ^(S)	T, A	IEC-754-1	
IV.	Temperature Index Test	For PVC outer sheath only ^(S)	T	ASTMD 2863	

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<u>S. No.</u>	<u>TEST</u>	<u>APPLICABLE FOR</u>	<u>TEST CONDUCTION REQUIRED AS</u>	<u>REFERENCE STANDARD</u>	<u>REMARKS</u>
5.0	Flammability Tests				
I.	Flammability test for single cable	For complete cable	T, A	IS: 1554 Part-I (As per category C2)/ IEC-60332 (Part-1)	
II.	Flammability test for bunched cables	For complete cable	T	IS: 1554 Part-1 (As per category C2)/ IEC-60332 Part-3-23, Category-B / Category-A	
III.	Swedish chimney test	For complete cable	A	SEN SS 424 1475	
IV.	Flammability test	For complete cable	A	IEEE:383	
6.0	Electrical Tests				
I.	High Voltage Test (Water Immersion test)	On Cores	T	IS 10810 Pt 45	
II.	High Voltage Test at Room Temperature	For complete cable	T, A, R	IS 10810 Pt 45	
III.	Insulation Resistance Test (Volume resistivity method)	For complete cable	T, A	IS 10810 Pt 43	