TELANGANA STATE POWER GENERATION CORPORATION LIMITED

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

VOLUME – IIB

TECHNICAL SPECIFICATION
FOR

LT XLPE POWER CABLES

SPECIFICATION NO : *PE-TS-410-507-E002*
REVISION : *0*

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

CONTENTS

TOTAL NO. OF SHEETS= 34
(INCLUDING COVER/ SEPARATOR SHEETS)

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

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

INSTRUCTIONS TO BIDDERS FOR PREPARING TECHNICAL OFFERS

1. In line with clause no. 4.1 of Section-D, Volume-II-B of the specification, 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) ("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.

2. <u>No technical submittal such as copies of type test certificates, technical literature, etc. is required during tender stage. Any such submission, even if made, shall not be considered as part of offer.</u>

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 from those given in Annexure-A [BOQ-Cum-Price schedule] of the specification shall not be considered (i.e., technical description & quantities as per specification shall prevail).

BIDDER'S STAMP & SIGNATURE

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 vender 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.

SECTION – 'A'

SCOPE OF ENQUIRY

SCOPE OF ENQUIRY

1.0 This specification covers the design, manufacture, inspection and testing at manufacturer's works, proper packing and delivery to site of LT XLPE POWER 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 confirm 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.

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.

5.00.00 SOURCE OF WATER

Source of water (total quantity of water is 2192 m^3/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 ºC
Monthly lowest temperature.		:	12.9 ºC
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].

SECTION – 'C'

SPECIFIC TECHNICAL REQUIREMENTS

1.0 SCOPE OF ENQUIRY

1.1 This enquiry covers the supply of the LT power cables conforming to this specification.

1.2 General technical requirements of the cables are indicated in Section-D and Datasheet-A. Project specific technical/ quality requirements/ changes are listed below.

1.3 Cables shall conform in all respects to the requirements stipulated in all the above parts of the specification.

1.4 The stipulations of Section-C, followed by those of Datasheet-A shall prevail in case of any conflict between the stipulations of Section-C, Datasheet-A and Section-D.

2.0 BILL OF QUANTITIES:

2.1 Quantity requirements shall be as per Annexure-A (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:

3.2 Technical:

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

		the offer (e.g. covering letter, annexures, etc.) which is deviating from specification requirements in any way shall not be considered by BHEL as part of offer.

3.3 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.

3.4 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.

3.5 Quality Plan applicable for project:

BHEL Standard Quality Plan no. PE-QP-999-507-E002, R0 (Enclosed with specification).

3.6 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 per Annexure IV (drawing/document distribution list) as applicable.
All softcopies shall be submitted through DMS only.

4. LIST OF STANDARD DELIVERABLES FOR LT XLPE POWER CABLES TO BE SUBMITTED BY SUCCESSFUL BIDDER

LT XLPE POWER CABLES			
SL. No.	**DOCUMENT TITLE**	**DWG. / DOCUMENT No.**	**SUBMISSION SCHEDULE**
1	Data Sheet for LT XLPE Power cables	PE-V0-410-507-E111	Within Two weeks from the date of LOI
2	Cross-sectional Drawings for LT XLPE Power cables	PE-V0-410-507-E113	Within Two weeks from the date of LOI
3	Quality Plan for LT XLPE Power cables (Along with routine/ type/ acceptance test requirements)	PE-V0-410-507-E913	Within Two weeks from the date of LOI
4	Type Test Reports for Tests conducted in last five years	PE-V0-410-507-E114	Within Two weeks from the date of LOI
5	Type Test Reports for Tests conducted for this contract	PE-V0-410-507-E115	Within a week from the date of conduction of Type Test

Annexure-IV

Requirement of copies of Drawings/Documents for project

S.NO.	DESCRIPTION	NOS.(HARD COPY)	SOFT COPY (Through DMS)	CD ROM
1.	All Drgs./docs.- First submission/resubmission	2	YES IN PDF	-
2.	Final Drgs./docs. after approval for distribution purpose	10	YES IN PDF	1
3.	As built drgs./docs.	6	YES IN PDF	1
6.	Instruction Manual (Erection,/O&M), commissioning procedure, Data Books/Plant hands book/ CATALOGUES etc.	6	YES IN PDF	1
7.	Test Reports	1	YES IN PDF	1

ANNEXURE-A

BOQ CUM PRICE SCHEDULE

(A) MAIN SUPPLY

(1.1) 1.1KV, Al conductor, XLPE insulated, Galvanised steel round wire armoured for twin and multicore cables (non – magnetic hard drawn aluminium wire armoured conforming to H4 grade for single core cables),INNER SHEATH: Extruded HRPVC FRLS compound conforming to type ST2 of IS: 5831 for multicore cable. Single core cables shall have no inner sheath.OVERALL SHEATH: Extruded FRLS HRPVC compound conforming to type ST2 of IS: 5831, black in colour.

S. NO.	ITEM CODE	Cable Size (No. of cores x Cross section Area (sq.mm)	Order Quantity (meters)	LOT-1 QUANTITY	Drum length (meters)	Unit price (Ex-works) Rs.	Total price (Ex-works) Rs.
A1	507 -28154-A	1C - 35	6000	4000	500		
A2	507-28157-A	1C - 120	1000	1000	500		
A3	507 -28005-A	1C - 400	28000	20000	500		
A4	507-28007-A	1C - 630	24000	17000	500		
A5	507-28011-A	2C - 10	8000	5500	500		
A6	507-28017-A	2C - 25	7000	5000	500		
A7	507-28021-A	2C - 50	2000	1500	500		
A8	507-28027-A	2C - 95	2500	1500	500		
A9	507-28039-A	3C - 10	18500	13000	500		
A10	507-28047-A	3C - 25	31000	22000	500		
A11	507-28049-A	3C - 50	11000	8000	500		
A12	507-28160-A	3C - 70	1000	1000	500		
A13	507-28041-A	3C - 150	3500	2500	500		
A14	507-28045-A	3C - 240	8000	5500	500		
A15	507-28031-A	3.5C - 25	18000	13000	500		
A16	507-28035-A	3.5C - 50	25000	17500	500		
A17	507-28037-A	3.5C - 95	9000	6500	500		
A18	507-28029-A	3.5C - 185	1500	1000	500		
A19	507-28053-A	4C - 10	13000	9000	500		

ANNEXURE-A

BOQ CUM PRICE SCHEDULE

(1.2) 1.1KV, Cu conductor, XLPE insulated, galvanised steel round wire armoured for twin and multicore cables (non – magnetic hard drawn aluminium wire armoured conforming to H4 grade for single core cables). INNER SHEATH: Extruded HRPVC FRLS compound conforming to type ST2 of IS: 5831 for multicore cable. Single core cables shall have no inner sheath. OVERALL SHEATH: Extruded FRLS HRPVC compound conforming to type ST2 of IS: 5831, black in colour.

S.NO.	ITEM CODE	Cable Size (No. of cores x Cross section Area (sq.mm)	Order Quantity (meters)	LOT-1 Quantity (meters)	Drum length (meters)	Unit price (Ex-works) Rs.	Total price (Ex-works) Rs.
A20	507-28015-A	2C-2.5	65000	45000	1000		
A21	507-28043-A	3C-2.5	165000	110000	1000		

Notes :

1. Quantities indicated above for S. No. (A) shall be known as Order Quantities. The variation in quantities of all sizes for Main item (A) put together shall be limited to (-) 30% to (+) 30% of the total contract value derived on the basis of the Ordered quantities of main item (A).

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-1 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 shall be cleared for manufacture based on progress of engineering and site requirements.

4. 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.

5. Standard drum length shall be 500 / 1000metres.Tolerance on individual drum length shall be ±5%. 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).

6. 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.

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 qoute for all sizes/types of cables as per specification, failing which their offer shall be rejected.

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

SECTION-D

STANDARD TECHNICAL SPECIFICATION

1.0 TECHNICAL REQUIREMENTS

1.1 Technical requirements for 1.1 kV XLPE 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. Minor changes in Quality Plan (which shall be to customer approval during contract stage) shall be without any commercial implication.

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 the 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 conducted as indicated in Annexure to QAP (enclosed with quality plan) and the same shall be 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.

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 SPEIFIC TECHNICAL AND QUALITY DOCUMENTATION TO BE SUBMITTED

4.1 By All Bidders

As technical offer:

a) A copy of "Instruction to bidder's for preparing technical offer" as enclosed with enquiry with bidder's signature and company seal.
b) A copy of "List of contents" as enclosed with enquiry with bidder's signature and company seal.
c) A copy of Annexure-A (BOQ-Cum-Price schedule) as enclosed with enquiry with bidder's signature and company seal.
d) A copy of Datasheet-A as enclosed with enquiry with bidder's signature and company seal.
e) A copy of Quality Plan(including Annexure to QAP) as enclosed with enquiry with bidder's signature and company seal.

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

4.2 By Successful Bidder (for approval during contract stage)

a. Datasheet 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.

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.

DATASHEET A

DATA SHEET-A

1.0	Type of Cable	LT XLPE POWER CABLE OF FRLSH TYPE	
2.0	Standard applicable in general	IS:7098 (Part-1), IS:8130, IS:5831, IS:10810, IS:3975, ASTMD:2843, ASTMD:2863, IEC-754-1, IEC:60332 (Part-1), IEC:60332-3-23, IEEE:60383	
3.0	Voltage Grade	1.1kV	
4.0	Number of cores, cross sectional area of conductors	As per Annexure-A (BOQ cum price schedule)	
5.0	Formula for calculating short circuit current for different durations	Ish= k A/ $\sqrt{}$ (t) where, Ish = Short circuit current in kA t = Fault clearing time in sec. K = a constant = 0.094 for Aluminium conductor XLPE insulation = 0.141 for copper conductor XLPE insulation	
6.0	Installation Conditions for specified current rating		
(a)	Ambient air temperature	50 deg. C	
(b)	Ambient temp. for underground cable	50 deg. C	
(c)	Thermal resistivity of soil	150 deg. C cm/W	
7.0	CONDUCTOR		
(a)	Material	Aluminium	Copper
	Grade and Class	STRANDED COMPACTED PLAIN Aluminium OF H2 GRADE & CLASS 2.	STRANDED COMPACTED HIGH CONDUCTIVITY PLAIN ANNEALED COPPER.
(b)	Standard Applicable	IS: 8130	
	Shape	Circular / shaped as per IS	
(d)	Min. number of strands	As per Table-2 of IS: 8130	
8.0	INSULATION		
(a)	Material	XLPE	
(b)	Standard Applicable	IS: 7098 Part-I	
(c)	Continuous withstand temperature	90°C	
(d)	Short-circuit withstand temperature	250°C	
(e)	Method of application	By extrusion; sleeve extrusion not permitted.	
9.0	CORE IDENTIFICATION	Colour coding as per IS.	
10.0	INNER SHEATH		
(a)	Material	Extruded FRLS HRPVC Type ST2 as per IS: 5831	
(b)	Colour	*Black*	
(c)	Whether FRLS	*Yes*	
(d)	Inner sheath applicable for single core cable	*No*	

(e)	Fillers	Acceptable
(f)	Material of fillers (if permitted)	Same as inner sheath (Material of filler to be compatible with that of inner sheath)
(g)	Method of application	
(1)	Multi-core cables:	
(i)	With fillers	*Pressure/Vacuum extruded*
(ii)	Without fillers	*Pressure extruded*
11.0	ARMOUR (where applicable)	
(a)	Material:	
(i)	Single core cables	Non Magnetic Hard drawn Aluminium Round Wire H4 grade to IS: 3975 & 7098 part-1
(ii)	Multi-core cables	Galvanised Steel *Round Wire* armour conforming to (i) Type *'a'/ 'b'* as per Table- 6 of IS 7098-I and (ii) IS 3975 as per project requirements.
(b)	Minimum Coverage	90%
(c)	Gap between armour wires	Shall not exceed one armour wire space (No cross-over/ over-riding)
(d)	Breaking load of joint	95 % of normal armour
12.0	OUTERSHEATH	
(a)	Material	Extruded FRLS HRPVC Type ST2 as per IS: 5831
(b)	Colour	*Black*
(c)	Whether FRLS	Yes
(d)	Method of application	Extruded
(e)	Marking	Manufacturer's name and /or trade mark, voltage grade, Year of manufacture, Type of insulation, Cable size (cross section area of conductor and no. of cores), IS Number(s), Type of inner & outer sheath e.g. "FR/FRLS" etc, @ 1m (by embossing) 'BHEL-PEM' and 'TSGENCO' @1m (by embossing) Progressive
13.0	TEST CONDUCTED	
(a)	Oxygen index test	Min 29 (As per ASTM D2863)
(b)	Temperature index test	Minimum 250ºC at oxygen index 21 (ASTM-D-2863)
(c)	Halogen acid gas evolution test	Max. 20% (as per IEC-754-1)
(d)	Smoke density rating test	Max.60% (As per ASTM D2843)
(e)	Flammability Test	As per IEC: 60332-III CAT-B, IEC: 60332-I, IEEE: 383 & SS: 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.
14.0	TOLERANCE ON OUTER DIAMETER	Up to 30mm; ± 1.5mm Above 30mm; ±5% or ± 2mm, whichever is less.
15.0	ANTI-RODENT AND TERMITE REPULSION	*YES* The test shall be carried out to also note the presence of rodent and termite repelling chemical in PVC compound. Normal procedure is that a few chippings of the PVC compound are slowly ignited in a porcelain dish or crucible in a muffle furnace at about 600°C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). A drop of aqueous sodium-sulphide solution is placed on a thick filter paper and it is allowed to soak. The spot is touched with a drop of above extract. A black spot indicates the presence of anti-termite & rodent compound.
16.0	TEST MINIMUM BENDING RADIUS	
(a)	Single core cables	15 x O.D.
(b)	Multi core cables	12 x O.D.
17.0	SAFE PULLING FORCE	
(a)	Aluminium conductor cable	30 N/ sq. mm.
(b)	Copper conductor cable	50 N/ sq. mm.
18.0	CABLE DRUMS	
(a)	Type & construction	Wooden as per IS 10418
(b)	Standard drum length	*500m (±) 5% / 1000m (±) 5%*
(c)	Particular information on cable drum	The cable drum should carry the following details in printed form. a) TSGENCO b) Manufacturer's name or trademark. c) Type of cable & voltage grade. d) Year of manufacture. e) Type of insulation e.g. XLPE. f) No. of core and size of cables. g) Cable code e.g. FRLS/FS. h) Length of cable on drum. i) No. of length on drum, if more than one. j) Direction of rotation, by arrow. k) Approx. gross mass. *l)* IS/IEC number and ISI mark.

BHEL	**STANDARD QUALITY PLAN**		CUSTOMER : TSGENCO			PROJECT: TITLE 1 X 800 MW KOTHAGUDEM TPS			SPECIFICATION NUMBER PE-TS-410-507-E002			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E002, **R0**			SPECIFICATION : TITLE			
	SHEET 1 OF 9		SYSTEM			ITEM : LT XLPE Power Cables			SECTION VOLUME III			
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
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 MATERIALS & BOUGHT OUT ITEMS**											
1.1	**Aluminium Rods (Conductor/ Armour Wire)**	**GENERAL :**										
		1. Physical properties	MA	Physical Tests	Sample/ Batch	IS:7098-I,IS:5082, IS:5484, IS:8130 & Appd Datasheet	IS:7098-I,IS: 5082, IS:5484, IS:8130 & Appd Datasheet	Log book/ Test Cert.	3/2	-	1/2	
		2. Elec.Properties	MA	Electrical Tests	Sample/ Batch	-do-	-do-	-do-	3/2	-	1/2	
		SPECIFIC CHECKS :										
		a) Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2	-	1	
		b) Grade	MA	-do-	-do-	IS 8130, IS 5082/ Approved datasheet	IS 8130, IS 5082/ Approved datasheet	-do-	3/2	-	1	
		c) Resistivity	MA	Electrical Tests	Manufacturer std.	IS 8130, IS 5082	IS 8130, IS 5082	-do-	3/2	-	1	
1.2	**XLPE Compound for insulation**	**GENERAL :**										
		1. Physical properties	MA	Physical Tests	Sample/ Batch	IS 7098-I & Mfs Std./ Approved datasheet	IS 7098-I & Mfs Std./ Approved datasheet	Log book/ Test Cert.	3/2	-	1/2	
		2. Elec.Properties	MA	Electrical Tests	Sample/ Batch	-do-	-do-	-do-	3/2	-	1/2	
		SPECIFIC CHECKS :										
		a) Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2	-	1	
		b) Type/ Grade	MA	-do-	-do-	Mfr. Std/ Approved datasheet	Mfr. Std/ Approved datasheet	-do-	3/2	-	1	
		c) Shelf life/ Storage condition	MA	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	3/2	-	1	

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

	STANDARD QUALITY PLAN		CUSTOMER : TSGENCO			PROJECT: TITLE 1 X 800 MW KOTHAGUDEM TPS			SPECIFICATION NUMBER PE-TS-410-507-E002			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E002, **R0**			SPECIFICATION : TITLE			
	SHEET 2 OF 9		SYSTEM			ITEM : LT XLPE Power Cables			SECTION VOLUME III			
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.3	**PVC Compound (for sheath)**	**GENERAL :**										
		1. Physical properties	MA	Physical Tests	Sample/ Batch	IS 7098-I, IS 5831& Mfr. Std./ Approved datasheet	IS 7098-I, IS 5831& Mfr. Std./ Approved datasheet	Log book/ Test Cert.	3/2	-	1/2	
		2. Elec.Properties	MA	Electrical Tests	Sample/ Batch	-do-	-do-	-do-	3/2	-	1/2	
		3. FRLS Properties (as applicable)	CR	Chemical/ Environ.	Sample/ Batch	-do-	-do-	-do-	3/2	-	1/2	
		SPECIFIC CHECKS :										
		a) Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2	-	1	
		b) Type/ Grade	MA	-do-	-do-	Approved datasheet	Approved datasheet	-do-	3/2	-	1	
		c) Shelf life/ Storage condition	MA	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	3/2	-	1	
1.4	**Fillers (as applicable)**	1. Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2	-	1	
		2. Type/ Grade	MA	-do-	-do-	Approved datasheet	Approved datasheet	-do-	3/2	-	1	(Fillers material chosen shall be compatible with the temerature rating of the cable and shall have no deleterious effect on any other componenet of the cable)

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

	STANDARD QUALITY PLAN		CUSTOMER : TSGENCO			PROJECT: TITLE 1 X 800 MW KOTHAGUDEM TPS			SPECIFICATION NUMBER PE-TS-410-507-E002			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E002, **R0**			SPECIFICATION : TITLE			
	SHEET 3 OF 9		SYSTEM			ITEM : LT XLPE Power Cables			SECTION VOLUME III			
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.5	**Galvanised steel wire/strip for Armour (as applicable)**	**GENERAL :**										
		1. Make	MA	Verify	Manufacturer std.	Manufacturer approved source	Manufacturer approved source	Log book/ Test Cert.	3/2	-	1	
		2. Dimension	MA	Measurement	-do-	IS 7098-I, IS 3975 & Approved datasheet	IS 7098-I, IS 3975 & Approved datasheet	-do-	3/2	-	2	
		3. Phy.and Elec. Properties	MA	Physical & Electrical Tests	Sample*	-do-	-do-	-do-	3/2	-	2	* Sample from each armour size/ Batch / Lot
		4.Galvanization Quality	MA	Galv.Tests	-do-	IS 3975 & Mfr. Std.	IS 3975 & Mfr. Std.	-do-	3/2	-	2	
1.6	**Wooden Drum**	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 Drum #**	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.	-do-	Surface shall be smooth	Surface shall be smooth	-do-	3/2		1	

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

	STANDARD QUALITY PLAN		CUSTOMER : TSGENCO			PROJECT: TITLE 1 X 800 MW KOTHAGUDEM TPS			SPECIFICATION NUMBER PE-TS-410-507-E002			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E002, **R0**			SPECIFICATION : TITLE			
	SHEET 4 OF 9		SYSTEM			ITEM : LT XLPE Power Cables			SECTION VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.0	**IN PROCESS**											
2.1	**Wire Drawing**	1. Size	MA	Dimensional	Plant Mfg. Std.	IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet	Log Book	2	-	1	
		2. Surface finish	MA	Visual	-do-	Surface shall be smooth	Surface shall be smooth	-do-	2	-	1	
		3. % of Elongation	MA	Mechanical	-do-	IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet	-do-	2	-	1	
2.2	**Stranding of wires**	1. No. of wires	MA	Counting	Plant Mfg. Std.	IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet	Log Book	2	-	-	
		2. Resistance	CR	Electrical	-do-	-do-	-do-	-do-	2	-	-	
		3. Sequence, lay length & Direction	MA	Visual, Meas.	One Sample of each size/ lot	Mfrs Std. / Appd. Datasheet	Mfrs Std. / Appd. Datasheet	-do-	2	-	-	
		4. Surface Finish	MA	Visual	100%	Surface shall be smooth	Surface shall be smooth	-do-	2	-	-	
		5. Dimension	MA	Measurement	One Sample of each size/ lot	IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet	-do-	2	-	-	
2.3	**Core Insulation (XLPE)**											
	(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. Eccentricity & Ovality #	CR	Measurement	One Sample of each size/ lot	IS 7098-I & Appd. Datasheet	IS 7098-I & Appd. Datasheet	-do-	2	-	1	*# To be checked at starting & finished end of extruded length.*
		3. Insulation Thickness	CR	Measurement	-do-	-do-	-do-	-do-	2	-	-	
		4. Dia over insulation	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
		5. Tensile Strength & % Elongatio	MA	Mechanical	100%	-do-	-do-	-do-	2	-	-	
		6. Spark Test or Water immersion test	CR	Electrical	100%	Mnfr's Std	Mnfr's Std	-do-	2	-	1	

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	SIGNATURE		
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	STANDARD QUALITY PLAN		CUSTOMER : TSGENCO			PROJECT: TITLE 1 X 800 MW KOTHAGUDEM TPS			SPECIFICATION NUMBER PE-TS-410-507-E002			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E002, **R0**			SPECIFICATION : TITLE			
	SHEET 5 OF 9		SYSTEM			ITEM : LT XLPE Power Cables			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.4	**Core Laying**	1. Dia over laid up core	MA	Measurement	One Sample of each size/ lot	IS 7098-I & Appd. Datasheet	IS 7098-I & Appd. Datasheet	Log Book	2	-	-	
		2. Sequence of lay & direction	MA	Visual & Meas.	-do-	IS 7098-I & Mfr. Std.	IS 7098-I & Mfr. Std.	-do-	2	-	-	
		3. Lay Length	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
2.5	**InnerSheath Extrusion (as 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. Thickness	CR	Measurement	One Sample of each size/ lot	IS 7098-I & Appd. Datasheet	IS 7098-I & Appd. Datasheet	-do-	2	-	-	
		3. Dia over inner sheath	MA	-do-	-do-	-do-	-do-	-do-	2	-	-	
2.6	**Armour(as applicable)**	1. No.of wires/Strips	MA	Counting	At the start of the process	IS 7098-I & Appd. Datasheet	IS 7098-I & Appd. Datasheet	Log Book	2	-	-	
		2. Lay length & Direction	MA	Visual & Meas.	-do-	IS 7098-I & Mfr. Std.	IS 7098-I & Mfr. Std.	-do-	2	-	-	
		3. Dia over armouring	MA	Measurement	-do-	IS 7098-I & Appd. Datasheet	IS 7098-I & Appd. Datasheet	-do-	2	-	-	
		4. Coverage	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
2.7	**Outer Sheath Extrusion (No repair permitted)**	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 7098-I & Appd. Datasheet	IS 7098-I & Appd. Datasheet	-do-	2	-	-	
		3. Dia over outer sheath	MA	-do-	-do-	-do-	-do-	-do-	2	-	-	
		4. Embossing/ Sequencial Marking	MA	Visual	100%	Approved data sheet	Approved data sheet	-do-	2	-	-	

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BHEL	**STANDARD QUALITY PLAN**	CUSTOMER : TSGENCO			PROJECT: TITLE 1 X 800 MW KOTHAGUDEM TPS			SPECIFICATION NUMBER PE-TS-410-507-E002				
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E002, **R0**			SPECIFICATION : TITLE				
	SHEET 6 OF 9	SYSTEM			ITEM : LT XLPE Power Cables			SECTION VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
3.0	**Finished Cable (INTERNAL)**	**1. Routine Test (Refer Note-F)**	CR	Electrical Tests & Measurement	100%	IS 7098-I & Appd. Datasheet	IS 7098-I & Appd. Datasheet	Test Report	2	-	1	
4.0	**Final Inspection (EXTERNAL)**	**1. Finish**	MA	Visual	One drum in each Lot	IS 7098-I & Appd. Datasheet	Free from Porosity, Bulging, Burnt particles,lumps, cuts &	Test Report	2	1	-	
		2. Length	MA	Measurement	-do-	-do-	Approved Data Sheet	-do-	2	1	-	
		3. Dimension	MA	-do-	As per IS	-do-	-do-	-do-	2	1	-	
		4. Armouring - Coverage & No.of Wires/Strips	MA	Visual & Meas.	-do-	-do-	-do-	-do-	2	1	-	
		5. Marking & Colour Coding	MA	Visual	As per IS	-do-	Approved Data Sheet	-do-	2	1	-	
		6. Acceptance Tests (Refer Note-F)	CR	Phy, Elect. Tests & FRLS Tests	Sample #	-do-	-do-	-do-	2	1	-	*# Refer Annexure-A to QAP enclsoed*
		7. Type Tests (Refer Note-F)	CR	Physical & Electrical Tests	Sample #	-do-	-do-	-do-	2	1	-	*# Refer Annexure-A to QAP enclsoed*
5.0	**Packing**	**Sealing Identification**	MA	Visual	100%	As per IS	As per IS	-do-	2	1	-	

NOTES:-

(A) JOINTS IN WIRE SHALL BE AS PERMITTED BY **IS** / MANUFACTURER'S STANDARD, VENDOR TO CERTIFY THE SAME.

(B) NO REPAIR OF CORE INSULATION PERMITTED

(C) RECORD OF RAW MATERIAL, PROCESS & ALL STAGES SHALL BE CERTIFIED BY VENDORS QC. AND ARE LIABLE TO AUDIT CHECK BY PURCHASER.

(D) FILLERS/DUMMY CORES ETC. SHALL BE AS PER APPROVED DATA SHEET

(E) VENDOR SHALL FURNISH COMPLIANCE CERTIFICATE TO THE INSPECTION AGENCY CONFIRMING THE PACKING AS PER BHEL SPECIFICATION.

(F) ***FOR LIST OF ROUTINE, TYPE & ACCEPTANCE TESTS, REFER ANNEXURE-A TO QAP ENCLOSED.***

LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER 1- BHEL/CUSTOMER 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

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS

A. Type Test Conduction:

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

2. Sampling:
   a) Type test to be conducted on each type & size of cable on one drum out of every 10 drums.
   b) 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:
   Acceptance tests to be conducted on one drum out of every 10 drums/ lot for every size.

3. Flammability Test to be conducted only on one sample/ lot.

C. Routine Test Conduction:

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

D. Tests listed in S.No-7.0 & 8.0 shall be conducted only on one sample / lot.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
1.0	**Tests for Conductor**				
I.	Annealing test	For copper conductor only	**T, A**	IS 10810 Pt 1	***Internal in process Test Report to be furnished for acceptance test***
II.	Tensile test	For aluminium conductor only	**T, A**	IS 10810 Pt 2	
III.	Wrapping test	For aluminium conductor only	**T, A**	IS 10810 Pt 3	
IV.	Resistance test	For Al/Cu	**T, A, R**	IS 10810 Pt 5	
2.0	**Tests for Armour Wires/Strips**				
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	**T,A**	IS 10810 Pt 36	
II.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	**T, A**	IS 10810 Pt 37	
III.	Elongation at break test	Applicable for GS wire/Strip only	**T, A**	IS 10810 Pt 37	
IV.	Torsion test	For GS round wire only	**T, A**	IS 10810 Pt 38	
V.	Winding test	For GS strip only	**T, A**	IS 10810 Pt 39	

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
VI.	Resistivity & DC resistance test	Applicable for Aluminium wire & GS wire	**A**	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	**A**	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	**A**	IS 10810 Pt 41	
IX.	Wrapping Test	For Aluminium wires only	**A**	IS 10810 Pt 3	
3.0	**Physical Tests for XLPE Insulation & PVC sheath**				
I.	Test for thickness	Applicable for XLPE insulation, PVC inner sheath & PVC outer sheath	**T, A**	IS 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for XLPE insulation & PVC outer sheath			
(a)	Before ageing		**T, A**	IS 10810 Pt 7	
(b)	After ageing		**T, A**	IS 10810 Pt 7	
III.	Ageing in air oven	Applicable for XLPE insulation & PVC outer sheath	**T**	IS 10810 Pt 11	
IV.	Loss of mass in air oven test	For PVC outer sheath only	**T**	IS 10810 Pt 10	
V.	Hot deformation test	For PVC outer sheath only	**T**	IS 10810 Pt 15	
VI.	Heat shock test	For PVC outer sheath only	**T**	IS 10810 Pt 14	
VII.	Shrinkage test	For XLPE insulation & PVC outer sheath only	**T**	IS 10810 Pt 12	
VIII.	Thermal stability test	For PVC outer sheath only	**T**	IS 10810 Pt 60	
IX.	Hot set test	For XLPE insulation only	**T, A**	IS 10810 Pt 30	
X.	Water absorption (gravimetric) test	For XLPE insulation only	**T**	IS 10810 Pt 33	
4.0	**Improved Fire performance (FR-LSH) Tests**				
I.	Oxygen index test	For PVC outer sheath only	**T, A**	IS 10810 Pt 58 / ASTMD 2863	**Applicable for Inner Sheath also, if the same is indicated in Datasheet-A**
II.	Smoke density test	For PVC outer sheath only	**T, A**	IS 10810 Pt 63 / ASTMD 2843	
III.	Halogen acid gas evolution test	For PVC outer sheath only	**T, A**	IS 10810 Pt 59 / IEC-754-1	
IV.	Temperature Index Test	For PVC outer sheath only	**T**	IS 10810 Pt 64 / ASTMD 2863	
5.0	**Flammability Tests**				
I.	Flammability test for bunched cables	For complete cable	**T**	IS 10810 Pt 62/ IEC-60332 (Part-3-23-Cat-B/Cat-A,	**Test & Category applicable as indicated in Datasheet-A**
II.	Flammability test for single cable	For complete cable	**T,A**	IS: 10810 Pt 61 / IEC:60332 Part-1	
III.	Swedish chimney test	For complete cable	**A**	SEN SS 424 1475 (Class F3)	
IV.	Flammability test	For complete cable	**A**	IEEE: 60383	

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
6.0	**Electrical Tests**				
I.	High Voltage Test	For complete cable	**T, A, R**	IS 10810 Pt 45	
II.	Insulation Resistance Test (Volume resistivity method)	For com plete cable	**T, A**	IS 10810 Pt 43	
7.0	**Anti-rodent and Termite Repulsion test**	For PVC outer sheath only	**A**	--	**Test applicable if indicated in Datasheet-A**
8.0	**Anti-Fungal Test**	For PVC outer sheath only	**A**	--	

DATA SHEET-C

S.No.	Particulars	Unit	Description
1.0	Type of Cable	Flame Retardant Low Smoke (FRLS) (Yes/ No)	
2	Reference design standards	-	
3	Rated Voltage	V	
4	Design Ambient Temperature	Deg. C	
5	Conductor		
	a) Material	-	
	b) Grade and class	-	
	c) Reference standard	-	
6	Insulation		
	a) Material	-	
	b) Reference standard	-	
	c) Minimum Thickness	mm	
	d) Continuous withstand temperature	Deg. C	
	e) Short-circuit withstand temperature	Deg. C	
	f) Method of application	-	
	g) Method of curing		
7	Core Identification		
8	Inner Sheath		
	a) Material	-	
	b) Reference standard	-	

	c) Minimum Thickness	mm	
	d) Colour	-	
	e) Whether FRLS	Yes/No	
	f) Whether inner sheath applicable for Single Core cable	Yes/No	
9	Armour		
	a) Material	-	
	b) Reference Standard	-	
	c) Minimum coverage	%	
	d) Method of jointing	-	
10	Outer Sheath		
	a) Material	-	
	b) Reference standard	-	
	c) Colour	-	
	d) Minimum thickness	mm	
	e) Whether FRLS	Yes/No	
	f) Method of application	-	
	g) Marking	-	
11	FRLS Characteristics		
	a) Oxygen Index (as per ASTMD 2863)	-	
	b) Temperature Index (in deg. C as per ASTMD 2863)	^{o}C	
	c) Maximum acid gas generation as per IEC754-1	%	
	d) Maximum smoke density rating as per ASTMD 2843	%	
12	Flammability Test		

	Flammability Test for single cable as per :- IS:7098 (Part-1) (IS:10810 Part-61) IEC:60332 (Part-1)	 *[*]* *[*]*	
13	Flammability Test for bunched cables as per:- a) IS:7098 (Part-1) (IS:10810 Part-62) CAT-A CAT-B b) IEC:60332 Part-3-23 CAT-A CAT-B	 *[*]* *[*]* *[*]* *[*]*	
14	Flammability Test as per IEEE:60383	Yes/No	
15	Swedish Chimney test as per SS-424-1475-F3	Yes/No	
16.	Anti-rodent and Termite repulsion Test	Yes/No	
17.	Hydrolytic Stability as per ASTM D 3137-81 (Duration:-14 days)	Yes/No	
18	UV Radiation Test as per BS EN ISO 4892/ ASTM-G-154 (Duration:- 14 days)	Yes/No	
19	Tolerance on Outer Diameter	mm	
20	Minimum Bending Radius	mm	
21	Safe Pulling Force	N/sq.mm	
22	Drums		
	a) Type & Construction	-	
	b) Standard Drum Length c) Marking on drum d) Both end of cables to be sealed with PVC/ Rubber caps to prevent moisture /water ingress	m - Yes/No	