

VOLUME-II

1 X 660 MW PANKI TPS

TECHNICAL SPECIFICATION

FOR

LT XLPE POWER CABLE

SPECIFICATION NO: PE-TS-426-507-E002

REVISION: 00



BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

NOIDA, UP (INDIA) – 201301

426464/2021/PS-PEM-EL



TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES

SPECIFICATION NO. ~~PE-RC-999-507-E002~~

VOLUME II

SECTION

REVISION ~~01~~DATE: ~~14.06.19~~

SHEET 1 OF 1

CONTENTS

<u>S. NO.</u>	<u>DESCRIPTION</u>	<u>NO. OF SHEETS</u>
1.	CONTENTS	01
2.	SECTION – I	
	COMPLIANCE CERTIFICATE	01
	SPECIFIC TECHNICAL REQUIREMENTS	01
	DATA SHEET-A	03
	DATA SHEET-C	03
3.	SECTION – II	
	STANDARD TECHNICAL SPECIFICATION	02
	QUALITY PLAN (ALONGWITH ANNEXURE A TO QP)	09
	TOTAL NO. OF SHEETS=	23
	(INCLUDING COVER/ SEPARATOR SHEETS)	

426464/2021/PS-PEM-EL



TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES

SPECIFICATION NO. ~~PE-RC-009-507-E002~~

VOLUME II

SECTION I

REVISION ~~1~~DATE: ~~14.06.19~~

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS



TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES

SPECIFICATION NO. ~~PE-RC-999-507-E002-~~

VOLUME II

SECTION I

REVISION ~~4-~~

DATE: ~~14.06.19~~

SHEET 1 of 1

COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.
2. There is no deviation with respect to specification other than those furnished in the 'schedule of deviations'.
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
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 description/ quantities from those given in '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



TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES

SPECIFICATION NO. ~~PE-RC-999-507-E002~~

VOLUME II

SECTION I

REVISION ~~4~~DATE: ~~14.06.19~~

SHEET 1 OF 1

1.0 ~~PURPOSE~~

~~This specification is intended for finalization of rate contract between BHEL PEM and Bidder. Standard technical detail as indicated in the specification shall be agreed upon between BHEL PEM and bidder. Project specific technical detail shall be made available to the bidder along with project enquiry.~~

2.0 SCOPE OF ENQUIRY

- 2.1 Design, Manufacture, Inspection and Testing at Manufacturer's works, proper packing and delivery to site of LT XLPE Power Cable conforming to this specification.
- 2.2 It is not the intent to specify herein all the details of design & manufacture of material. However, the material shall conform in all respects to high standard of design, engineering & workmanship and shall be capable of performing in continuous commercial operation at site condition.
- 2.3 Technical requirements of LT XLPE Power Cable are indicated in Data Sheet-A & Section-II.
- 2.4 The stipulation of Data Sheet-A shall prevail in case of any conflict between the stipulations of Data Sheet-A & Section-II.

3.0 BILL OF QUANTITIES

The bidder to quote for items as per price schedule attached with NIT. ~~The quantity as mentioned in the BOQ is only for evaluation purpose.~~ However actual ordered quantity may vary from project to project throughout the contract.

4.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

- 4.1 ~~After rate contract; against specific project requirement following information shall be furnished by BHEL:-~~

~~a) BOQ (Bill of Quantities)~~

- 4.2 Following documents shall be submitted ~~for specific project requirement~~ after placement of order for BHEL & customer's approval: -

Sl. No.	Drawing / Document Description	Drawing / Document no	Document Type	First Submission	Resubmission
1	Technical Data sheet - LT XLPE Power cables	426 PE-V0- XXX -507-E111	Primary	Refer Delivery Schedule of NIT.	
2	Cross-sectional Drgs.- LT XLPE Power Cables	426 PE-V0- XXX -507-E113	Primary		
3	Quality Plan - LT XLPE Power Cables	426 PE-V0- XXX -507-E913	Primary		

- 4.3 Drawings/documents shall be submitted through Document Management System (DMS).



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES

SPECIFICATION NO. ~~PE-RC-999-507-E002~~

VOLUME II

SECTION I

REVISION ~~4~~DATE: ~~14.06.19~~

SHEET 1 OF 3

DATA SHEET-A

1.0	Type of Cable	Flame Retardant Low Smoke halogen (FR-LSH)	
2.0	Standard applicable in general(Latest amendment to be referred if any)	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 and quantities	As per BOQ-Cum-Price Schedule	
5.0	FAULT CHARACTERISTICS		
	Fault Level	50kA RMS	
	Fault Clearing Time	1.0 sec – for 630 Sq mm cross section cables 0.5 sec – for 400 Sq mm cross section cables 0.25 sec – for 300 Sq mm cross section cables 0.2 sec – for 240 Sq mm cross section cables	
6.0	CONDUCTOR		
(a)	Material	Aluminium	Copper
	Grade and Class	Stranded, Compacted, H2, Class 2	Stranded, plain annealed high conductivity, Class 2
(b)	Standard Applicable	IS: 8130	
(c)	Shape	Aluminium	Copper
		Circular/ Shaped – as per IS	Circular – for all sizes
(d)	Min. number and diameter of strands for main and neutral conductor [Neutral conductor cross section w.r.t main conductor shall be as per Table-2 of IS: 7098 (Part-1)]	As per Table-2 of IS: 8130	
7.0	INSULATION		
(a)	Material	Cross-Linked Polyethylene(XLPE)	
(b)	Standard Applicable	IS: 7098 (Part-1)	
(c)	Continuous withstand temperature	90°C	
(d)	Short-circuit withstand temperature	250°C	
(e)	Method of application	By extrusion; sleeve extrusion not permitted.	
(f)	Nominal Thickness of insulation	As per IS: 7098 (Part-1)	
8.0	CORE IDENTIFICATION		Colour coding as per IS-7098 (Part-I)
9.0	INNER SHEATH		
(a)	Material	Extruded HRPVC Type ST-2	
(b)	Standard Applicable	IS: 7098 (Part-1) & IS: 5831	
(c)	Colour	Black	
(d)	Whether FR-LSH	No (Project specific requirement shall be informed later)	
(e)	Inner sheath applicable for single core cable	No	



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES

SPECIFICATION NO. ~~PE-RC-999-507-E002~~

VOLUME II

SECTION I

REVISION ~~1-~~DATE: ~~14.06.19~~

SHEET 2 OF 3

(f)	Fillers	Acceptable
(g)	Material of fillers (if permitted)	Same as inner sheath (Material of filler to be compatible with that of inner sheath)
(h)	Method of application	
(1)	Multi-core cables:	
(i)	With fillers	Pressure/ Vacuum extruded
(ii)	Without fillers	Pressure extruded
(2)	Single-core cables:	NOT APPLICABLE
10.0	ARMOUR	
(a)	Applicable	YES
(b)	Material:	
(i)	Single core cables	Non Magnetic Hard drawn Aluminium Round Wire H4 grade to IS: 8130
(ii)	Multi-core cables	Galvanised Steel Round Wire OR Galvanised Steel Formed Wire/Strip, conforming to (i) Type 'a' / 'b' as per Table-6 of IS 7098 part-I and (ii) IS 3975 (as specified in BOQ cum price schedule) (Project specific requirement for Type 'a' or 'b' shall be informed later)
(iii)	Standard Applicable	Dimension as per IS: 7098 (Part-1) Table-6 and tolerance on dimension as per IS:3975
(c)	Minimum Coverage	90%
(d)	Gap between armour wires	Shall not exceed one armour wire space (No cross-over/ over-riding)
(e)	Breaking load of joint	95 % of normal armour
(f)	Paint on joint	Zinc rich paint shall be applied on armour joint surface of G.S. wire / formed wire
11.0	OUTERSHEATH	
(a)	Material	HRPVC Type ST2 as per IS: 5831
(b)	Colour	Black
(c)	Whether FR-LSH	Yes
(d)	Method of application	Extruded
(e)	Thickness of outer sheath	As per Table-8 of IS: 7098 (Part-1)
(f)	Marking	Cable size (cross section area and no. of cores), voltage grade and Reference IS @ 1m (by embossing) Word "XLPE", "FR-LSH" @ 1m (by embossing) Manufacturer's name and/ or trade name, and year of manufacture @ 1m (by embossing) 'BHEL-PEM' and 'CUSTOMER' Name @1m (by embossing) Progressive sequential marking of length of the cable in metres @ 1m (by embossing/ printing) <i>Further customer specific marking requirement (if any) shall be informed later.</i> The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.
12.0	FR-LS CHARACTERISTICS	
(a)	Oxygen index	Min 29 (As per IS 7098-I /ASTMD 2863)/

426464/2021/PS-PEM-EL



DOCUMENT TITLE

TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES

SPECIFICATION NO. ~~PE-RC-999-507-E002~~

VOLUME II

SECTION I

REVISION 1

DATE: ~~14.06.19~~

SHEET 3 OF 3

		Min 21 (as per NES-715-1) (Project specific requirement shall be informed later)
(b)	Temperature index	Min. 250°C (As per IS 7098-I /ASTMD 2863)
(c)	Acid gas generation	Max. 20% by weight (As per IS 7098-I /IEC-60754-1)
(d)	Smoke density rating	Max. 60% (As per IS 7098-I /ASTM D 2843)
(e)	Flammability Test	
(i)	Flammability test for single cable	YES As per IEC-60332 Part-1
(ii)	Flammability test for bunched cables	YES As per IEC-60332 Part-3-23, CAT-B
(iii)	Flammability test as per IEEE: 60383	YES
(iv)	As per Swedish Chimney test SEN-SS-424-1475-F3	YES
(f)	Special Tests	
I.	Hydrolytic Stability Test	No/ Refer Cl. 3.4 of Sec-II
II.	Ultraviolet Radiation Test	No/ Refer Cl. 3.4 of Sec-II
13.0	Anti-rodent and Termite repulsion Test	YES
14.0	Anti-Fungal Test	No
15.0	TOLERANCE ON OUTER DIAMETER	± 2mm
16.0	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 of Drum	Wooden as per IS 10418
(b)	Standard drum length	500m (±) 5% / 1000m (±) 5%. (as specified in BOQ-Cum-Priced Schedule)
(c)	Painting	Entire surface to be painted
(d)	Construction details	Clause no 4.2 of Section-II of this technical specification
(e)	Particular details on Drum	Clause no 4.3 of Section-II of this technical specification. Further customer specific marking requirement (if any) shall be informed later.
19.0	Sea Worthy packing	No

426464/2021/PS-PEM-EL

	DOCUMENT TITLE TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES	SPECIFICATION NO. PE-RC-999-507-E002
		VOLUME II
		SECTION I
		REV NO. 0 DATE 14.06.19
		SHEET 1 OF 3

DATASHEET C**GUARANTEED TECHNICAL PARTICULARS
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)**

S.No.		Unit	Description
A	GENERAL	-	
1	Name of manufacturer	-	
2	Place of Manufacture	-	
3	Current rating of cables conforms to	-	
4	Short circuit rating conforms to	-	
5	Formula for calculating short circuit current for different duration	-	
6	Permissible conductor temperature		
	(a) Maximum continuous rating	deg. C	
	(b) Short circuit rating	deg. C	
7	(a) Installation Conditions at site		
	i) Ambient air temperature	deg. C	
	ii) Ground temperature	deg. C	
	iii) Depth of laying of cables buried in ground	cm	
8	CHARACTERISTICS OF FRLS SHEATH		
	(a) Oxygen index	%	
	(b) Temperature index	deg. C	
	(c) Acid gas generation	%	
	(d) Smoke density rating	%	
9	CABLE DRUMS		
	(a) Type & construction	-	
	(b) Standard drum length	Mtr	
	(c) Tolerance on drum length	%	
B	INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE		
1	No. of cores x size	No. x sq.mm	
2	Voltage grade (Uo/U)	kV	
3	Base current ratings (*) based on Sl. (A) 7.0		
	(a) In air	Amp	
	(b) In ground	Amp	
	(c) ducts	Amp	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

426464/2021/PS-PEM-EL

54/2021/PS-PEM-EL		DOCUMENT TITLE		SPECIFICATION NO. PE-RG-999-507-E002	
बीएचईल 		DOCUMENT TITLE		VOLUME II	
		TECHNICAL SPECIFICATION FOR		SECTION I	
		LT XLPE POWER CABLES		REV NO. 4 DATE 14.06.19	
				SHEET 2 OF 3	

4	Short circuit rating for 1 sec duration	kA	
5	(a) D.C. resistance of conductor at 20 deg C (main / neutral)	ohm/km	
	(b) A.C. resistance of conductor at 90 deg. C (main / neutral)	ohm/km	
	(c) Reactance of cable at Normal frequency	ohm/km	
	(d) Electrostatic capacitance of cable at normal frequency	μF/km	
6	CONDUCTOR		
	(a) Material type	-	
	(b) Grade	-	
	(c) No & dia of wires in each core before stranding	no x mm	
	(d) Shape	-	
7	INSULATION		
	(a) Material	-	
	(b) Nominal thickness (main / neutral)	mm	
	(c) Minimum thickness (main / neutral)	mm	
	(d) Minimum volume resistivity at 27 deg. C	Ohm-cm	
	(e) Minimum volume resistivity at 90 deg. C	Ohm-cm	
8	INNERSHEATH		
	(a) Material	-	
	(b) Whether FRLS	-	
	(c) Thickness (min.)	mm	
	(d) Method of application for multi-core cables	-	
	(e) Type and shape of fillers (if used)	-	
	(f) Colour	-	
9	ARMOUR		
	(a) Material	-	
	(b) Type of armour	-	
	(c) Size/ dimensions (Nominal dia of wire)	mm	
	(d) Minimum no. of round / formed wires	No.	
	(e) Minimum coverage	%	
	(f) Gap between armour wire/strip	-	
	(g) Breaking load of joint	-	
	(h) Maximum resistivity of GS formed / Round wire	Ohm-cm	
	(i) Maximum resistivity of Aluminium round wire	Ohm-cm	
10	OUTERSHEATH		
	(a) Material	-	
	(b) Whether FRLS	-	
	(c) Minimum thickness	mm	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

426464/2021/PS-PEM-EL

	DOCUMENT TITLE TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES	SPECIFICATION NO. PE-RC-000-507-E002
		VOLUME II
		SECTION I
		REV NO. 0 DATE 14.06.19
		SHEET 3 OF 3

	(d) Colour	-	
	(e) Method of application	-	
11	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	
	(e) Tolerance on overall diameter	(±) mm	
12	Ovality	mm	
13	Minimum bending radius	x O.D	
14	Safe Pulling Force	N/mm ²	
15	Weight of cable	kg./km	
16	Dimension of drum	mm	
17	Shipping weight (approx.)	kg	
18	Cable marking on outer sheath	-	
19	Marking on drum	-	

(*) For single core cables, the continuous current rating shall be furnished separately for armour earthed at one end and at both ends.

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

426464/2021/PS-PEM-EL



TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES

SPECIFICATION NO. PE-RC-999-507-E002

VOLUME II

SECTION II

REVISION 1

DATE: 14.06.19

SECTION-II

STANDARD TECHNICAL REQUIREMENTS



TECHNICAL SPECIFICATION FOR LT XLPE Power Cable

SPECIFICATION NO. ~~PE-RC-999-507-E002~~

VOLUME II

SECTION II

REVISION ~~00~~DATE: ~~09.08.17~~

Sheet 1 of 2

1.0 CODES AND STANDARDS

- 1.1 The material shall comply with all currently applicable safety codes and statutory regulations of India as well as of the locality where the material is to be installed.
- 1.2 The design, material, construction, manufacture, inspection and testing of LT XLPE POWER Cable shall conform to the latest revision of relevant standards as per Data Sheet-A.
- 1.3 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

2.0 TECHNICAL REQUIREMENTS

- 2.1 LT XLPE POWER Cable shall be supplied as per technical particulars specified in Data Sheet – A.

3.0 QUALITY ASSURANCE, TESTING & INSPECTION

- 3.1 Bidder shall confirm compliance with the BHEL Standard Quality Plan (PE-QP-999-507-E002, Rev-01) as attached with the specification without any deviations. At contract stage (project specific), the successful bidder shall submit the same QP for BHEL/ ultimate customer's approval. In case bidder has reference QP agreed with ultimate customer, same can be submitted for specific project after award of contract for BHEL/ultimate customer's approval. There shall be no commercial implication to BHEL on account of minor changes in QP during contract stage.
- 3.2 All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan.
- 3.3 Type testing, routine / acceptance testing and special testing requirements shall be as per Annexure –A to QAP. Charges for all these tests for all the equipments & components shall be deemed to be included in the bid price (except UV Radiation & Hydraulic Stability test).
- 3.4 The charges of UV Radiation test & Hydrolytic Stability test (if applicable) shall be reimbursed extra at actual against original money receipt of Govt. Lab. (CPRI/ ERDA etc).
- 3.5 Cost of cables consumed for testing shall be to bidder's account.

4.0 PACKING

- 4.1 Cables shall be supplied in non-returnable drums. Material of cable drums shall be wooden.
- 4.2 For wooden drums, all wooden parts shall be manufactured from seasoned wood treated with copper naphthenates / zinc naphthenates (refer IS: 401) and anti-termite. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Dimensions of wooden drums shall be as per IS 10418. All ferrous parts shall be treated with suitable rust protective



TECHNICAL SPECIFICATION FOR LT XLPE Power Cable

SPECIFICATION NO. ~~PE-RC-999-507-E002~~

VOLUME II

SECTION II

REVISION ~~00-~~

DATE: ~~09.08.17~~

Sheet 2 of 2

finish or coating to avoid rusting during transit and storage. BIS certification mark shall be stamped on each cable drum.

- 4.3 Each drum shall carry manufacturer's name, purchaser's name, address and contract no., item no. & type, size & length of cable and net gross weight stencilled on both sides of drum. A tag containing same information shall be attached to the leading end of the cable. An arrow & suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

		STANDARD QUALITY PLAN		CUSTOMER :		PROJECT: TITLE		SPECIFICATION PE-RC-999-507-E002 Rev 1																			
SHEET 1 OF 9		CHARACTERISTIC CHECK		SYSTEM CAT.		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD		SECTION II VOLUME II		AGENCY		REMARKS							
SL. NO.		COMPONENT/ OPERATION		3		4		5		6		7		8		9		P		W		V		10		11	
1		2		3		4		5		6		7		8		9		10		11		12		13		14	
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/ Copper Rods (Conductor/ Armour Wire)																											
GENERAL : 1. Physical properties																											
MA																											
2. Elec.Properties																											
MA																											
SPECIFIC CHECKS : a) Make																											
MA																											
b) Grade																											
MA																											
c) Resistivity																											
MA																											
1.2 XLPE Compound for insulation																											
GENERAL : 1. Physical properties																											
MA																											
2. Elec.Properties																											
MA																											
SPECIFIC CHECKS : a) Make																											
MA																											
b) Type/ Grade																											
MA																											
c) Shelf life/ Storage condition																											
MA																											
BHEL																											
PARTICULARS																											
BIDDER/VENDOR																											
NAME																											
SIGNATURE																											
DATE																											
BIDDER'S/VENDORS COMPANY SEAL																											

STANDARD QUALITY PLAN SHEET 2 OF 9		CUSTOMER : TITLE : BIDDER/ : VENDOR :		PROJECT : TITLE : QUALITY PLAN NUMBER: PE-QP-999-507-E002, R01 ITEM : LT XLPE Power Cables		SPECIFICATION PE-RC-999-507-E002 Rev 1 NUMBER : SPECIFICATION TITLE TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLE					
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS	
									P	W	V
1	2	3	4	5	6	7	8	9	10	11	
1.3	PVC Compound (for sheath)	GENERAL : 1. Physical properties 2. Elec.Properties 3. FRLS Properties (as applicable) SPECIFIC CHECKS : a) Make b) Type/ Grade c) Shelf life/ Storage condition	MA	Physical Tests Electrical Tests Chemical/ Environ.	Sample/ Batch Sample/ Batch Sample/ Batch	IS 7098-I, IS 5831 & Mfr. Approved datasheet -do- -do-	IS 7098-I, IS 5831 & Mfr. Std./ Approved datasheet -do- -do-	Inspection Report/ Test Cert. -do- -do-	2/3 - 2/3 - 2/3 -	1/2 1/2 1/2	
1.4	Fillers (as applicable)	1. Make 2. Type/ Grade	MA	Verify -do- -do-	100% -do- -do-	Manufacturer approved source Approved datasheet Compound Manufacturer std.	Manufacturer approved source Approved datasheet Compound Manufacturer std.	COC/ Test Cert. -do- -do-	2/3 - 2/3 - 2/3 -	1 1 1	
			MA	Verify -do-	100% -do-	Manufacturer approved source Approved datasheet	Manufacturer approved source Approved datasheet	COC/ Test Cert. -do-	2/3 - 2/3 -	1 2	(Fillers material chosen shall be compatible with the temerature rating of the cable and shall have no deleterious effect on any other component of the cable)
BHEL			PARTICULARS		BIDDER/VENDOR						
			NAME								
			SIGNATURE								
			DATE								
							BIDDER/S/VENDORS COMPANY SEAL				

STANDARD QUALITY PLAN		CUSTOMER :		PROJECT :		SPECIFICATION PE-RC-999-507-E002		Rev 1	
BIDDER / VENDOR		QUALITY PLAN		TITLE		SPECIFICATION		TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLE	
SHEET 3 OF 9		SYSTEM		ITEM : LT XLPE Power Cables		SECTION II		VOLUME II	
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	REMARKS
1	2	3	4	5	6	7	8	9	10
1.5	Galvanised steel wire/strip for Armour (as applicable)	GENERAL : 1. Make 2. Dimension 3. Phys.and Elec. Properties 4. Galvanization Quality	MA	Verify	Manufacturer std.	Manufacturer approved source	Manufacturer approved source	Inspection Report/ Test Cert. -do-	2/3 - 1
			MA	Measurement	-do-	IS 7098-I, IS 3975 & Approved datasheet	IS 7098-I, IS 3975 & Approved datasheet	-do-	2/3 - 2
			MA	Physical & Electrical Tests Galv. Tests	Sample*	-do-	-do-	-do-	2/3 - 2
			MA		-do-	IS 3975 & Mfr. Std.	IS 3975 & Mfr. Std.	-do-	2/3 - 2
1.6	Wooden Drum	1. Phy. & Constructional checks	MA		Mfr's Plant Std.	IS 10418	IS 10418	Inspection Report/ Test Cert. COC	2/3 - 1
		2. Anti termite treatment	MA	Chem.	Mfr's Plant Std.	Mfr's Plant Std.	Mfr's Plant Std.		2/3 - 1
1.7	Steel Drum #	1. Dimension	MA	Meas.	Mfr's Plant Std.	Approved drawing of steel drum / BHEL specification	Approved drawing of steel drum / BHEL specification	Inspection Report/ Test Cert.	2/3 - 1
		2. Surface finish	MA	Visual	-do-	Surface shall be smooth	Surface shall be smooth	-do-	2/3 - 1
BHEL									
PARTICULARS			BIDDER/VENDOR						
NAME									
SIGNATURE									
DATE									
BIDDERS/VENDORS COMPANY SEAL									

		STANDARD QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION PE-RC-999-507-E002 Rev 1	
SHEET 4 OF 9		BIDDER/ :		VENDOR :		QUALITY PLAN		TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLE	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	7	8	9	10
						ACCEPTANCE NORM		FORMAT OF RECORD	SECTION II VOLUME II
								AGENCY	REMARKS
								P	W
								V	
1	2	3	4	5	6	7	8	9	10
2.0	IN PROCESS								
2.1	Wire Drawing	1. Size 2. Surface finish 3. % of Elongation	MA MA MA	Dimensional Visual Mechanical	Plant Mfg. Std. -do- -do-	IS 8130 & Appd. Datasheet Surface shall be smooth IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet Surface shall be smooth IS 8130 & Appd. Datasheet	Inspection Report -do- -do-	2 - 1 2 - 1 2 - 1
2.2	Stranding of wires	1. No. of wires 2. Resistance 3. Sequence, lay length & Direction 4. Surface Finish 5. Dimension	MA CR MA MA MA	Counting Electrical Visual, Meas. Visual Measurement	Plant Mfg. Std. -do- One Sample of each size/ lot 100%	IS 8130 & Appd. Datasheet -do- Mfrs Std. / Appd. Datasheet Surface shall be smooth IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet -do- Mfrs Std. / Appd. Datasheet Surface shall be smooth IS 8130 & Appd. Datasheet	Inspection Report -do- -do- -do- -do-	2 - - 2 - - 2 - - 2 - - 2 - -
2.3	Core Insulation (XLPE) (No repair permitted)	1. Surface finish 2. Eccentricity & Ovality # 3. Insulation Thickness 4. Dia over insulation 5. Tensile Strength & % Elongation 6. Spark Test or Water immersion test	MA CR CR MA MA CR	Visual Measurement Measurement Measurement Mechanical Electrical	100% One Sample of each size/ lot -do- -do- 100% 100%	Free from bulging, burnt particles, lumps, cuts & scratches IS 7098-1 & Appd. Datasheet -do- -do- -do- Mnfr's Std	Free from bulging, burnt particles, lumps, cuts & scratches IS 7098-1 & Appd. Datasheet -do- -do- -do- Mnfr's Std	Inspection Report -do- -do- -do- -do- -do-	2 - 1 2 - 1 2 - - 2 - - 2 - - 2 - 1
BHEL									
PARTICULARS						BIDDER/VENDOR			
NAME									
SIGNATURE									
DATE									
BIDDER'S/VENDORS COMPANY SEAL									

STANDARD QUALITY PLAN				CUSTOMER :		PROJECT		SPECIFICATION PE-RC-999-507-E002		Rev 1		
SHEET 5 OF 9				BIDDER/ VENDOR		QUALITY PLAN		NUMBER: PE-QP-999-507-E002, R01		TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLE		
				SYSTEM CAT.		ITEM : LT XLPE Power Cables		SECTION II		VOLUME II		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	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		
2.4	Core Laying	1. Dia over laid up core	Measurement	One Sample of each size/ lot	IS 7098-I & Appd. Datasheet	IS 7098-I & Appd. Datasheet	Inspection Report	2	-	-		
		2. Sequence of lay & direction	Visual & Meas.	-do-	IS 7098-I & Mfr. Std.	IS 7098-I & Mfr. Std.	-do-	2	-	-		
		3. Lay Length	Measurement	-do-	-do-	-do-	-do-	2	-	-		
2.5	InnerSheath Extrusion (as applicable)	1. Surface finish	Visual	100%	Surface shall be smooth	Surface shall be smooth	Inspection Report	2	-	-		
		2. Thickness	Measurement	One Sample of each size/ lot	IS 7098-I & Appd. Datasheet	IS 7098-I & Appd. Datasheet	-do-	2	-	-		
		3. Dia over inner sheath	-do-	-do-	-do-	-do-	-do-	2	-	-		
2.6	Armour(as applicable)	1. No. of wires/Strips	Counting	At the start of the process	IS 7098-I & Appd. Datasheet	IS 7098-I & Appd. Datasheet	Inspection Report	2	-	-		
		2. Lay length & Direction	Visual & Meas.	-do-	IS 7098-I & Mfr. Std.	IS 7098-I & Mfr. Std.	-do-	2	-	-		
		3. Dia over armouring	Measurement	-do-	IS 7098-I & Appd. Datasheet	IS 7098-I & Appd. Datasheet	-do-	2	-	-		
2.7	Outer Sheath Extrusion (No repair permitted)	4. Coverage	Measurement	-do-	-do-	-do-	-do-	2	-	-		
		1. Surface finish	Visual	100%	Surface shall be smooth	Surface shall be smooth	Inspection Report	2	-	-		
		2. Sheath Thickness	Measurement	One Sample of each size/ lot	IS 7098-I & Appd. Datasheet	IS 7098-I & Appd. Datasheet	-do-	2	-	-		
		3. Dia over outer sheath	-do-	-do-	-do-	-do-	-do-	2	-	-		
		4. Embossing/ Sequential Marking	Visual	100%	Approved data sheet	Approved data sheet	-do-	2	-	-		
BHEL				PARTICULARS		BIDDER/VENDOR						
				NAME								
				SIGNATURE								
				DATE								
				</								

		STANDARD QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION PE-RC-999-507-E002 Rev 1																	
SHEET 6 OF 9		CHARACTERISTIC CHECK		BIDDER/ VENDOR		QUALITY PLAN		NUMBER : TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLE																	
COMPONENT/OPERATION		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT		ITEM : LT XLPE Power Cables																	
SL. NO.		CAT.		4		5		6		7		8		9		FORMAT OF RECORD		AGENCY		SECTION II		VOLUME II		REMARKS	
1		2		3		4		5		6		7		8		9		P		W		V		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		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 & scratches		Test Report		2		1		-					
		2. Length		MA		Measurement		-do-		-do-		Approved Data Sheet		-do-		-do-		2		1		-			
		3. Dimension		MA		-do-		As per IS		-do-		-do-		-do-		-do-		2		1		-			
		4. Armouring - Coverage & No.of Wires/Strips		MA		Visual & Meas.		-do-		-do-		-do-		-do-		-do-		2		1		-			
		5. Marking & Colour Coding		MA		Visual		As per IS		-do-		Approved Data Sheet		-do-		-do-		2		1		-			
		6. Acceptance Tests (Refer Note-F)		CR		Phy, Elect. Tests & FRILS Tests		Sample #		-do-		-do-		-do-		-do-		2		1		-		# Refer Annexure-A to QAP enclosed	
		7. Type Tests (Refer Note-F)		CR		Physical & Electrical Tests		Sample #		-do-		-do-		-do-		-do-		2		1		-		# Refer Annexure-A to QAP enclosed	
5.0 Packing		Sealing Identification		MA		Visual		100%		As per IS		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	

426464/2021/PS-PEM-EL

	ANNEXURE-A TO QP	CUSTOMER:	PROJECT TITLE	SPECIFICATION NUMBER: PE TS RC 507 E002 R1
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E002, R01	SPECIFICATION TITLE:
	SHEET 7 OF 9	SYSTEM	ITEM: LT XLPE POWER CABLES	DOC. NO.

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS**A. Type Test Conduction:**

- Tests for which "T" is indicated in the 'Test Conduction Required As' column below shall be conducted as Type Test.
- Sampling:
 - Type test to be conducted on each type & size of cable on one drum out of every 10 drums for every lot (CU/AL conductor)
 - Flammability Test to be conducted only on one sample/ lot.

B. Acceptance Test Conduction:

- Tests for which "A" is indicated in the 'Test Conduction Required As' column below shall be conducted as Acceptance tests.
- Sampling:
Acceptance tests to be conducted on one drum out of every 10 drums/ lot for every size & type.
- Flammability Test to be conducted only on one sample/ lot (Project specific sampling plan shall be informed later)

C. Routine Test Conduction:

- 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.

Note: LOT shall be considered as per IS: 7098 Part-I, appendix-B.

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	<u>Internal in process Test Report to be furnished for acceptance test</u>
II.	Tensile test	For aluminium conductor only (Not applicable for compacted circular or shaped conductor)	T, A	IS 10810 Pt 2	
III.	Wrapping test	For aluminium conductor only (Not applicable for compacted circular or shaped conductor)	T, A	IS 10810 Pt 3	
IV.	Resistance test	For Al/Cu	T, A, R	IS 10810 Pt 5	

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

426464/2021/PS-PEM-EL

	ANNEXURE-A TO QP	CUSTOMER:	PROJECT TITLE	SPECIFICATION NUMBER: PE-TS-RC-607-E002-R1
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E002, R01	SPECIFICATION TITLE:
	SHEET 8 OF 9	SYSTEM	ITEM: LT XLPE POWER CABLES	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
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 / Adhesion Test	For GS strip only	T, A	IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Aluminium wire & GS wire	T, A	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 41	
IX.	Wrapping Test	Applicable for Aluminium wire & GS wire	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.	Cold Impact test	For PVC outer sheath only	T	IS 5831/1984	
X.	Bleeding and Blooming test	For PVC outer sheath only	T	IS 5831/1984	
XI.	Hot set test	For XLPE insulation only	T, A	IS 10810 Pt 30	
XII.	Water absorption (gravimetric) test	For XLPE insulation only	T	IS 10810 Pt 33	
4.0	Improved Fire performance (FR-LSH) Tests				

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

426464/2021/PS-PEM-EL

	ANNEXURE-A TO QP	CUSTOMER:	PROJECT TITLE	SPECIFICATION NUMBER: PE-TS-RC-507-E002-R1
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E002, R01	SPECIFICATION TITLE:
	SHEET 9 OF 9	SYSTEM	ITEM: LT XLPE POWER CABLES	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
I.	Oxygen index test	For PVC outer sheath only	T, A	IS 10810 Pt 58 / ASTM D 2863/ NES 715-I	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 / ASTM D 2843	
III.	Acid gas generation 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, A	IS 10810 Pt 64 / ASTM D 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)	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	
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 complete cable	T, A	IS 10810 Pt 43	
7.0	Anti-rodent and Termite Repulsion test	For PVC outer sheath only	A	Refer Note	Test applicable if indicated in Datasheet-A
8.0	Anti-Fungal Test	For PVC outer sheath only	A	--	
9.0	Special Tests				
I.	Hydrolytic Stability Test	For complete cable	**	ASTM D 3137:81	Test applicable if indicated in Datasheet-A
II.	Ultraviolet Radiation Test	For complete cable	**	BS EN ISO 4892-2	

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

Note: A few chipping of the PVC compound is slowly ignited on a porcelain dish or cubicle in a muffle furnace at about 60-degree C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). Place a drop of aqueous sodium sulphide solution on a thick filter paper and allow soaking. Touch the spot with a drop of above extract. A black spot indicates the presence of lead, the anti-termite and rodent compound.

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