TECHNICAL SPECIFICATION

FOR

HT XLPE POWER CABLES

VOLUME-II

SPECIFICATION NO: *PE-RC-999-507-E001*

REVISION: 00

RATE CONTRACT

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

CONTENTS

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

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 are 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

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 HT XLPE POWER CABLES conforming to this specification.

2.2. 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 at site conditions.

2.3. Technical requirements of HT XLPE POWER CABLE are indicated in Data Sheet-A & Section-II.

2.4. The stipulations of Data Sheet-A shall prevail in case of any conflict between the stipulations of Data Sheet - A & Section-II.

2.5. The documents shall be in English Language and MKS system of units

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 - HT XLPE Power cables	PE-V0-XXX-507-E101	Primary	Within 2 week of award of contract.	Within 1 week of comments
2	Cross-sectional Drgs.- HT XLPE Power cables	PE-V0-XXX-507-E103	Primary	Within 2 week of award of contract.	Within 1 week of comments
3	Quality Plan - HT XLPE Power cables	PE-V0-XXX-507-E912	Primary	Within 2 week of award of contract.	Within 1 week of comments

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

DATASHEET-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-2), 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	3.3/3.3 kV (unearthed)	6.6/6.6 kV (unearthed)	11/11 kV (unearthed)
4.0	Number of cores, cross sectional area of conductors and quantities	As per BOQ-Cum-Price Schedule		
5.0	CONDUCTOR			
(a)	Material	Aluminium		
	Grade and Class	Stranded, H2, Class 2		
(b)	Standard Applicable	IS: 8130		
(c)	Shape	Compacted Circular/ Shaped (Project specific requirement shall be furnished later)		
(d)	Min. number and diameter of strands	As per Table-2 of IS: 8130		
(e)	Conductor screen			
(i)	Material	Extruded Cross-linked Semi-conducting compound		
(ii)	Minimum thickness	*0.3 mm*		
6.0	INSULATION			
(a)	Material	Extruded Cross-Linked Polyethylene(XLPE)		
(b)	Standard Applicable	IS: 7098 (Part-2)		
(c)	Continuous withstand temperature	90°C		
(d)	Short-circuit withstand temperature	250°C		
(e)	Insulation Shield Strippable	No (Project specific requirement shall be furnished later)		
7.0	INSULATION SCREEN	For both Single core cable & Multi core cables		
(a)	Non-metallic			
(i)	Material	Extruded Cross-linked Semi-conducting compound		
(ii)	Minimum thickness	*0.3 mm*		
(b)	Metallic	For both Single core cable & Multi core cables (Project specific requirement shall be furnished later)		
(i)	Material	Copper Tape (Project specific requirement shall be furnished later)		
(ii)	Size	*Nominal thickness 0.1mm with tolerance (±) 10%*		
(iii)	Minimum Overlap	*10%*		
(c)	Earth fault current withstand capacity	*300A,2 sec* (For multi-core cables, screen of each core shall be rated individually for the above value).		
8.0	EXTRUSION (Insulation and Screens)			
(a)	Process	Triple Extrusion		

		(Extruded semi-conducting compound conductor screen and insulation screen shall be applied along with XLPE insulation in a single operation by triple extrusion process).
(b)	Method of Curing	*Dry curing/Gas curing/Steam curing* (Project specific requirement shall be furnished later)
9.0	CORE IDENTIFICATION	By coloured strips applied on the cores or by numerals printing on the cores
10.0	INNER SHEATH	For both Single core cable & Multi core cables (Project specific requirement shall be furnished later)
(a)	Material	Extruded HRPVC Type ST-2
(b)	Standard Applicable	IS: 7098 (Part-2) & IS: 5831
(c)	Colour	*Black*
(d)	Whether FR-LSH	*YES* (Project specific requirement shall be furnished later)
(e)	Inner sheath applicable for single core cable	YES (Project specific requirement shall be furnished later)
(f)	Fillers	Acceptable (only for centre filler)
(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* (Project specific requirement shall be furnished later)
(ii)	Without fillers	*Pressure extruded*
(2)	Single-core cables:	*Not applicable* (Project specific requirement shall be furnished later)
(i)	Thickness of inner sheath	As per Table-5 of IS: 7098 (Part-2)
11.0	ARMOUR	
(a)	*Applicable*	*YES*
(b)	Material:	
(i)	Single core cables	Aluminium Round Wire H4 grade to IS: 8130
(ii)	*Multi-core cables*	*Galvanised Steel Strip* conforming to (i) Table-6 of IS 7098 part-2 OR *GALVANISED SINGLE ROUND STEEL WIRE* conforming to (i) IS 3975/1999 As per BOQ .
(iii)	Standard Applicable	Dimension as per IS: 7098 (Part-2) 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
12.0	OUTERSHEATH	
(a)	Material	Extruded *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-7 of IS: 7098 (Part-2)
(f)	Marking	*BHEL-PEM and Customer's name, 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. "FRLSH" etc., IS number, ISI mark/BIS mark @ 5m/1m (by embossing),* *Progressive sequential marking of length of cable in meters @ 1m (by embossing/ printing) for 11kV, 6.6kV & 3.3 kV Cables.* (Project specific requirement shall be furnished later)
13.0	FR-LSH CHARACTERISTICS	
(a)	Oxygen index	Min 29 (As per IS 7098-2 /ASTMD 2863)
(b)	Temperature index	Min. 250^{o}C(As per IS 7098-2 /ASTMD 2863)
(c)	Acid gas generation	Max. 20% by weight (As per IS 7098-2 /IEC-60754-1)
(d)	Smoke density rating	Max. 60% (As per IS 7098-2 /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, CAT-B*
(iii)	*Flammability test as per IEEE: 60383*	*YES*
(iv)	*As per Swedish Chimney test SEN-SS-424-1475-F3*	*YES*
14.0	*Anti-rodent and Termite repulsion Test*	*YES*
15.0	*Anti-Fungal Test*	*No*
16.0	Special Tests	
(a)	*Hydrolytic Stability as per ASTM D 3137 :81 (Duration:- 14 days)*	*No (Past Reports required as per Project Specific requirement)*
(b)	*UV Radiation Test as per BS EN ISO 4892-2 (Duration:- 14 days)*	*No (Past Reports required as per Project Specific requirement)*
(c)	*UV Radiation Test as per ASTM G 154 (Duration:- 14 days)*	*No (Past Reports required as per Project Specific requirement)*
17.0	TOLERANCE ON OUTER DIAMETER	(±)2 mm. over the declared value
18.0	CABLE DRUMS	
(a)	*Type of Drum*	Wooden as per IS 10418 (Project specific requirement shall be furnished later)
(b)	Standard drum length	*500m (±) 5% / 600m (±) 5%/ 750m (±) 5%* (Project specific requirement shall be furnished later)
(c)	Construction details	Clause no 4.2 of Section-II of this technical specification
(c)	Marking 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*

20	Design Ambient Temperature	*50 degC*

DATASHEET C

GUARANTEED TECHNICAL PARTICULARS
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)

S.No.	Particulars	Unit	Description
1.0	GENERAL		
1.1	Name of Manufacturer	-	
1.2	Place of Manufacture	-	
2.0	STANDARDS APPLICABLE		
2.1	IS: 7098 Part-2 For general specification of XLPE Cables	YES	
2.2	IS: 8130 For conductor material	YES	
2.3	IS: 5831 For material of innersheath & outersheath	YES	
2.4	IS: 3975 / IS: 8130 For armour of 3 core/ single core cables	YES	
2.5	IS: 10810 For method of tests	YES	
2.6	ASTMD-2863 For oxygen index test	YES	
2.7	SS:424-14-75 & IEC-60332-3 & IEC-60332-1 & IEEE: 60383 For flammability test	YES	
2.8	IEC-60754-1 For acid gas generation test	YES	
2.9	ASTMD-2843 For smoke generation test	YES	
2.10	Current rating of cables conforms to	-	
2.11	Short circuit rating conforms to	-	
2.12	Formula for calculating short circuit current for different durations	-	
3.0	INSTALLATION CONDITIONS AT SITE		
3.1	Ambient air temperature	deg. C	
3.2	Ground temperature	deg. C	
3.3	Depth of laying of cables buried in ground	cm	
3.4	Thermal resistivity of soil	deg. C cm/W	

4.0	CHARACTERISTICS OF FR-LSH SHEATH		
4.1	Oxygen index	%	
4.2	Temperature index	Deg C	
4.3	Acid gas generation	%	
4.4	Smoke density rating	%	
5.0	CABLE DRUMS		
5.1	Type & construction	-	
5.2	Standard drum length	M	
5.3	Tolerance on drum length	%	
6.0	INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE		
6.1	No. of cores x size	-	
6.2	Voltage grade (Uo/U)	kV	
6.3	Base current ratings (*) based on Clause No. 3.0		
a)	In air	Amp	
b)	In ground	Amp	
c)	Ducts	Amp	
6.4	Short circuit rating	kA, sec	
6.5	Properties		
a)	D.C. resistance of conductor at20 deg. C	ohm/km	
b)	A.C. resistance of conductor at90 deg. C	ohm/km	
c)	Reactance of cable at normal frequency	ohm/km	
d)	Electrostatic capacitance of cable at normal frequency	µF/km	
6.6	CONDUCTOR		
a)	Material type & grade	-	
b)	No & dia of wires in each core before stranding	no x mm	
c)	Shape	-	
6.7	CONDUCTOR SCREEN		
a)	Material	-	
b)	Minimum thickness	mm	

6.8	XLPE INSULATION		
a)	Nominal thickness of insulation	mm	
b)	Method of curing	-	
6.9	INSULATION SCREEN		
a)	Type of screen	-	
b)	Material and thickness (minimum and nominal)	mm	
i)	Metallic	-	
	- Type of tapes and Minimum overlapping - Thickness (nominal)	- mm.	
ii)	Non-metallic	-	
	- Thickness (minimum)	mm.	
iii)	Earth fault current withstand capacity (calculation to be furnished)	kA, sec.	
6.10	PVC ST2 INNERSHEATH		
a)	Material - FRLS	- Yes/ No	
b)	Thickness (min.)	mm.	
c)	Method of application	-	
1)	Multi-core cables		
i)	With fillers	-	
ii)	With out fillers	Pressure Extruded	
2)	Single core cables		
d)	Type & Shape of fillers (if used)	-	
e)	Colour	-	
6.11	ARMOUR		
a)	Material	-	
b)	Size/ dimensions	mm.	
c)	Minimum no. of wires/ formed wires	No.	
d)	Tolerance on formed wire dimension	mm.	
e)	Maximum resistivity of GS formed wire	-	
f)	Maximum resistivity of Al round wire	Ohm-m	
g)	Minimum coverage	%	
6.12	PVC/POLYETHYLENE ST2 FR-LSH OUTERSHEATH		
a)	Minimum thickness of outer sheath	mm.	
6.13	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.	
6.14	Tolerance on overall diameter	(±) mm	
6.15	Minimum bending radius	x O.D.	
6.16	Safe pulling force	N	
6.17	Weight of cable	kg./km	
6.18	Dimension of drum	mm.	
6.19	Shipping weight	kg	
6.20	Cable marking on outer sheath	-	
6.21	Drum marking	-	

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

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SECTION-II

STANDARD TECHNICAL SPECIFICATION

1.0 TECHNICAL REQUIREMENTS

1.1 Technical requirements for HT XLPE POWER CABLES shall be as indicated in this section, in addition to those specified in Section I & Datasheet-A.

2.0 CODES & STANDARDS

2.1 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.

2.2 The design, material, construction, manufacture, inspection and testing of HT XLPE POWER CABLES shall conform to the latest revision of relevant standards and codes of practices mentioned in Data Sheet – A.

2.3 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

3.0 QUALITY ASSURANCE REQUIREMENTS

3.1 Bidder shall confirm compliance with the BHEL Standard Quality Plan (PE-QP-999-507-E001A R0) as attached with the specification without any deviations. At contract stage, 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 to QAP. Charges for all these tests for all the equipment & components shall be deemed to be included in the bid price (except UV Radiation & Hydrolytic 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 **Wooden drums:**

For wooden drums, all wooden parts shall be manufactured from seasoned wood treated with copper napthenates / zinc napthenates (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 finish or coating to avoid rusting during transit and storage. BIS certification mark shall be stamped on each cable drum.

Steel Drums:

Cables shall be supplied in non-returnable heavy construction steel drums. New or practically new cable drums made of steel and painted with epoxy resin paint are to be used. Cable ends are carefully protected before packing. Polyethylene sheet shall be wrapped over the cables and then sealed properly. For Typical details of Steel drums, Annexure-I to Section-II, may be referred by the bidder. Bidder may modify, to choose appropriate dimensions of steel drums to suite various sizes/weight/ lengths of HT XLPE power cables. BIS certification mark shall be stamped on each cable drum.

4.3 Each drum shall carry manufacturer's name, Owner's name, address and contract number, Type of cable & voltage grade, Year of manufacture, Type of insulation / sheath e.g. XLPE /HRPVC FRLS as applicable, No. of core and size of cables, Cable code, Length of cable on drum,IS number, ISI Mark, Approx. gross mass stenciled on both side of the drum, Direction of rotation by arrow. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.

ANNEXURE-II

QUALITY PLAN

	STANDARD QUALITY PLAN		CUSTOMER :			PROJECT: TITLE			SPECIFICATION NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E001A, **R0**			SPECIFICATION : TITLE			
	SHEET 1 OF 11		SYSTEM			ITEM : HT 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**
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												
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-II,IS: 5082, IS:5484, IS:8130 & Appd Datasheet	IS:7098-II,IS: 5082, IS:5484, IS:8130 & Appd Datasheet	Inpection Report/ Test Cert.	2/3	-	1/2	
		2. Elec.Properties	MA	Electrical Tests	Sample/ Batch	-do-	-do-	-do-	2/3	-	1/2	
		SPECIFIC CHECKS :										
		a) Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.	2/3	-	1	
		b) Grade	MA	-do-	-do-	IS 8130, IS 5082/ Approved datasheet	IS 8130, IS 5082/ Approved datasheet	-do-	2/3	-	1	
		c) Resistivity	MA	Electrical Tests	Manufacturer std.	IS 8130, IS 5082	IS 8130, IS 5082	-do-	2/3	-	1	
1.2	**XLPE Compound for insulation**	**GENERAL :**										
		1. Physical properties	MA	Physical Tests	Sample/ Batch	IS 7098-II & Mfs Std./ Approved datasheet	IS 7098-II & Mfs Std./ Approved datasheet	Inpection Repor/ Test Cert.	2/3	-	1/2	
		2. Elec.Properties	MA	Electrical Tests	Sample/ Batch	-do-	-do-	-do-	2/3	-	1/2	
		SPECIFIC CHECKS :										
		a) Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.	2/3	-	1	
		b) Type/ Grade	MA	-do-	-do-	Approved datasheet	Approved datasheet	-do-	2/3	-	1	
		c) Shelf life/ Storage condition	MA	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	2/3	-	1	

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

	STANDARD QUALITY PLAN	CUSTOMER :	PROJECT: TITLE	SPECIFICATION NUMBER :
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER: PE-QP-999-507-E001A, R0	SPECIFICATION : TITLE
	SHEET 2 OF 11	SYSTEM	ITEM : HT 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	**Semi Conducting Compound**	**GENERAL :**										
		1. Physical properties	MA	Physical Tests	Sample/ Batch	IS 7098-II & Mfs Std./ Approved datasheet	IS 7098-II & Mfs Std./ Approved datasheet	Inpection Report/ Test Cert.	2/3	-	1/2	
		SPECIFIC CHECKS :										
		1. Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.	2/3	-	1	
		2. Type/ Grade	MA	-do-	-do-	Approved datasheet	Approved datasheet	-do-	2/3	-	1	
		3. Shelf life/ Storage condition	MA	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	2/3	-	1	
1.4	**Copper Tape**	**GENERAL :**										
		1. Physical properties	MA	Physical Tests	Sample/ Batch	IS 7098-II, IS 1897, IS 613 & Mfr. Std./ Approved datasheet	IS 7098-II, IS 1897, IS 613 & Mfr. Std./ Approved datasheet	Inpection Report/ Test Cert.	2/3	-	1/2	
		2. Elec.Properties	MA	Electrical Tests	Sample/ Batch	-do-	-do-	-do-	2/3	-	1/2	
		3. Dimension	MA	Measurement	-do-	-do-	-do-	-do-	2/3	-	2	
		SPECIFIC CHECKS :										
		1. Resistivity	MA	Electrical Tests	Manufacturer std.	IS 613	IS 613	-do-	3/2	-	1	
1.5	**Fillers (as applicable)**	1. Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.	2/3	-	1	
		2. Type/ Grade	MA	-do-	-do-	Approved datasheet	Approved datasheet	-do-	2/3	-	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)
1.6	**PVC Compound (for sheath)**	**GENERAL :**										
		1. Physical properties	MA	Physical Tests	Sample/ Batch	IS 7098-II, IS 5831& Mfr. Std./ Approved datasheet	IS 7098-II, IS 5831& Mfr. Std./ Approved datasheet	Inpection Report/ Test Cert.	2/3	-	1/2	
		2. Elec.Properties	MA	Electrical Tests	Sample/ Batch	-do-	-do-	-do-	2/3	-	1/2	
		3. FRLS Properties (as applicable)	CR	Chemical/ Environ.	Sample/ Batch	-do-	-do-	-do-	2/3	-	1/2	

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

	STANDARD QUALITY PLAN		CUSTOMER :			PROJECT: TITLE			SPECIFICATION NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E001A, R0			SPECIFICATION : TITLE			
	SHEET 3 OF 11		SYSTEM			ITEM : HT 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
		SPECIFIC CHECKS :										
		a) Make	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.	2/3	-	1	
		b) Type/ Grade	MA	-do-	-do-	Approved datasheet	Approved datasheet	-do-	2/3	-	1	
		c) Shelf life/ Storage condition	MA	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	2/3	-	1	
1.7	**Galvanised steel wire/strip for Armour (as applicable)**	**GENERAL :**										
		1. Make	MA	Verify	Manufacturer std.	Manufacturer approved source	Manufacturer approved source	Inpection Report/ Test Cert.	2/3	-	1	
		2. Dimension	MA	Measurement	-do-	IS 7098-II, IS 3975 & Approved datasheet	IS 7098-II, IS 3975 & Approved datasheet	-do-	2/3	-	2	
		3. Phy.and Elec. Properties	MA	Physical & Electrical Tests	Sample*	-do-	-do-	-do-	2/3	-	2	* Sample from each armour size/ Batch / Lot
		4.Galvanization Quality	MA	Galv.Tests	-do-	IS 3975 & Mfr. Std.	IS 3975 & Mfr. Std.	-do-	2/3	-	2	
1.8	**Steel Drum #**	1. Dimension	MA	Meas.	Mfr's Plant Std.	Approved drawing of steel drum / BHEL specification	Approved drawing of steel drum / BHEL specification	Inpection Report/ Test Cert.	2/3	-	1	# (If applicable)
		2. Surface finish	MA	Visual	-do-	Surface shall be smooth	Surface shall be smooth	-do-	2/3	-	1	
1.9	**Wooden Drum**	1. physical & constructional check	MA	Visual	Mfr's Plant Std.	IS 10418	IS 10418	Inpection Report/ Test Cert.	2/3	-	1	
		2. Anti-termite treatment	MA	Chem	-do-	Mfr's Plant Std.	Mfr's Plant Std.	COC	2/3	-	1	

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

	STANDARD QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER: PE-QP-999-507-E001A, R0	SPECIFICATION : TITLE
	SHEET 4 OF 11	SYSTEM	ITEM : HT 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	Inpection Report	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	Inpection Report	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/	IS 8130 & Appd. Datasheet	IS 8130 & Appd. Datasheet	-do-	2	-	-	
2.3	**Conductor Screening**	1. Surface Finish	MA	Visual	100%	Surface shall be smooth	Surface shall be smooth	Inpection Report	2	-	-	
		2. Radial Thickness	CR	Mechanical	One Sample of each size/	IS 7098-II & Appd. Datasheet	IS 7098-II & Appd. Datasheet	-do-	2	-	-	
2.4	**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	Inpection Report	2	-	1	
		2. Eccentricity & Ovality #	CR	Measurement	One Sample of each size/ lot	IS 7098-II & Appd. Datasheet	IS 7098-II & 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	-	-	

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

	STANDARD QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER: PE-QP-999-507-E001A, R0	SPECIFICATION : TITLE
	SHEET 5 OF 11	SYSTEM	ITEM : HT 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
2.5	**Insulation Screening**	**NON METTALIC**										
		1. Surface finish	MA	Visual	100%	Surface shall be smooth	Surface shall be smooth	Inpection Report	2	-	-	
		2. Thickness	CR	Measurement	One Sample of each size/ lot	IS 7098-II & Appd. Datasheet	IS 7098-II & Appd. Datasheet	-do-	2	-	-	
		METALLIC										
		1. Dimension of tape	CR	Measurement	One Sample of each size/	Mfrs Std. / Appd. datasheet	Mfrs Std. / Appd. datasheet	Inpection Report	2	-	-	
		2. Overlap of Tape Band	MA	-do-	-do-	-do-	-do-	-do-	2	-	-	
		3. Tightness of Tape	MA	Visual	-do-	Mfs Std.	Mfs Std.	-do-	2	-	-	
2.6	**Core Laying**	1. Dia over laid up core	MA	Measurement	One Sample of each size/	IS 7098-II & Appd. Datasheet	IS 7098-II & Appd. Datasheet	Inpection Report	2	-	-	
		2. Sequence of lay & direction	MA	Visual & Meas.	-do-	IS 7098-II & Mfr. Std.	IS 7098-II & Mfr. Std.	-do-	2	-	-	
		3. Lay Length	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
2.7	**InnerSheath Extrusion (as applicable)**	1. Surface finish	MA	Visual	100%	Surface shall be smooth	Surface shall be smooth	Inpection Report	2	-	-	*(Pimple, fish eye, porosity & burnt particles not permitted.)*
		2. Thickness	CR	Measurement	One Sample of each size/	IS 7098-II & Appd. Datasheet	IS 7098-II & Appd. Datasheet	-do-	2	-	-	
		3. Dia over inner sheath	MA	-do-	-do-	-do-	-do-	-do-	2	-	-	
2.8	**Armour(as applicable)**	1. No.of wires/Strips	MA	Counting	At the start of the process	IS 7098-II & Appd. Datasheet	IS 7098-II & Appd. Datasheet	Inpection Report	2	-	-	
		2. Lay length & Direction	MA	Visual & Meas.	-do-	IS 7098-II & Mfr. Std.	IS 7098-II & Mfr. Std.	-do-	2	-	-	
		3. Dia over armouring	MA	Measurement	-do-	IS 7098-II & Appd. Datasheet	IS 7098-II & Appd. Datasheet	-do-	2	-	-	
		4. Coverage	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	

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

	STANDARD QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E001A, R0			SPECIFICATION : TITLE			
	SHEET 6 OF 11		SYSTEM			ITEM : HT 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
2.9	**Outer Sheath Extrusion (No repair permitted)**	1. Surface finish	MA	Visual	100%	Surface shall be smooth	Surface shall be smooth	Inpection Report	2	-	-	*(Pimple, fish eye, porosity & burnt particles not permitted.)*
		2. Sheath Thickness	CR	Measurement	One Sample of each size/ lot	IS 7098-II & Appd. Datasheet	IS 7098-II & 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	-	-	
3.0	**Finished Cable (INTERNAL)**	**1. Routine Test (Refer Note-F)**	CR	Electrical Tests & Measurement	100%	IS 7098-II & Appd. Datasheet	IS 7098-II & Appd. Datasheet	Test Report	2	-	1	
4.0	**Final Inspection (EXTERNAL)**	**1. Finish**	MA	Visual	One drum in each Lot	IS 7098-II & 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	-	

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

	STANDARD QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER: PE-QP-999-507-E001A, R0			SPECIFICATION : TITLE			
	SHEET 7 OF 11		SYSTEM			ITEM : HT 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			REMARKS
									P	**W**	**V**	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
		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	-do-	-do-	-do-	-do-	2	1	-	
		7. Type Tests (Refer Note-F)	CR	Physical & Electrical Tests	Sample #	-do-	-do-	-do-	2	1	-	*# Refer Annexure 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 / BHEL SPECIFICATION, 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 TO QAP ENCLOSED.***

LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER 1- BHEL 2-VENDOR 3- SUB VENDOR CHP:CUSTOMER HOLD POINT WHICH WILL BE DECIDED AT CONTRACT STAGE

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

Annexure to Quality Plan

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 1 drum for every 10 drums or less of each type and size of cable/ lot.
   b) Electrical tests to be conducted on one drum of every size & voltage grade of cables.
   c) FRLS test & Flammability Test to be conducted on every size & voltage grade of cables. Sampling quantity as per appendix –D of IS 7098-2, D2.2.

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) Acceptance tests shall be as per 1 drum for every 10 drums or less of each type and size of cable/ lot.
b) FRLS test & Flammability Test to be conducted on every size & voltage grade of cables. Sampling quantity as per appendix –D of IS 7098-2, D2.2.

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.

2. Sampling: Routine tests shall be conducted on 100% cable drums.

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 *(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	
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	

Annexure to Quality Plan

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
IV.	Torsion test	For GS round wire only	T, A	IS 10810 Pt 38	
V.	Winding test	For GS strip only	T, A	IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Aluminium wire & GS wire	*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	For Aluminium wires only	*T, A*	IS 10810 Pt 3	
3.0	Physical Tests for XLPE Insulation & PVC sheath				
I.	Test for thickness & Eccentricity	Applicable for XLPE insulation, HRPVC inner sheath & For HRPVC *inner/outer sheath* only	T, A	IS 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for XLPE insulation & For HRPVC *inner/outer sheath* only			
(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 & For HRPVC *inner/outer sheath* only	T	IS 10810 Pt 11	
IV.	Loss of mass in air oven test	For HRPVC *inner/outer sheath* only	T	IS 10810 Pt 10	
V.	Hot deformation test	For HRPVC *inner/outer sheath* only	T	IS 10810 Pt 15	
VI.	Heat shock test	For HRPVC *inner/outer sheath* only	T	IS 10810 Pt 14	
VII.	Shrinkage test	For XLPE insulation & For HRPVC *inner/outer sheath* only	T	IS 10810 Pt 12	
VIII.	Thermal stability test	For HRPVC *inner/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	
XI.	Degree of cross-linking	For XLPE insulation only	T	IS 7098-II	
4.0	Tests On Extruded Semi-conducting Screen				
I.	Test for Strippability	Applicable for Semi-conducting Strippable screen	T	IS 7098-II	Not applicable since it is bonded type
II.	Volume Resistivity	Applicable for Semi-conducting Strippable screen	T	IS 7098-II	
III.	Test for cross linking		A	IS 7098-II	
5.0	Improved Fire performance (FR-LSH) Tests				

Annexure to Quality Plan

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
I.	Oxygen index test	*For inner/outer sheath only*	T, A	IS 10810 Pt 58 / ASTMD 2863	*Sample shall be as per IS 7098,Part 2*
II.	Smoke density test	*For inner/outer sheath only*	T, A	ASTMD 2843	
III.	Acid gas generation test	*For inner/outer sheath only*	T, A	IS 10810 Pt 59 / IEC-754-1	
IV.	Temperature Index Test	*For inner/outer sheath only*	T,A	IS 10810 Pt 64 / ASTMD 2863	
6.0	Flammability Tests				
I.	Flammability test for bunched cables	For complete cable	T,A	IEC-60332 (Part-3)	
II.	Flammability test for single cable	For complete cable	T,A	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	
7.0	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	
III.	Partial discharge test (shall be carried out on full drum length)		T,A,R	IS 10810 Pt 46	
IV.	Bending Test followed by Partial Discharge test		T	IS 10810 Pt 50	
V.	Dielectric Power Factor Test (i) As a function of voltage (ii) As a function of temperature		T	IS 10810 Pt 48	
VI.	Heat Cycle Test		T	IS 10810 Pt 49	
VII.	Impulse Withstand Test		T	IS 10810 Pt 47	
VIII.	Thermal ageing test	For complete cable	T	IS 7098-II	
IX.	*Flammability Test*	*For HRPVC sheathed cable*	*T*	*IS 10810 Pt 53*	
8.0	Anti-rodent and Termite Repulsion test	For HRPVC *outer sheath* only	A	Refer Note	Test applicable as indicated in Datasheet-A
9.0	Anti-Fungal Test	For HRPVC outer sheath only	A	Self-certification by vendor for anti-fungal property.	
10.0	Special Test				
I.	Hydrolytic Stability	For Complete Cable	A (**)	ASTM D 3137	Test applicable as indicated in Datasheet-A
II.	Ultraviolet Test	For Complete Cable	A (**)	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.