2 x 660 MW UDANGUDI STPP STAGE-1

BOQ-CUM-PRICE SCHEDULE FOR HT XLPE POWER CABLES

Sr. No.	Item code	Item description	Unit	PEM TOTAL BOQ	PEM Drum Length (Meters)	ISG TOTAL BOQ	ISG Drum Length (Meters)	TOTAL REQUIREMENT (PEM+ISG)	UNIT PRICE (EX-WORKS) (Rs)	TOTAL PRICE (EX-WORKS) (Rs)	Freight %age interms of Total Ex-Works	GST %age	REMARKS
1.0		**11/11 KV AL. CONDUCTOR/ XLPE INSULATED/ ARMOURED/ UNEARTHED GRADE POWER CABLE**											
1.1	507-27025-A	1C-630	MTR	72750	500M X 114 + 750 M X21			72750					
1.2	507-27014-A	1C-300	MTR	30250	500M X 59 + 750MX 1			30250					
1.3	507-27037-A	3C-240	MTR	14250	500M X 15 + 750MX9			14250					
2.0		**6.6/6.6 KV AL. CONDUCTOR/ XLPE INSULATED/ ARMOURED/ UNEARTHED GRADE POWER CABLE.**											
2.1	507-27113-A	1C-630	MTR	35000	750M x 46 + 500M X 1			35000					
2.2	507-27117-A	3C-150	MTR	20500	500M X 41	25750	500M X 50 +750M X 1	46250					
2.3	507-27125-A	3C-240	MTR			2000	500M X 4	2000					
2.4	507-27129-A	3C-300	MTR			3750	500M X 6 +750M X 1	3750					
Notes:													
1	Standard drum length shall be 750 & 500 metres.Tolerance on individual drum length shall be ±5%.												
2	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.												
3	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).												
4	Bidder shall indicate unit price of cables inclusive of type test charges. No separate Type Test charges are to be quoted by bidder.												
5	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.												

	PRE - QUALIFYING REQUIREMENTS
ENQUIRY NO:	
PROJECT:	2 X 660 MW UDANGUDI
PACKAGE:	HT XLPE CABLES

CRITERIA FOR EVALUATION - FINANCIAL :

	Amount (in Rs.)
Average annual financial turnover during the last Three Financial Years should not be less than RUPEES TWELVE CRORE SEVENTY ONE LAKH ONLY	Rs.12,71,00,000/-

Notes:-

a) The bidder has to submit financial accounts (audited, if applicable comprising of Audit report, Balance Sheet, Profit & Loss A/c Statement and Notes/Schedules pertaining to Turnover/Sales/Revenue), for last three years (or from the date of incorporation, whichever is less) as on tender due date to review the above criteria. In case the incorporation of vendor is less than 3 years, average annual financial turnover shall be calculated based on available information as below:-

i) If the accounts are available for <= 1 Financial Year, the Average Annual Turnover shall be calculated based on available information divided by 1 (One).

ii) If the accounts are available for >1 but < = 2 Financial Years, the Average Annual Turnover shall be calculated based on available information divided by 2 (Two).

iii) If the accounts are available for >2 but <= 3 Financial Years, the Average Annual Turnover shall be calculated based on available information divided by 3 (Three).

b) Foreign bidder is to submit a latest report from reputed third party business rating agency like Dun & Bradstreet, Credit reform etc. in addition to the documents mentioned at point (a) above for review of above criteria.

c) Other Income shall not be considered for arriving at Annual Turnover/Sales.For evaluation purpose,turnover figure excluding taxes shall be considered.

d) For evaluation of foreign bidder, exchange rate (TT selling rate of SBI) as on scheduled date of tender opening (Part-I bid in case of two part bid) shall be considered.

1393793/2023/PS-PEM-EL

BHEL	**2X660 MW UDANGUDI STPP PRE-QUALIFICATION REQUIRMENTS FOR HT XLPE POWER CABLES**	PE-PQ-435-507-E011 REVISION NO. 0 DATE 31/03/2023 SHEET NO. 1 OF 1

ITEMS : HT XLPE Power Cable

SCOPE : Supply : YES; Erection & Commissioning : NO

1.0	Vendor should be a manufacturer of HT power cables.
2.0	Availability of test reports on HT XLPE FRLS power cables to establish in-house capability to carry out all routine, type & acceptance tests as per relevant IS/ International Standards (except UV radiation & hydrolytic stability test which can be conducted at Govt. Lab/ Govt. approved Independent lab).
3.0	Capacity of manufacturing 40 km of HT XLPE power cables per month.
4.0	Manufactured and supplied at least One (1) Km. FRLS Cables.
5.0	Manufactured and supplied HT XLPE power cable sizes of minimum 240 sq. mm for 3/3.5 core and minimum 630 sq. mm for single core cable.
6.0	Manufactured & supplied at least 50 km of 11kV/6.6kV/3.3kV grade XLPE power cables in one or more orders and at least 15 km in one single order.
7.0	Minimum two (2) nos. purchase orders for HT XLPE Power cables shall be submitted which should not be more than five (5) years old from date of techno- commercial bid opening for establishing continuity in business.

NOTE:

1. Consideration of offer shall be subject to customer's approval of bidders, if applicable.
2. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.
3. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder/collaborators to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.
4. After satisfactory fulfillment of all the above criteria/ requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.
5. Bidder to submit test reports as per PQR Clause No. 2 to establish vendor has in-house facility to conduct all tests including impulse withstand test.

PREPARED BY	CHECKED BY	REVIEWED BY		APPROVED BY
31/03/23	Megha 31/03/23	31.3.23	31/03/23	
NAME: M S S RAJPAL DESIGNATION: MANAGER	NAME: MEGHA DESIGNATION: MANAGER	NAME: AYAN SAHA DESIGNATION: DGM	SANDEEP LODH SR. DGM	NAME: DEBASISA RATH DESIGNATION: AGM-ELECT

TECHNICAL SPECIFICATION

FOR

HT XLPE POWER CABLES

VOLUME-II

SPECIFICATION NO: ***PE-TS-435-507-E001***

REVISION: 00

TANGEDCO

2 x 660 MW UDANGUDI STPP STAGE-1

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

	DOCUMENT TITLE	SPECIFICATION NO. PE-TS- 435-507-E001	
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CONTENTS

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

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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 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

	DOCUMENT TITLE	SPECIFICATION NO. PE-TS- 435-507-E001	
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1.0 SCOPE OF ENQUIRY

1.1 This specification covers the Design, Manufacture, Inspection and Testing at Manufacturer's works, proper packing and delivery to site of HT XLPE POWER CABLES.

1.2 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.

1.3 General technical requirements of the HT XLPE POWER CABLE are indicated in Section-II. Project specific technical/ quality requirements / changes are listed in Section-I.

1.4 The stipulations of Section-I, followed by those of Data Sheet-A shall prevail in case of any conflict between the stipulations of Section-I, Data Sheet - A & Section-II.

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

2.0 BILL OF QUANTITIES:

2.1 Quantity requirements shall be as per BOQ-cum-price schedule as part of NIT.

2.2 Vendor shall submit the drawing/document submission/resubmission schedule after approval of documents.

2.3 In BOM each of the item to be uniquely identified with item code no. or item Sl. No. Supplier to ensure that all the items which will find separate mention in the packing list are covered in detailed BOM.

2.4 Supplier to also give the following undertaking in the BOM: "The BoM provided herewith completes the scope (in content and intent) of material supply under PO No. ----------, dated --------. Any additional material which may become necessary for the intended application of the supplied item(s)/package will be supplied free of cost in most reasonable time."

3.0 TECHNICAL REQUIREMENTS

3.1 List of primary and secondary documents and their submission schedule shall be as per NIT

3.2 Specific Technical Requirement:

S.No.	***Reference Clause No. of Section- II (if any)***	***Specific Requirement/ Change***
1		
2		

3.3 Quality/ Inspection:

S.No.	***Reference Clause No. of Section- II (if any)***	***Specific Requirement/ Change***

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	DATA SHEET-A	SHEET OF	

S.No.	Particulars	Unit	Description
1	**Type of Cable**		Flame Retardant-Low Smoke (FR-LSH) HT CABLE
1.1	**Voltage Grade**		*6.6/6.6 kV (unearthed)/ 11/11 kV (unearthed)*
2	**STANDARDS APPLICABLE**		
2.1	Standard applicable in general (Latest amendment to be referred if any)	YES	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
2.2	Current rating of cables conforms to	-	As per IS:3961 (P-7)/2017
2.3	Short circuit rating conforms to	-	IEC 60949
2.4	Formula for calculating short circuit current for different durations	-	KxA/√t K Amp (Where A =Total area of Conductor in mm2 & t = time in seconds , K= 0.094 for Al)
3	**INSTALLATION CONDITIONS AT SITE**		
3.1	Ambient air temperature	deg. C	50
3.2	Ground temperature	deg. C	30
3.3	Depth of laying of cables buried in ground	cm	90
3.4	Thermal resistivity of soil	deg. C cm/W	150
5	**CONDUCTOR**		
5.1	Material type & grade	-	H2 Grade Stranded Aluminium Conductor, Class-2 of IS:8130/2013
5.2	Cable Size		As per BOQ-Cum-Price Schedule
5.3	Shape	-	Compacted Circular
6	**CONDUCTOR SCREEN**		
6.1	Material	-	Extruded layer of Semi Conducting Compound
6.2	Minimum thickness	mm	0.3
7	**XLPE INSULATION**		Extruded XLPE compound as per IS:7098 (P-2)/2011
7.1	Nominal thickness of insulation	mm	As per IS:7098 (P-2)/2011
7.2	Extrusion & method of curing	-	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) by Gas curing/Steam curing
7.3	Continuous withstand temperature		90°C
7.4	Short-circuit withstand temperature		250°C
8	**INSULATION SCREEN**		For both single core cable and Multicore cables
8.1	Type of screen	-	Insulation screen shall consist of two parts: 1. Non-Metallic Part 2. Metallic Part
8.2	Material and thickness (minimum and nominal)	mm	
8.2.1	Metallic	-	Copper Tape applied helically on core (Nominal thickness 0.10 mm with tolerance (±) 10%)
	No. of tapes and Minimum overlapping	-	1. No. of tapes and Minimum overlapping 10%
8.2.2	Non-metallic	-	Extruded Semi Conducting Compound shall be bonded type. Semiconducting Tape shall also be provided & it should be easily strippable. Thickness of Semi Conducting Compound - 0.3 mm (Min.)
8.3	Earth fault current withstand capacity (calculation to be furnished)	kA, sec.	300A,1 sec (For multi-core cables, screen of each core shall be rated individually for the above value).
8.4	Extrusion & method of curing		Same as that, mentioned for Insulation above.

8.5	**CORE IDENTIFICATION**		By coloured strips of Red, yellow & Blue colour applied on the cores
9.0	**INNERSHEATH**		For both single core cable and Multicore cables
9.1	Material		Extruded HRPVC Type ST-2
9.2	Standard Applicable		IS: 7098 (Part-2) & IS: 5831
9.3	Colour		*Black*
9.4	Whether FR-LSH		***NO***
9.5	Inner sheath applicable for single core cable		***YES***
9.6	Fillers		Acceptable
9.7	Material of fillers (if permitted)		Same as inner sheath (Material of filler to be compatible with that of inner sheath)
9.8	Method of application		
9.8.1	Multi-core cables:		
9.8.1.1	With fillers		*Pressure/Vacuum extruded*
9.8.1.2	Without fillers		*Pressure extruded*
9.8.2	Single-core cables:		*Pressure extruded*
9.9	Thickness of inner sheath		As per Table-5 of IS: 7098 (Part-2)
10	**ARMOUR**		
10.1	Material	-	Non-Magnetic hard drawn H4 grade Aluminium Single Round Wire to IS: 8130/2013 for single core cables Galvanised Steel Flat Strip to IS : 3975/1999 as per Table-6 of IS 7098 part-2. for multi-core cables
10.2	Standard Applicable		Dimension as per IS: 7098 (Part-2) Table-6 and tolerance on dimension as per IS:3975
10.3	Tolerance on formed wire dimension	-	±10 %
10.4	Minimum Coverage		90%
10.5	Gap between armour wire		Shall not exceed one armour wire space (No cross over / Over riding)
10.6	Breaking load of Joint		95% of normal armour
10.7	Maximum resistivity of GS Round wire	Ohm-cm	14.5×10^{-6}
10.8	Maximum resistivity of Al round wire	Ohm-mm^2/km	28.264
11	**OUTERSHEATH**		
11.1	Material		Extruded *HRPVC*
			Type ST2 as per IS: 5831
11.2	Colour		*Black*
11.3	Whether FR-LSH		YES
11.4	Method of application		Extruded
11.5	Thickness of outer sheath		As per Table-7 of IS: 7098 (Part-2)
11.6	Marking/Embossing on Outersheath		*BIS Mark, Owner's name ,Manufacturer's name and trade mark, year of manufacture, Cable code, Type of cable and voltage class, nominal cross section area of conductor and no. of cores, 'BHEL-PEM', etc. and Progressive Sequential length marking, @ 1M (by embossing/printing) for 11kV & 6.6 kV Cables. Cable shall be marked as having FRLSH outer sheath at every 5 Meters for 11kV & 6.6 kV Cables. (The embossing/printing shall be progressive, automatic, in line and marking shall be legible and indelible)*
12	**FR-LSH CHARACTERISTICS**		
12.1	Oxygen index		Min 29 (As per IS 7098-2 /ASTMD 2863)
12.2	Temperature index		Min. 250°C(As per IS 7098-2 /ASTMD 2863)
12.3	Acid gas generation		Max. 20% by weight (As per IS 7098-2 /IEC-60754-1)
12.4	Smoke density rating		Max. 60% (As per IS 7098-2 /ASTM D 2843)
12.5	Flammability Test		
13	**FLAMMABILITY**		
13.1	*Flammability test for single cable*		*YES (As per: IEC-60332 Part-1)*

13.2	*Flammability test for bunched cables*		*YES (As per: IEC-60332 Part-3, CAT-B)*
13.3	*Flammability test as per IEEE: 60383*		*YES*
13.4	*As per Swedish Chimney test SEN-SS-424-1475-F3*		*YES*
14	*Anti-rodent and Termite repulsion Test*		*YES*
15	*Anti-Fungal Test*		*NO (self certification by supplier for Anti-fungal properties)*
16	Special Tests		
16.1	*Hydrolytic Stability as per ASTM D 3137 :81 (Duration:- 14 days)*		*NO (Only type test report to be submitted)*
16.2	*UV Radiation Test as per BS EN ISO 4892-2 (Duration:- 14 days)*		*NO (Only type test report to be submitted)*
16.3	*UV Radiation Test as per ASTM G 154 (Duration:- 14 days)*		*NO (Only type test report to be submitted)*
17	**DIAMETERS**		
17.1	Tolerance on overall diameter	(±) mm	(±)2 mm. over the declared value
18	**Cable Drum Details**		
18.1	*Type of Drum*		Wood/ Steel
18.2	Standard drum length		*500m (±)5% / 750M (±) 5% (as specified in BOQ-Cum-Priced Schedule).*
18.3	Details of marking on Drum		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, Approx. gross mass stencilled on both side of the drum. 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.
19	Cable packing		Please refer Clause no 4 of Section-II of this technicalSpecification. It may be noted that the outer most cable layer shall be covered with water proof cover polythene followed by complete drum covering with wooden plank of suitable thickness across flanges. (Please refer typical drawing of cable drum packing, attached in section -II)

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	DATA SHEET-C	SHEET OF	

NOTE: DATA SHEET C TO BE SUBMITTED BY SUCCESSFUL BIDDER . ONLY PARAMETERS INDICATED AS VENDOR TO FURNISH (VTF) TO BE FILLED UP

S.No.	Particulars	Unit	Description
1	**GENERAL**		
1.1	Name of Manufacturer		Vendor to furnish (VTF)
1.2	Place of Manufacture		Vendor to furnish (VTF)
2	**Type of Cable**		Flame Retardant-Low Smoke (FR-LSH) HT CABLE
2.1	**Voltage Grade**		*6.6/6.6 kV (unearthed)/ 11/11 kV (unearthed)*
3	**STANDARDS APPLICABLE**		
3.1	Standard applicable in general (Latest amendment to be referred if any)	YES	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
3.2	Current rating of cables conforms to	-	As per IS:3961 (P-7)/2017
3.3	Short circuit rating conforms to	-	IEC 60949
3.4	Formula for calculating short circuit current for different durations	-	KxA/√t K Amp (Where A =Total area of Conductor in mm2 & t = time in seconds , K= 0.094 for Al)
4	**INSTALLATION CONDITIONS AT SITE**		
4.1	Ambient air temperature	deg. C	50
4.2	Ground temperature	deg. C	30
4.3	Depth of laying of cables buried in ground	cm	90
4.4	Thermal resistivity of soil	deg. C cm/W	150
5	**INFORMATION TO BE FILLED IN FOR EACH SIZE CABLE IN THE FORM OF TABLE**		
5.1	No. of cores x size		Vendor to furnish (VTF)
5.2	Voltage grade (Uo/U)		Vendor to furnish (VTF)
5.3	Base current ratings (*) based on Clause No. 3.0		
5.3.1	In air		Vendor to furnish (VTF)
5.3.2	In ground		Vendor to furnish (VTF)
5.3.3	ducts		Vendor to furnish (VTF)
5.4	Short circuit rating		Vendor to furnish (VTF)
5.5	Properties		
5.5.1	D.C. resistance of conductor at 20 deg. C		Vendor to furnish (VTF)
5.5.2	A.C. resistance of conductor at 90 deg. C		Vendor to furnish (VTF)
5.5.3	Reactance of cable at normal frequency		Vendor to furnish (VTF)
5.5.4	Electrostatic capacitance of cable at normal frequency		Vendor to furnish (VTF)
6	**CONDUCTOR**		
6.1	Material type & grade	-	H2 Grade Stranded Aluminium Conductor, Class-2 of IS:8130/2013
6.2	No & dia of wires in each core before stranding	no x mm	Vendor to furnish (VTF)
6.3	Shape	-	Compacted Circular
7	**CONDUCTOR SCREEN**		
7.1	Material	-	Extruded layer of Semi Conducting Compound
7.2	Minimum thickness	mm	0.3
8	**XLPE INSULATION**		Extruded XLPE compound as per IS:7098 (P-2)/2011
8.1	Nominal thickness of insulation	mm	Vendor to furnish (VTF)
8.2	Extrusion & method of curing	-	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) by Gas curing/Steam curing
8.3	Continuous withstand temperature		90°C
8.4	Short-circuit withstand temperature		250°C
9	**INSULATION SCREEN**		For both single core cable and Multicore cables
9.1	Type of screen	-	Insulation screen shall consist of two parts: 1. Non-Metallic Part 2. Metallic Part

9.2	Material and thickness (minimum and nominal)	mm	
9.2.1	Metallic *(Vendor to furnish exact calculation based on actual thickness)*	-	Copper Tape applied helically on core (Nominal thickness 0.10 mm with tolerance (±) 10%)
9.2.2	No. of tapes and Minimum overlapping	-	1. No. of tapes and Minimum overlapping 10%
9.3	Non-metallic	-	Extruded Semi Conducting Compound shall be bonded type. Semiconducting Tape shall also be provided & it should be easily strippable. Thickness of Semi Conducting Compound - 0.3 mm (Min.)
9.4	Earth fault current withstand capacity (calculation to be furnished)	kA, sec.	300A,1 sec (For multi-core cables, screen of each core shall be rated individually for the above value).
9.5	Extrusion & method of curing		Same as that, mentioned for Insulation above.
9.6	**CORE IDENTIFICATION**		By coloured strips of Red, yellow & Blue colour applied on the cores
10.0	**INNERSHEATH**		For both single core cable and Multicore cables
10.1	Material		Extruded HRPVC Type ST-2
10.2	Standard Applicable		IS: 7098 (Part-2) & IS: 5831
10.3	Colour		Black
10.4	Whether FR-LSH		NO
10.5	Inner sheath applicable for single core cable		YES
10.6	Fillers		Acceptable
10.7	Material of fillers (if permitted)		Same as inner sheath (Material of filler to be compatible with that of inner sheath)
10.8	Method of application		
10.9	Multi-core cables:		
10.9.1	With fillers		Vendor to furnish (VTF)
10.9.2	Without fillers		Pressure extruded
10.10	Single-core cables:		Vendor to furnish (VTF)
10.11	Type & Shape of fillers (if used)		Vendor to furnish (VTF)
10.12	Thickness (min.)	mm.	Vendor to furnish (VTF)
11	**ARMOUR**		
11.1	Material	-	Non-Magnetic hard drawn H4 grade Aluminium Single Round Wire to IS: 8130/2013 for single core cables Galvanised Steel Flat Strip to IS : 3975/1999 as per Table-6 of IS 7098 part-2. for multi-core cables
11.2	Standard Applicable		Dimension as per IS: 7098 (Part-2) Table-6 and tolerance on dimension as per IS:3975
11.3	Size/ dimensions	-	Vendor to furnish (VTF)
11.4	Minimum no. of wires/ formed wires	-	Vendor to furnish (VTF)
11.5	Tolerance on formed wire dimension	-	±10 %
11.6	Minimum Coverage		90%
11.7	Gap between armour wire		Shall not exceed one armour wire space (No cross over / Over riding)
11.8	Breaking load of Joint		95% of normal armour
11.9	Maximum resistivity of GS Round wire	Ohm-cm	14.5 x 10-6
11.10	Maximum resistivity of Al round wire	Ohm-mm^2/km	28.264
12	**OUTERSHEATH**		
12.1	Material		Extruded HRPVC
			Type ST2 as per IS: 5831
12.2	Colour		Black
12.3	Whether FR-LSH		YES
12.4	Method of application		Extruded
12.5	Thickness of outer sheath		Vendor to furnish (VTF)
13	**DIAMETERS**		
13.1	Diameter of insulated conductor	mm.	Vendor to furnish (VTF)
13.2	Cable diameter under armour	mm.	Vendor to furnish (VTF)
13.3	Cable diameter over armour	mm.	Vendor to furnish (VTF)
13.4	Overall diameter of cable	mm.	Vendor to furnish (VTF)
13.5	Tolerance on overall diameter	(±) mm	±2.0
13.6	Minimum bending radius	x O.D.	Vendor to furnish (VTF)
13.7	Safe pulling force	kg.	Vendor to furnish (VTF)
13.8	Weight of cable	kg./km	

13.8.1	Weight of conductor	MT./km	Vendor to furnish (VTF)
13.8.2	Weight of XLPE insulation	MT./km	Vendor to furnish (VTF)
13.8.3	Weight of PVC (Inner Sheath & Fillers)	kg./km	Vendor to furnish (VTF)
13.8.4	Weight of Aluminium Round Wire / GS formed Wire (Approx)	kg./km	Vendor to furnish (VTF)
13.8.5	Weight of PVC (Outer Sheath)	kg./km	Vendor to furnish (VTF)
13.9	Dimension of drum (F X B X T) (Approx)	mm.	Vendor to furnish (VTF)
13.10	Shipping weight (Approx)	kg	Vendor to furnish (VTF)
14	**Cable marking on outer sheath**	-	
14.1	Marking/Embossing on Outersheath *(VTF Manufacturer's Name and Trade Mark)*		BIS Mark, Owner's name ,Manufacturer's name and trade mark, year of manufacture, Cable code, Type of cable and voltage class, nominal cross section area of conductor and no. of cores, 'BHEL-PEM', etc. and Progressive Sequential length marking, @ 1M (by embossing/printing) for 11kV & 6.6 kV Cables. Cable shall be marked as having FRLSH outer sheath at every 5 Meters for 11kV & 6.6 kV Cables. (The embossing/printing shall be progressive, automatic, in line and marking shall be legible and indelible)
15	**FR-LSH CHARACTERISTICS**		
15.1	Oxygen index		Min 29 (As per IS 7098-2 /ASTMD 2863)
15.2	Temperature index		Min. 250oC(As per IS 7098-2 /ASTMD 2863)
15.3	Acid gas generation		Max. 20% by weight (As per IS 7098-2 /IEC-60754-1)
15.4	Smoke density rating		Max. 60% (As per IS 7098-2 /ASTM D 2843)
15.5	Flammability Test		
16	**FLAMMABILITY**		
16.1	*Flammability test for single cable*		*YES (As per: IEC-60332 Part-1)*
16.2	*Flammability test for bunched cables*		*YES (As per: IEC-60332 Part-3, CAT-B)*
16.3	*Flammability test as per IEEE: 60383*		*YES*
16.4	*As per Swedish Chimney test SEN-SS-424-1475-F3*		*YES*
17	**Anti-rodent and Termite repulsion Test**		*YES*
18	**Anti-Fungal Test**		*NO (self certification by supplier for Anti-fungal properties)*
19	**Special Tests**		
19.1	*Hydrolytic Stability as per ASTM D 3137 :81 (Duration:- 14 days)*		*NO (Only type test report to be submitted)*
19.2	*UV Radiation Test as per BS EN ISO 4892-2 (Duration:- 14 days)*		*NO (Only type test report to be submitted)*
19.3	*UV Radiation Test as per ASTM G 154 (Duration:- 14 days)*		*NO (Only type test report to be submitted)*
20	**Cable Drum Details**		
20.1	*Type of Drum*		*Wood/ Steel*
20.2	Standard drum length		*500m (±)5% / 750M (±) 5% (as specified in BOQ-Cum-Priced Schedule).*
20.3	Details of marking on Drum *(VTF Manufacturer's Name and Trade Mark)*		*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, Approx. gross mass stencilled on both side of the drum. 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.*
21	**Cable packing**		*Please refer Clause no 4 of Section-II of this technicalSpecification. It may be noted that the outer most cable layer shall be covered with water proof cover polythene followed by complete drum covering with wooden plank of suitable thickness across flanges. (Please refer typical drawing of cable drum packing, attached in section -II)*

SECTION-II

STANDARD TECHNICAL SPECIFICATION

	DOCUMENT TITLE	SPECIFICATION NO. PE-TS-XXX-507-E001	
BHEL	**TECHNICAL SPECIFICATION FOR HT XLPE POWER CABLES**	VOLUME II	
		SECTION II	
		REVISION 00	DATE: 31.03.2023
		SHEET **1** of **1**	

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

2.2 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) 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 requirements, 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 as per data sheet-A and if these tests are performed) 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 as specified in Datasheet-A.

4.2 In case of 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 polythene followed by complete drum covering by wooden plank. 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.

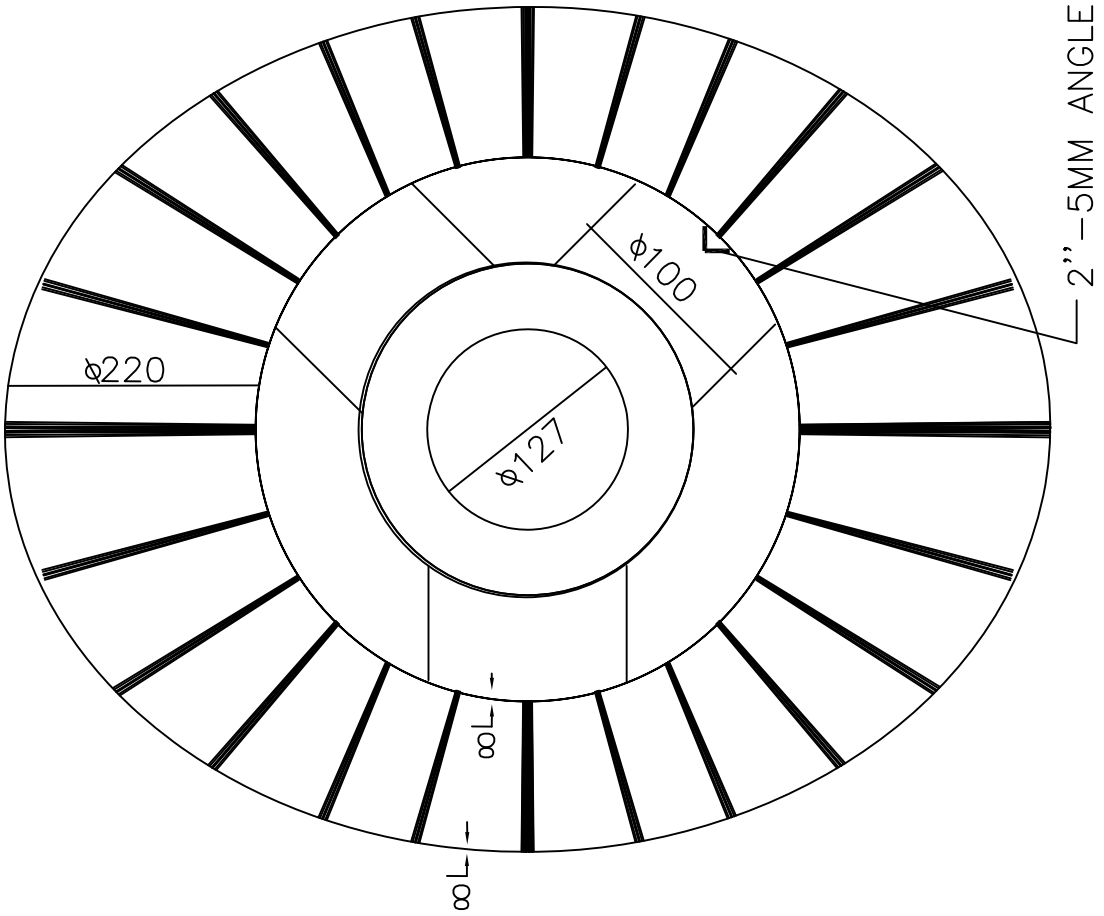
4.3 In case of Steel drums, New or practically new cable drums made of steel and painted with epoxy resin paint are to be used. Cable ends are carefully protected before packing. Over the cables polyethylene sheet shall be wrapped and then sealed properly. For Typical details of Steel drums, Annexure-B 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.

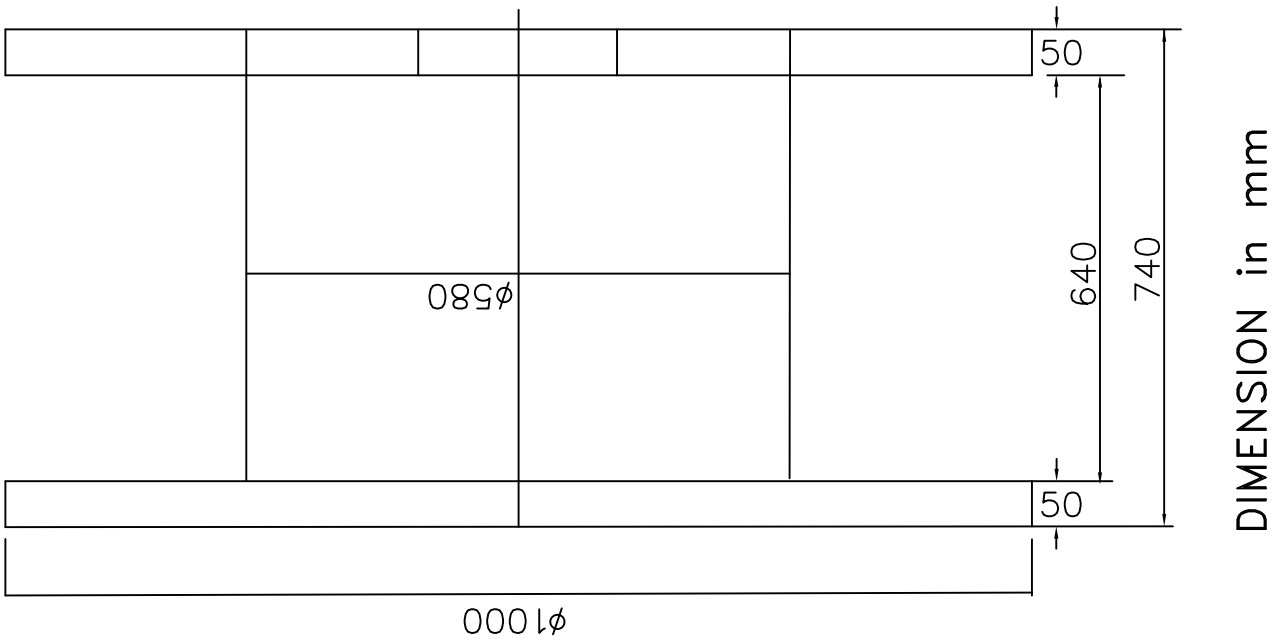
4.4 Cable drums to be secured with wooden planks to avoid any sharp cuts/damages to the wrapped cable (Refer annexure-C to section-II)

STEEL DRUM DRAWING (TYPICAL)

Annexure-A to Section II

(Sheet 1 of 2)

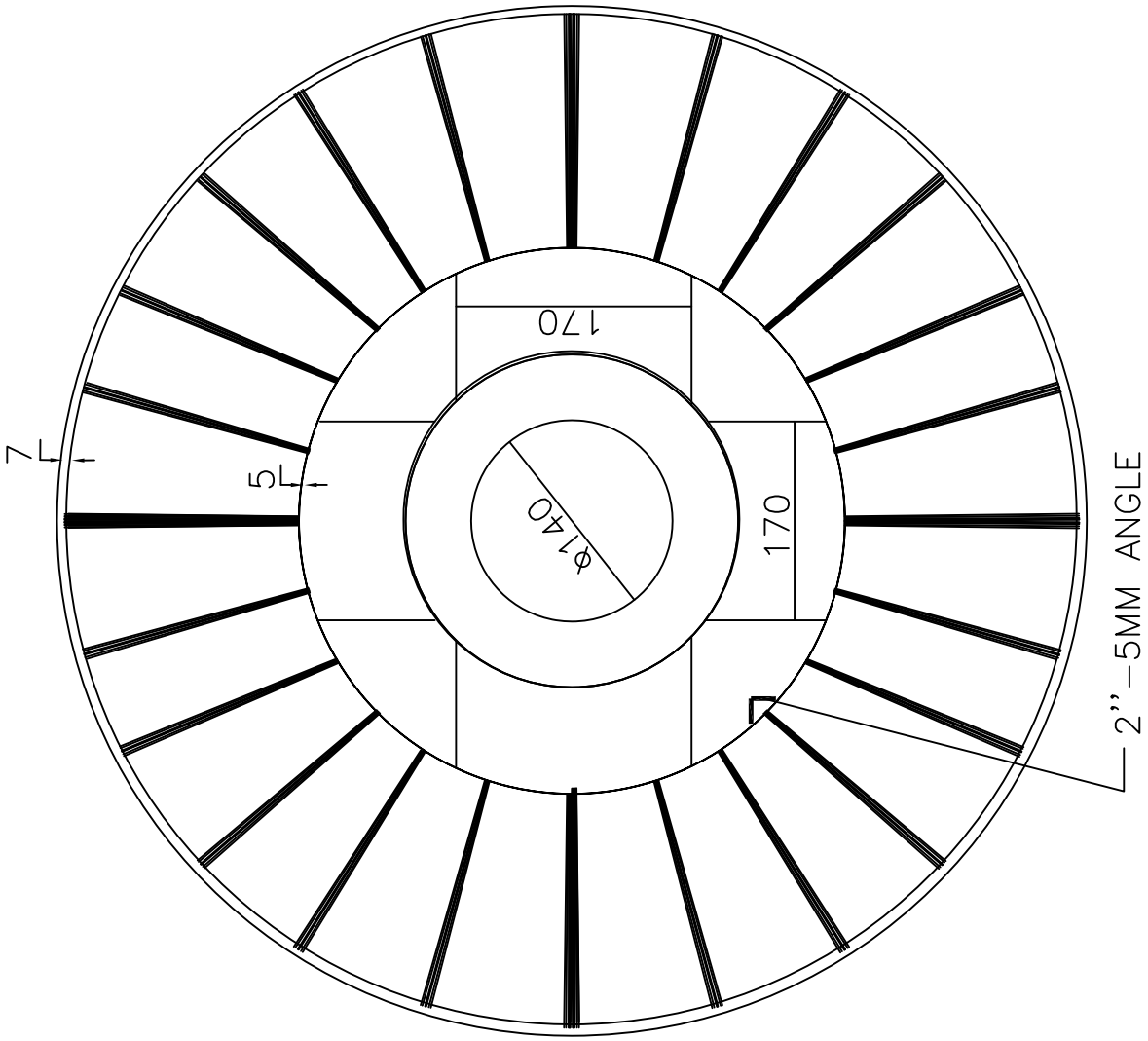


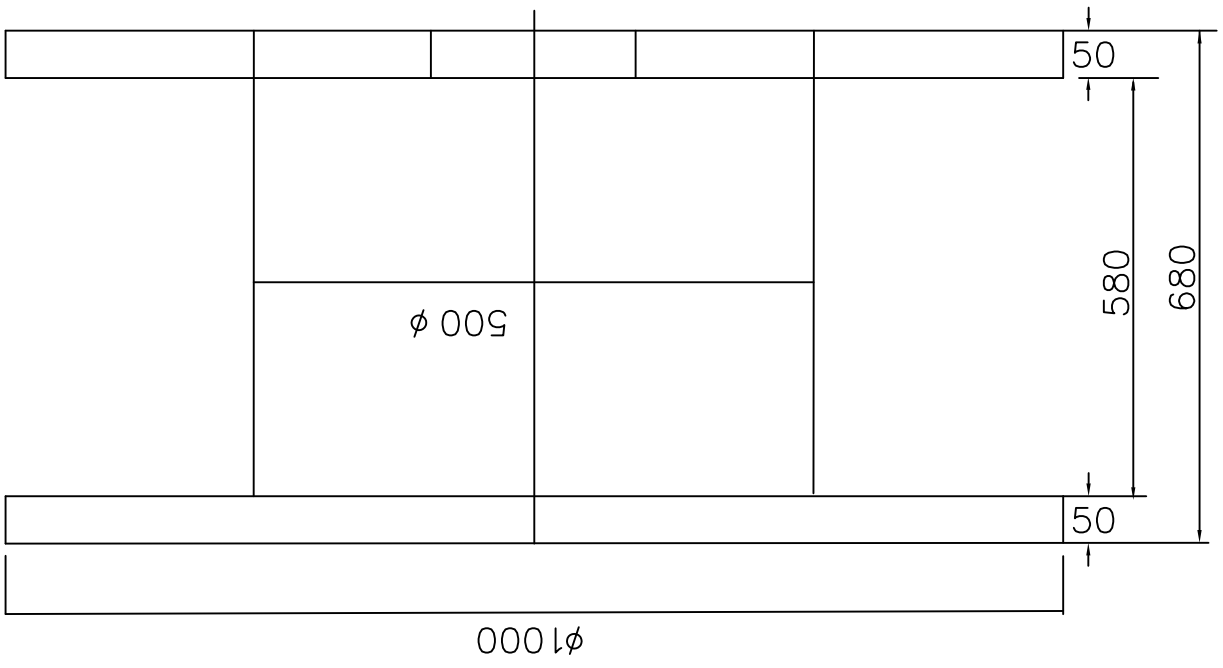


1393793/2023/PS-PEM-EL

Annexure-A to Section II

(Sheet 2 of 2)





DIMENSION in mm

TYPICAL DRAWING OF CABLE DRUM PACKING

Annexure-B of Section-II

QUALITY PLAN

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-507-E001, R1.	
	PROJECT:		PO NO.:	
	ITEM: HT XLPE Cables	SYSTEM: CABLE	SECTION: II	SHEET 1 OF 11

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					6						**			
					M	C/N				D	M	C	N	
1	2	3	4	5			7	8	9					
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**													
1.1	**Aluminium/copper Rods (Conductor/Armour Wire)**	**GENERAL :**												
		1. Physical properties	MA	Physical Tests	Sample/ Batch	Sample/ Batch	IS 5082 / IS 613	IS 5082/ IS 613	Test Cert.	✓	P/V	V	-	
		2. Elec .Properties	MA	Electrical Tests	Sample/ Batch	Sample/ Batch	-do-	-do-	-do-	✓	P/V	V	-	
		SPECIFIC CHECKS :												
		a) Make	MA	Physical verification	Sample/ Batch	Sample/ Batch	Manufacturer approved source	Manufacturer approved source	Test Cert.	✓	P	V	-	
		b) Grade	MA	-do-	-do-	-do-	IS 8130	IS 8130	-do-	✓	P	V	-	
		c) Resistivity	MA	Electrical Tests	Manufacturer std.	Manufacturer std.	IS 5082 / IS 613	IS 5082/ IS 613	-do-	✓	P	V	-	
1.2	**XLPE Compound for insulation**	**GENERAL :**												
		1. Physical properties	MA	Physical Tests	Sample/ Batch	Sample/ Batch	IS 7098-II	IS 7098-II	Test Cert.	✓	P	V	-	
		2. Elec. Properties	MA	Electrical Tests	Sample/ Batch	Sample/ Batch	-do-	-do-	-do-	✓	P	V	-	
		SPECIFIC CHECKS :												

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ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
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Reviewed by:	MANISH	MANISH SHUKLA	Reviewed by:	RITESH KUMAR JAISWAL	R.K. JAISWAL		

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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-507-E001, R1.	
	PROJECT:		PO NO.:	
	ITEM: HT XLPE Cables	SYSTEM: CABLE	SECTION: II	SHEET 2 OF 11

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			
		a) Make	MA	Physical verification	100%	100%	Manufacturer approved source	Manufacturer approved source	Test Cert.	✓	P/V	V	-	
		b) Type/ Grade	MA	-do-	-do-	-do-	Approved datasheet	Approved datasheet	-do-	✓	P/V	V	-	
		c) Shelf life/ Storage condition	MA	-do-	-do-	-do-	-do-	-do-	-do-	✓	P/V	V	-	
1.3	**Semi Conducting Compound**	**GENERAL :**												
		1. Physical properties	MA	Physical Tests	Sample/ Batch	Sample/ Batch	IS 7098-II	IS 7098-II	Inspection Report/ Test Cert.	✓	P	V	-	
		SPECIFIC CHECKS :												
		1. Make	MA	Physical verification	100%	100%	Manufacturer approved source	Manufacturer approved source	-do-	✓	P	V	-	
		2. Type/ Grade	MA	-do-	-do-	-do-	IS 7098-II	IS 7098-II	-do-	✓	P	V	-	
		3. Shelf life/ Storage condition	MA	-do-	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	✓	P	V	-	
1.4	**Copper Tape**	**GENERAL :**												
		1. Physical properties	MA	Physical Tests	Sample/ Batch	Sample/ Batch	IS 7098-II & Approved datasheet	IS 7098-II & Approved datasheet	Inpection Report/	✓	P	V	-	

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:		ABHISHEK	Checked by:		KUNAL GANDHI		
Reviewed by:	MANISH	MANISH SHUKLA	Reviewed by:	RITESH KUMAR JAISWAL	R.K. JAISWAL		

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	Sign & Date	Name	Seal
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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-507-E001, R1.	
	PROJECT:		PO NO.:	
	ITEM: HT XLPE Cables	SYSTEM: CABLE	SECTION: II	SHEET 3 OF 11

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			
									Test Cert.					
		2. Elec. Properties	MA	Electrical Tests	Sample/ Batch	Sample/ Batch	-do-	-do-	-do-	✓	P	V	-	
		3. Dimension	MA	Measurement	-do-	-do-	-do-	-do-	-do-	✓	P	V	-	
		3. Continuity	MA	Electrical Tests	-do-	-do-	-do-	-do-	-do-	✓	P	V	-	
		SPECIFIC CHECKS :												
		1. Resistivity	MA	Electrical Tests	Sample/ Batch	Sample/ Batch	IS 613	IS 613	-do-	✓	P	V	-	
1.5	**Fillers (as applicable)**	1. Make	MA	Physical verification	100%	100%	Manufacturer approved source	Manufacturer approved source	Test Cert.	✓	P/V	V	-	Fillers material chosen shall be compatible with the temperature rating of the cable and shall have no deleterious effect on any other comp. of cable)
		2. Type/ Grade	MA	-do-	-do-	-do-	Approved datasheet	Approved datasheet	-do-	✓	P/V	V	-	

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	Sign & Date	Name		Sign & Date	Name	Seal	
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Reviewed by:	MANISH	MANISH SHUKLA	Reviewed by:	RITESH KUMAR JAISWAL	R.K. JAISWAL		

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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-507-E001, R1.	
	PROJECT:		PO NO.:	
	ITEM: HT XLPE Cables	SYSTEM: CABLE	SECTION: II	SHEET 4 OF 11

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			
1.6	PVC Compound (for sheath)	**GENERAL :**												
		1. Physical properties	MA	Physical Tests	Sample/ Batch	Sample/ Batch	IS 5831	IS 5831	Test Cert.	✓	P/V	V	-	
		2. Elec. Properties	MA	Electrical Tests	-do-	-do-	-do-	-do-	-do-	✓	P/V	V	-	
		3. FRLS Properties (as applicable)	CR	Chemical/ Environ.	-do-	-do-	Approved datasheet	Approved datasheet	-do-	✓	P/V	V	-	
		SPECIFIC CHECKS :												
		a) Make	MA	Physical verification	100%	100%	Manufacturer approved source	Manufacturer approved source	Test Cert.	✓	P	V	-	
		b) Type/ Grade	MA	-do-	-do-	-do-	Approved datasheet	Approved datasheet	-do-	✓	P	V	-	
		c) Shelf life/ Storage condition	MA	-do-	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	✓	P	V	-	
1.7	Galvanised steel round wire/ formed wire strip/ Aluminium round wire for Armour (as applicable)	**GENERAL :**												
		1. Make	MA	Physical verification	Manufacturer std.	Manufacturer std.	Manufacturer approved source	Manufacturer approved source	Test Cert.	✓	P	V	-	
		2. Dimension	MA	Measurement	-do-	-do-	Approved datasheet	Approved datasheet	-do-	✓	P/V	V	-	
		3. Phy.and Elec. Properties	MA	Physical & Electrical Tests	Sample *	Sample*	-do-	-do-	-do-	✓	P/V	V	-	*: SAMPLE FROM EACH ARMOUR

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	Sign & Date	Name		Sign & Date	Name	Seal	
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Reviewed by:	MANISH	MANISH SHUKLA	Reviewed by:	RITESH KUMAR JAISWAL	R.K. JAISWAL		

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	ITEM: HT XLPE Cables	SYSTEM: CABLE	SECTION: II	SHEET 5 OF 11

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			
														SIZE/ BATCH /LOT
		4.Galvanization Quality	MA	Galv. Tests	-do-	-do-	IS 3975	IS 3975	-do-	✓	P/V	V	-	
1.8	**Steel Drum (as applicable)**	1. Phy. & Constructional checks	MA	Measurement	Mfr's Plant Std.	Mfr's Plant Std.	Approved drawing of steel drum	Approved drawing of steel drum	Inspection Report	✓	P	V	-	
		2. Surface finish	MA	Visual	-do-	-do-	-	Surface shall be smooth	-do-	✓	P	V	-	
1.9	**Wooden Drum (as applicable)**	1. Phy. & Constructional checks	MA	Measurement	Mfr's Std.	Mfr's Std.	IS 10418	IS 10418	Inspection Report	✓	P	V	-	
		2. Anti-termite treatment	MA	Chem.	Mfr's Std.	Mfr's Std.	Mfr's Std.	Mfr's Std.	-do-	✓	P	V	-	
2.0 IN PROCESS														
2.1	**Wire Drawing**	1. Size	MA	Dimensional	Mfr's Std.	Mfr's Std.	Appd. Datasheet	Appd. Datasheet	Inspection Report	✓	P	V	-	
		2. Surface finish	MA	Visual	-do-	-do-	-	Surface shall be smooth	-do-	✓	P	V	-	
		3. % of Elongation	MA	Mechanical	-do-	-do-	IS 8130	IS 8130	-do-	✓	P	V	-	
2.2	**Stranding of wires**	1. No. of wires	MA	Counting	Mfr's Std.	Mfr's Std.	Appd. Datasheet	Appd. Datasheet	Inspection Report	✓	P	V	-	

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ENGINEERING			QUALITY			Sign & Date	
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Reviewed by:	MANISH	MANISH SHUKLA	Reviewed by:	RITESH KUMAR JAISWAL	R.K. JAISWAL		

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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-507-E001, R1.	
	PROJECT:		PO NO.:	
	ITEM: HT XLPE Cables	SYSTEM: CABLE	SECTION: II	SHEET 6 OF 11

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					6						**			
1	2	3	4	5	M	C/N	7	8	9	D	M	C	N	
		2. Resistance	CR	Electrical	-do-	-do-	-do-	-do-	-do-	✓	P	V	-	
		3. Sequence, lay length & Direction	MA	Visual, Meas.	One Sample of each size/ lot	-	Mfrs Std. / Appd. Datasheet	Mfrs Std. / Appd. Datasheet	-do-		P	-	-	
		4. Surface Finish	MA	Visual	100%	-	-	Surface shall be smooth	-do-		P	-	-	
		5. Dimension	MA	Measurement	One Sample of each size/ lot	-	Appd. Datasheet	Appd. Datasheet	-do-		P	-	-	
2.3	Conductor Screening	1. Surface Finish	MA	Visual	100%	-	-	Surface shall be smooth	Inpection Report		P	-	-	
		2. Radial Thickness	CR	Mechanical	One Sample of each size/ lot	-	IS 7098-II & Appd. Datasheet	IS 7098-II & Appd. Datasheet	-do-		P	-	-	
2.4	Core Insulation (XLPE) (No repair permitted)	1. Surface finish	MA	Visual	100%	100%	-	Free from bulging, burnt particles, lumps, cuts & scratches	Inspection Report/ Test report	✓	P	V	-	
		2. Eccentricity & Ovality #	CR	Measurement	One Sample of each size/ lot	One Sample of each	Mnfr's Std	Mnfr's Std	-do-	✓	P	V	-	# To be checked at starting & finished

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:		ABHISHEK	Checked by:		KUNAL GANDHI		
Reviewed by:	MANISH	MANISH SHUKLA	Reviewed by:	RITESH KUMAR JAISWAL	R.K. JAISWAL		

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BHEL		CUSTOMER :		QP NO.: PE-QP-999-507-E001, R1.	
		PROJECT:		PO NO.:	
		ITEM: HT XLPE Cables	SYSTEM: CABLE	SECTION: II	SHEET 7 OF 11

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			
						size/ lot								end of extruded length.
		3. Insulation Thickness	CR	Measurement	-do-	-	Appd. Datasheet	Appd. Datasheet	-do-		P	-	-	
		4. Dia over insulation	MA	Measurement	-do-	-	-do-	-do-	-do-		P	-	-	
		5. Tensile Strength & % Elongation	MA	Mechanical	100%	-	IS:7098-II	IS:7098-II	-do-		P	-	-	
2.5	Insulation Screening	**NON METTALIC**												
		1. Surface finish	MA	Visual	100%	100%	-	Surface shall be smooth	Inspection Report	✓	P	V	-	
		2. Thickness	CR	Measurement	One Sample of each size/ lot	-do-	Appd. datasheet	Appd. datasheet	-do-	✓	P	V	-	
		METALLIC												
		1. Dimension of tape	CR	Measurement	One Sample of each size/ lot	One Sample of each size/ lot	Appd. datasheet	Appd. datasheet	Inspection Report/ Test report	✓	P	V	-	
		2. Overlap of Tape Band	MA	-do-	-do-	-do-	Mfs Std.	Mfs Std.	-do-	✓	P	V	-	
		3. Tightness of Tape	MA	Visual	-do-	-do-	Mfs Std.	Mfs Std.	-do-	✓	P	V	-	

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:		ABHISHEK	Checked by:		KUNAL GANDHI		
Reviewed by:		MANISH SHUKLA	Reviewed by:		RITESH KUMAR JAISWAL / R.K. JAISWAL		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
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Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-507-E001, R1.	
	PROJECT:		PO NO.:	
	ITEM: HT XLPE Cables	SYSTEM: CABLE	SECTION: II	SHEET 8 OF 11

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			
2.6	Core Laying	1. Dia over laid up core	MA	Measurement	One Sample of each size/ lot	One Sample of each size/ lot	Appd. Datasheet	Appd. Datasheet	Inspection Report	✓	P	V	-	
		2. Sequence of lay & direction	MA	Visual & Meas.	-do-	-do-	IS 7098-II & Mfr. Std.	IS 7098-II & Mfr. Std.	-do-	✓	P	V	-	
		3. Lay Length	MA	Measurement	-do-	-do-	-do-	-do-	-do-	✓	P	V	-	
2.7	InnerSheath Extrusion (as applicable)	1. Surface finish	MA	Visual	100%	-	-	Surface shall be smooth	Inspection Report		P	-	-	
		2. Thickness	CR	Measurement	One Sample of each size/ lot	-	Appd. Datasheet	Appd. Datasheet	-do-		P	-	-	
		3. Dia over inner sheath	MA	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
2.8	Armour(as applicable)	1. No.of wires/Strips	MA	Counting	At the start of process	-	Mfr. Std.	Mfr. Std.	Inspection Report		P	-	-	
		2. Lay length & Direction	MA	Visual & Meas.	-do-	-	-do-	-do-	-do-		P	-	-	
		3. Dia over armouring	MA	Measurement	-do-	-	Appd. Datasheet	Appd. Datasheet	-do-		P	-	-	
		4. Coverage	MA	Measurement	-do-	-	-do-	-do-	-do-		P	-	-	

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:		ABHISHEK	Checked by:		KUNAL GANDHI		
Reviewed by:	MANISH	MANISH SHUKLA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL		

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	PROJECT:		PO NO.:	
	ITEM: HT XLPE Cables	SYSTEM: CABLE	SECTION: II	SHEET 9 OF 11

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			
2.9	Outer Sheath Extrusion (No repair permitted)	1. Surface finish	MA	Visual	100%	-	-	Surface shall be smooth	Inspection Report/ Test report		P	-	-	
		2. Sheath Thickness	CR	Measurement	One Sample of each size/ lot	-	Appd. Datasheet	Appd. Datasheet	-do-		P	-	-	
		3. Dia over outer sheath	MA	-do-	-do-	-	-do-	-do-	-do-		P	-	-	
		4. Embossing/ Sequencial Marking	MA	Visual	100%	-	Approved data sheet	Approved data sheet	-do-		P	-	-	
3.0	Finished Cable (INTERNAL)	1. Routine Test (Refer Note-H)	CR	Electrical Tests & Measurement	100%	100%	#	#	-do-	✓	P	V	V	#: Refer Annexure-A to QP
4.0	Final Inspection (EXTERNAL)	1. Finish & Length (cable & drum)	MA	Visual	One drum in each Lot	One drum in each Lot	Appd. Datasheet	Free from Porosity, Bulging, Burnt particles, lumps, cuts & scratches	Inspection Report	✓	P	W	W	
		2. Dimension	MA	-do-	As per IS 7908-II	As per IS 7908-II	Appd. Datasheet	Appd. Datasheet	-do-	✓	P	W	W	

BHEL						BIDDER/ SUPPLIER	
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	Sign & Date	Name		Sign & Date	Name	Seal	
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Reviewed by:	MANISH	MANISH SHUKLA	Reviewed by:	RITESH KUMAR JAISWAL	R.K. JAISWAL		

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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
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	PROJECT:		PO NO.:	
	ITEM: HT XLPE Cables	SYSTEM: CABLE	SECTION: II	SHEET 10 OF 11

Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			
		3. Armouring - Coverage No. of Wires/Strips	MA	Visual & Meas.	As per IS 7908-II	As per IS 7908-II	Appd. Datasheet	Appd. Datasheet	-do-	✓	P	W	W	
		4. Marking & Colour Coding	MA	Visual	As per IS 7098-II	As per IS	As per IS 7098-II	Approved Data Sheet	-do-	✓	P	W	W	
		5. Acceptance Tests (Refer Note-H)	CR	Phy, Elect. Tests & FRLS Tests	-do-	-do-	#	-do-	-do-	✓	P	W	W	#: Refer Annexure-A to QP.
		6. Type Tests (Refer Note-H)	CR	Physical & Electrical Tests	#	#	-do-	-do-	-do-	✓	P	W	W	#: Refer Annexure-A to QP.
5.0	**Packing**	**1. Sealing Identification**	MA	Visual	100%	100%	As per IS 7098-II	As per IS 7098-II	-	✓	P	W	-	
		2. Cable drums	MA	Visual	100%	100%	Appd. Datasheet	Appd. Datasheet	-	✓	P	W	-	
NOTES:														

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:		ABHISHEK	Checked by:		KUNAL GANDHI		
Reviewed by:	MANISH	MANISH SHUKLA	Reviewed by:	RITESH KUMAR JAISWAL	R.K. JAISWAL		

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Sl. No.	COMPONENTS & OPERATIONS	CHARACTERSTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	

A). Joints in conductors & armour shall be as permitted by IS: 8130 & IS: 7098-I respectively.
B). No repair of core insulation permitted.
C). Cable ends shall be sealed.
D). Record of raw material, process & all stages shall be certified by vendors' QC and are liable to audit check by purchaser.
E). Fillers/dummy cores etc. shall be as per BHEL specification.
F). Wherever extent of check for stage is mentioned as 'sample' & not defined in QP, the same shall be as per vendors sampling plan agreed by purchaser.
G). Vendor shall furnish compliance certificate to the inspection agency confirming the packing as per IS/ BHEL specification.
H). For lists of routine tests, acceptance tests & type tests refer annexure to QAP.
I). 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.
J). 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.
K). BHEL reserves the right to perform repeat test, if required.
L). Photographs of cable to be despatched shall be sent to BHEL Purchase Group for review prior to issue of MDCC.
M). Project specific QP shall be developed based on customer requirement.
N). For export jobs, BHEL Technical Specification for Seaworthy Packing for Export Jobs is to be followed.
O). Packing shall be suitable for storage at site in tropical climate conditions.
P). Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred.

LEGENDS:

*Records, identified with "Tick"(√) shall be essentially included by supplier in QA documentation.

** **M**: Supplier/ Manufacturer/ Sub-Supplier, **C**: Main Supplier/ BHEL/ Third Party Inspection Agency, **N**: Customer

P: Perform, **W**: Witness, **V:** Verification, as appropriate

MA: Major, **MI**: Minor, **CR:** Critical, **D**: Documentation

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:		ABHISHEK	Checked by:		KUNAL GANDHI		
Reviewed by:	MANISH	MANISH SHUKLA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL		

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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) Sampling for Type test as per D-2.2 of Annexure-D of IS 7098-2.
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) Sampling for Acceptance tests as per D-2.2 of Annexure-D of IS 7098-2.
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.	Tensile test	For aluminium conductor only *(Not applicable for compacted circular or shaped conductor)*	T, A	IS 10810 Pt 2	
II.	Wrapping test	For aluminium conductor only *(Not applicable for compacted circular or shaped conductor)*	T, A	IS 10810 Pt 3	
III.	Resistance test	For Al	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	
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	

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
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, PVC inner sheath & For PVC *inner/outer sheath* only	T, A	IS 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for XLPE insulation & For PVC *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 PVC *inner/outer sheath* only	T	IS 10810 Pt 11	
IV.	Loss of mass in air oven test	For PVC *inner/outer sheath* only	T	IS 10810 Pt 10	
V.	Hot deformation test	For PVC *inner/outer sheath* only	T	IS 10810 Pt 15	
VI.	Heat shock test	For PVC *inner/outer sheath* only	T	IS 10810 Pt 14	
VII.	Shrinkage test	For XLPE insulation & For PVC *inner/outer sheath* only	T	IS 10810 Pt 12	
VIII.	Thermal stability test	For PVC *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	
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 Crosslinking		A	IS 7098-II	
5.0	Improved Fire performance (FR-LSH) Tests				
I.	Oxygen index test	*For 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 outer sheath only*	T, A	ASTMD 2843	
III.	Acid gas generation test	*For outer sheath only*	T, A	IS 10810 Pt 59 / IEC-754-1	
IV.	Temperature Index Test	*For outer sheath only*	T,A	IS 10810 Pt 64 / ASTMD 2863	
6.0	Flammability Tests				

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
I.	Flammability test for bunched cables	For complete cable	T,A	IEC-60332 (Part-3 of 23 CAT-B)	
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(Water immersion)	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 PVC sheathed cable*	*T*	*IS 10810 Pt 53*	
8.0	Anti-rodent and Termite Repulsion test	For PVC *outer sheath* only	T	--	