

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: HRN0000126 RFQ DATE : 10.07.2019	Due Date/Day: 31.07.2019 WED Time : 13:00 HRS Tender Box : Reception Area Opening Venue: NEW ENGG. BLDG
MMI:PU:RF:003			
(address for communication) :		(for all correspondence) Purchase Executive : NARENDRA KUMAR H R Phone : 26998250 Fax : E-mail: narendra.kr@bhel.in	

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
1	SA0653956820 CBL, FRLS PVC, XLPE,1C, 630SQMM, CU,ARMD * HSN/SAC : 9032 Test Certificate CABLE, SINGLE CORE, VOLTAGE: 1100V. SIZE: 630SQMM. CONDTR: ANNEALED TINNED COPPER. INSULATION : XLPE SHEATH INNER/OUTER: FRLS PVC. ARMOUR. SHEATH COLOR: BLACK, AS PER SPECIFICATION : PS4082067	6,000	M	6,000	11.09.2019

Total Number of Items - 1

- 1.
- 2.

TWO PART BID - SUBMIT TECHNICAL AND PRICE BID IN SEPARATE SEALED COVERS

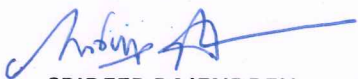
NOTES:

1. This RFQ is governed by:
 - a) INSTRUCTIONS TO BIDDERS/SELLERS and GENERAL CONDITIONS OF CONTRACT FOR PURCHASE available at <http://edn.bhel.com> (**RFQ-P0 Terms & Conditions**)
 - b) Any other specific Terms and Conditions mentioned.
 2. Bidders / Representatives who would like to be present during opening of offers are required to furnish authorization letter for the same.
- * The HSN/SAC no mentioned against the line items in the RFQ are indicative only.

For and On behalf of BHEL.

NARENDRA KUMAR H R
Control Equipment

1 OF 1

		 A4 - 10	PRE-QUALIFICATION CRITERIA (PQC) FOR 630 SQ.MM, 1C, XLPE, FRLS, ARMoured CU CABLE		Ref: PQC/408/MAITREE/001	
			GROUP: GENERATOR CONTROLS ENGINEERING		REV. NO. 00	
COPY RIGHT AND CONFIDENTIAL THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.			1. The supplier should be a manufacturer of LT XLPE FRLS power cables with in house testing capabilities for all routine, type and acceptance test as per BHEL-EDN Purchase Specification. (Except special tests like UV radiation, Hydrolytic stability test which can be conducted at Government Laboratory / Government approved independent Laboratory). 2. Bidder should have minimum Rs. 4 crores annual turnover for last three consecutive years, for which supporting documents like balance sheet, profit and loss account should be furnished to qualify. 3. The supplier should have manufactured and supplied a quantity of 3000 meters / month, XLPE insulated, armoured and FRLS PVC sheathed cable of minimum size 240 sq.mm with 3/3.5 core or 630 sq.mm with single core. 4. Minimum two (2) nos. of purchase orders for LT XLPE power cables shall be submitted along with the bid, which should not be more than five (5) years old from the date of application for registration or date of techno-commercial bid opening for establishing continuity in business. 5. The bidder has to submit a declaration stating that the bidder's firm is not blacklisted / put on hold by any Government undertaking (Central/State Govt. or PSU) <u>Notes:</u> a) Bidder shall submit documents to support the PQC clauses along with the bid. b) Consideration of offer shall be subject to customer's approval of bidders, if applicable. Vendor evaluation procedure as per BHEL-EDN standard practice will be followed. c) Bidder to submit all supporting documents in English. If documents submitted by bidder are in a language other than English, a self-attested English translated document should also be submitted. d) After satisfactory fulfillment of the criteria (Sl. No. 1 to 5 indicated above), offer shall be considered for further evaluation as per NIT and all other terms of the tender. In case bidder does not meet the requirements of Pre-Qualification Criteria or does not submit details mentioned in above clauses, offers will be summarily rejected and bidder's Technical offers/proposals will not be evaluated. e) Notwithstanding the anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.			
			APPROVED  R. RUKMANI			
		PREPARED  SRIDEEP RAJENDREN	CHECKED  K. PARTHASARTHY	ISSUED 408	DATE 04/07/2019	

		 A4-10	PURCHASE SPECIFICATION		PS/408/2067	
					REV. NO. 00	
					Page 1 of 24	
COPY RIGHT AND CONFIDENTIAL THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.		PURCHASE SPECIFICATION FOR XLPE INSULATED, ARMOURED AND FRLS PVC SHEATHED COPPER CABLE				
					APPROVED  R.RUKMANI	
			PREPARED  SRIDEEP RAJENDREN	ISSUED ENGG	DATE 15/07/2019	



A4 - 10

**PURCHASE SPECIFICATION FOR
XLPE INSULATED, ARMOURED AND FRLS PVC
SHEATHED COPPER CABLE**

PS/408/2067

REV. NO. 00

Page 2 of 24

COPY RIGHT AND CONFIDENTIAL
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

TABLE OF CONTENTS

Sl. No.	Title	Page No.
1	STANDARD TECHNICAL SPECIFICATION	3
2	ANNEXURE-I : TECHNICAL DATASHEET	6
3	ANNEXURE-II : GUARANTEED TECHNICAL PARTICULARS	9
4	ANNEXURE-III : COMPLIANCE CERTIFICATE	13
5	ANNEXURE-IV : STANDARD QUALITY PLAN	15

COPY RIGHT AND CONFIDENTIAL
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

A4 - 10

PURCHASE SPECIFICATION FOR
XLPE INSULATED, ARMoured AND FRLS PVC
SHEATHED COPPER CABLE

PS/408/2067

REV. NO. 00

Page 3 of 24

STANDARD TECHNICAL SPECIFICATION

1.0 TECHNICAL REQUIREMENTS

1.1 This specification covers the design, manufacture, inspection and testing at manufacturer's works, proper sea-worthy packing and delivery to BHEL-EDN of **XLPE INSULATED, ARMoured AND FRLS PVC SHEATHED COPPER CABLE** as mentioned in different sections of this specification.

1.2 Technical requirements for XLPE INSULATED, ARMoured AND FRLS PVC SHEATHED COPPER CABLE shall be as indicated in this specification.

1.3 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.

2.0 CODES & STANDARDS

2.1 The design, material, construction, manufacture, inspection, testing and performance of XLPE INSULATED, ARMoured AND FRLS PVC SHEATHED COPPER CABLE shall conform to the latest revision of relevant standards and codes of practices mentioned in Annexure-I.

2.2 Bidder shall sign (with bidder's stamp), the compliance certificate provided in Annexure-III, and submit along with the offer.

2.3 Successful bidder shall fill the Guaranteed Technical particulars in the format provided in Annexure-II and submit the same for BHEL/customer's approval after placement of order.

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



A4 - 10

**PURCHASE SPECIFICATION FOR
XLPE INSULATED, ARMOURED AND FRLS PVC
SHEATHED COPPER CABLE**

PS/408/2067

REV. NO. 00

Page 4 of 24

COPY RIGHT AND CONFIDENTIAL
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

3.0 QUALITY ASSURANCE REQUIREMENTS

- 3.1 Bidder shall confirm compliance with the BHEL Standard Quality Plan (EDN-1306-QAP-003) in Annexure-IV 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 QP. Charges for all these tests for all the equipment & components shall be deemed to be included in the bid price
- 3.4 Cost of cables consumed for testing shall be to bidder's account.

4.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

- 4.1 Following documents/drawings shall be submitted after placement of order for BHEL / customer's approval:

Sl. No.	Drawings/Document Description	Drawings / Document Number
1.	Technical Data Sheet - XLPE INSULATED, ARMOURED AND FRLS PVC SHEATHED COPPER CABLE	EDN-1306-TDS-001
2.	Cross-sectional Drawing - XLPE INSULATED, ARMOURED AND FRLS PVC SHEATHED COPPER CABLE	EDN-1306-CSD-002
3.	Quality Plan - XLPE INSULATED, ARMOURED AND FRLS PVC SHEATHED COPPER CABLE *	EDN-1306-QAP-003
4.	Packing Drum Drawing - XLPE INSULATED, ARMOURED AND FRLS PVC SHEATHED COPPER CABLE	EDN-1306-PDD-004

		बि एच ई एल BHEL A4 - 10 PURCHASE SPECIFICATION FOR XLPE INSULATED, ARMOURED AND FRLS PVC SHEATHED COPPER CABLE	PS/408/2067
			REV. NO. 00
			Page 5 of 24
COPY RIGHT AND CONFIDENTIAL THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.		Note: * Standard Quality Plan as enclosed in the technical specification (Annexure-IV) is to be appended with cover sheet bearing document number and description as stated above. The signed and stamped copy of the same shall be submitted to BHEL without making any changes in the contents of the document.	
		5.0 Packing Sea worthy packing shall be done. The cables shall be supplied in non-returnable wooden drums with drum length of 500m. The tolerance shall be +5%. The wood used shall be pine wood and shall be treated as per ISPM – 15 (fumigation) and accompanied by Phytosanitary/Fumigation certificate. To prevent moisture entry, free ends of the cable to be sealed with plastic caps.	

		 A4 - 10	PURCHASE SPECIFICATION FOR XLPE INSULATED, ARMoured AND FRLS PVC SHEATHED COPPER CABLE	PS/408/2067
				REV. NO. 00
				Page 6 of 24
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.		ANNEXURE-I TECHNICAL DATASHEET		



**PURCHASE SPECIFICATION FOR
XLPE INSULATED, ARMoured AND
FRLS PVC SHEATHED COPPER CABLE**

TECHNICAL DATASHEET

SPECIFICATION NO. PS/408/2067

ANNEXURE-I

REVISION 0

DATE: 15.07.2019

SHEET 7 OF 24

TECHNICAL DATASHEET

1.0	Type of Cable	Flame Retardant Low Smoke (FRLS)
2.0	Standard applicable in general (Latest amendment to be referred if any)	IEC 60502-1, IEC 60228, IEC 60287, IEC 60949, ASTM D:2843, ASTM D:2863, IEC-754-1, IEC:60332 (Part-1), IEC:60332-3-23, IEEE:383 & other relevant IEC
3.0	Voltage Grade	1100 V
4.0	Number of cores, cross sectional area of conductor	Single core, 630 SQ.MM
5.0	CONDUCTOR	
(a)	Material	Copper
	Grade and Class	Stranded, annealed tinned high conductivity, Class 5
(b)	Standard Applicable	IEC 60228
(c)	Shape	Circular as per IEC 60228
(d)	No. of strands and dia. of each strand nominal (mm)	2257/0.60
(e)	Diameter of wire in conductor maximum (mm)	0.61
(f)	Maximum resistance of conductor at 20 °C Ohms per kM	0.0292
(g)	Diameter of bunched conductor (max.) in mm	33
6.0	INSULATION	
(a)	Material	Cross-Linked Polyethylene(XLPE)
(b)	Standard Applicable	IEC-60502 (Part-1)
(c)	Continuous withstand temperature	90°C
(d)	Short-circuit withstand temperature	250°C
(e)	Method of application	By extrusion; sleeve extrusion not permitted.
(f)	Method of curing	Dry/ Steam/ Gas/ Sioplas
(g)	Nominal Thickness of insulation in mm	2.4
7.0	CORE COLOUR IDENTIFICATION	Not applicable
8.0	INNER SHEATH	
(a)	Material	PVC Type ST-2
(b)	Standard Applicable	IEC-60502 (Part-1)
(c)	Colour	Black
(d)	Whether FRLS	NO
(e)	Inner sheath applicable for single core cable	YES
(h)	Method of application	Extruded
(i)	Nominal thickness in mm	1.2
9.0	ARMOUR	
(a)	Applicable	YES
(b)	Standard Applicable	IEC-60502 (Part-1)
(c)	Material	Aluminium Round Wire grade to IEC-60502 (Part-1)



**PURCHASE SPECIFICATION FOR
XLPE INSULATED, ARMOURED AND
FRLS PVC SHEATHED COPPER CABLE**

TECHNICAL DATASHEET

SPECIFICATION NO. PS/408/2067

ANNEXURE-I

REVISION 0 DATE: 15.07.2019

SHEET 8 OF 24

(d)	Nominal diameter in mm	2.5
(e)	Minimum Coverage	90%
(f)	Gap between armour wires	Shall not exceed one armour wire space (No cross-over/ over-riding)
(g)	Breaking load of joint	95 % of normal armour
10.0	OUTERSHEATH	
(a)	Material	PVC Type ST2 as per IEC-60502 (Part-1)
(b)	Colour	Black
(c)	Whether FRLS	Yes
(d)	Method of application	Extruded
(e)	Thickness of outer sheath	As per clause 13.3 of IEC-60502 (Part-1)
(f)	Marking	Cable size (cross section area and no. of cores) and voltage grade @ 5m (by embossing) Word "XLPE" "FRLS" @ 5m (by embossing) Manufacturer's name and/ or trade name, and year of manufacture @ 5m (by embossing) 'BHEL-EDN' @5m (by embossing) Progressive sequential marking @ 1m (by embossing/ printing)
11.0	FRLS CHARACTERISTICS	
(a)	Oxygen index	Min 29 (As per Relevant IEC / ASTM D 2863)
(b)	Temperature index	Min. 250°C (As per Relevant IEC / ASTM D 2863)
(c)	Acid gas generation	Max. 20% by weight (As per IEC 60502-1/ IEC 60754-1)
(d)	Smoke density rating	Max. 60% (As per IEC 60502-1/ IEC 61034-2 / ASTM D 2843)
(e)	Flammability Test	
(i)	Flammability test for single cable	YES As per IEC-60332 Part-1
(ii)	Flammability test for bunched cable	YES As per IEC -60332 part-3 CAT-B
(iii)	Swedish Chimney test SEN-SS-424-1475-F3	YES, Class F3
(iv)	Grouped Vertical Cable under fire condition	YES As per IEEE 383
12.0	TOLERANCE ON OUTER DIAMETER	Up to 30mm; $\pm 1.5\text{mm}$ Above 30mm; + 5% or $\pm 2\text{mm}$, whichever is less.
13.0	MINIMUM BENDING RADIUS	
(a)	Single core cables	15 x O.D.
14.0	SAFE PULLING FORCE	
(a)	Copper conductor cable	50 N/ sq. mm.
15.0	CABLE DRUMS	
(a)	Type of Drum	Pine wood
(b)	Standard drum length	500m (+) 5%
16.0	SEA WORTHY PACKING	YES
17.0	ADDITIONAL REQUIREMENTS	The cables must be resistant to solar radiation, the effect of oil, seawater, bacterial action, insects and rodents.

		 A4 - 10	PURCHASE SPECIFICATION FOR XLPE INSULATED, ARMoured AND FRLS PVC SHEATHED COPPER CABLE	PS/408/2067
				REV. NO. 00
				Page 9 of 24
COPY RIGHT AND CONFIDENTIAL THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.		ANNEXURE-II <u>GUARANTEED TECHNICAL PARTICULARS</u>		

	PURCHASE SPECIFICATION FOR XLPE INSULATED, ARMoured AND FRLS PVC SHEATHED COPPER CABLE		SPECIFICATION NO. PS/408/2067	
			ANNEXURE-II	
			REVISION 0	DATE: 15.07.2019
	GUARANTEED TECHNICAL PARTICULARS		SHEET 10 OF 24	

GUARANTEED TECHNICAL PARTICULARS

S.No.		Unit	Description
1.0	General	-	
1.1	Name of manufacturer	-	
1.2	Place of Manufacture	-	
2.0	Standards Applicable		
2.1	IEC 60502 Part-I For general specification of XLPE Cables	-	YES
2.2	IEC: 60228 For conductor material	-	YES
2.3	IEC 60502 Part-I For material of inner sheath & outer sheath.	-	YES
2.4	IEC 60502 Part-I For armour of single core cables	-	YES
2.5	IEC : 60811 For method of tests	-	YES
2.6	Relevant IEC For cable drums	-	YES
2.7	ASTMD-2863 For oxygen index test	-	YES
2.8	ASTMD-2843 For smoke density test	-	YES
2.9	SS:424-14-75 & IEC-332-III-Cat-B & CAT-A, IEC-332-I & IEEE: 383 For flammability test	-	YES
2.10	IEC-754-1 For Acid gas generation	-	YES
2.11	Current rating of cables conforms to	-	
2.12	Short circuit rating conforms to	-	
2.13	Formula for calculating short circuit current for Different duration	-	
3.0	(a) Installation Conditions at site	deg. C	
	i) Ambient air temperature	deg. C	
	ii) Ground temperature	cm	
	iii) Depth of laying of cables buried in ground	deg. C cm/W	
	(b) Installation conditions for current rating specified at clause 6.3		

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	PURCHASE SPECIFICATION FOR XLPE INSULATED, ARMoured AND FRLS PVC SHEATHED COPPER CABLE	SPECIFICATION NO. PS/408/2067	
		ANNEXURE-II	
	GUARANTEED TECHNICAL PARTICULARS	REVISION 0	DATE: 15.07.2019
		SHEET 11 OF 24	

4.0	CHARACTERISTICS OF FRLS SHEATH		
	(a) Oxygen index		
	(b) Temperature index		
	(c) Acid gas generation		
	(d) Smoke density rating		
	(e) Flammability test: i) Single cable ii) Bunched cable iii) Swedish chimney test Shall be as per IEC 60332-1, IEC 60332-3 (CAT B) & IEEE 383. Swedish chimney test shall be as per SS: 424 1475 (Class F3).		
5.0	CABLE DRUMS		
	(a) Type & construction		
	(b) Standard drum length		
	(c) 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 Cl. 3.0		
	(a) In air	Amp	
	(b) In ground	Amp	
	(c) ducts	Amp	
6.4	Short circuit rating	kA,Sec	
6.5	(a) D.C. resistance of conductor at 20 deg C	ohm/km	
	(b) A.C. resistance of conductor at 90 deg. C	ohm/km	
	(c) Reactance of cable at Normal frequency	ohm/km	
	(d) Electrostatic capacitance of cable at normal frequency	mF/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	XLPE INSULATION		
	(a) Nominal thickness of insulation	mm	
	(b) Method of Curing	-	
6.8	PVC ST2 INNERSHEATH		
	(a) Material	-	
	(b) Thickness (min.)	mm	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	PURCHASE SPECIFICATION FOR XLPE INSULATED, ARMoured AND FRLS PVC SHEATHED COPPER CABLE		SPECIFICATION NO. PS/408/2067	
			ANNEXURE-II	
	GUARANTEED TECHNICAL PARTICULARS		REVISION 0	DATE: 15.07.2019
			SHEET 12 OF 24	

	(c) Method of application	-	
	(e) Colour		
6.9	ARMOUR		
	(a) Material		
	(b) Size/ dimensions		
	(c) Minimum no. of wires /formed wires		
	(d) Tolerance on formed wire dimension		
	(f) Maximum resistivity of Aluminium round wire		
6.10	PVC ST2 FRLS OUTERSHEATH		
	(a) Nominal thickness of outer sheath	mm	
6.11	DIAMETERS		
	(a) Diameter of insulated conductor	mm	
	(b) Cable diameter under armour	mm	
	(c) Cable diameter over armour	mm	
	(d) Overall diameter of cable	mm	
6.12	Tolerance on overall diameter	(±) mm	
6.13	Minimum bending radius	x O.D	
6.14	Safe Pulling Force	kG	
6.15	Weight of cable	kg./km	
	(a) Weight of conductor	MT/km	
	(b) Weight of XLPE insulation	MT/km	
	(c) Weight of PVC (Inner Sheath & Outer Sheath)	kg./km	
	(d) Weight of Armour (As applicable)	kg./km	
6.16	Dimension of drum	mm	
6.17	Shipping weight	kg	
6.18	Cable marking on outer sheath		

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

		 A4 - 10	PURCHASE SPECIFICATION FOR XLPE INSULATED, ARMoured AND FRLS PVC SHEATHED COPPER CABLE	PS/408/2067
				REV. NO. 00
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.				Page 13 of 24

ANNEXURE-III

COMPLIANCE CERTIFICATE

		 A4 - 10	PURCHASE SPECIFICATION FOR XLPE INSULATED, ARMOURED AND FRLS PVC SHEATHED COPPER CABLE	PS/408/2067
			<u>ANNEXURE-III</u>	REV. NO. 00
COPY RIGHT AND CONFIDENTIAL THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.		<u>COMPLIANCE CERTIFICATE</u> The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer. 1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same 2. There is no deviation with respect to specification other than those furnished in the 'schedule of deviations'. 3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer. 4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification. 5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in NIT shall not be considered (i.e., technical description & quantities as per specification shall prevail). ----- BIDDER'S STAMP & SIGNATURE		

		 A4 - 10	PURCHASE SPECIFICATION FOR XLPE INSULATED, ARMoured AND FRLS PVC SHEATHED COPPER CABLE	PS/408/2067
				REV. NO. 00
				Page 15 of 24
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.		ANNEXURE-IV <u>STANDARD QUALITY PLAN</u>		

STANDARD QUALITY PLAN		CUSTOMER :		SPECIFICATION NUMBER: PS/08/2067						
BIDDER/ VENDOR:		QUALITY PLAN NUMBER: EDN-1306-QAP-003, R0		SPECIFICATION TITLE: PURCHASE SPEC FOR XLPE INSULATED ARMORED AND FRLS PVC SHEATHED COPPER CABLE						
SHEET 16 OF 24		SYSTEM		ITEM : LT XLPE Insulated, Armoured & FRLS PVC sheathed Power Cables						
S.L. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
Instructions: 1. Cable manufacturer to maintain records to show co-relation of raw materials to finished cables i.e. raw material batch/ lot no. should be traceable to the final cable drum number or batch no. 2. Cable manufacturer to maintain all quality records identified as per all QP stages enumerated below whether it is identified for BHEL verification or witness or not.										
1.0	RAW MATERIALS & BOUGHT OUT ITEMS									
1.1	Aluminium / Copper Rods (Conductor/ Armour Wire)	GENERAL : 1. Physical properties 2. Elec.Properties SPECIFIC CHECKS : a) Make b) Grade c) Resistivity	MA MA MA MA MA	Physical Tests Electrical Tests Verify -do- Electrical Tests	Sample/ Batch Sample/ Batch 100% -do- Manufacturer std.	IEC 60502-1/IEC 60228 & Appd Datasheet -do- Manufacturer approved source Approved datasheet IEC 60502-1/IEC 60228 & Appd Datasheet	IEC 60502-1/IEC 60228 & Appd Datasheet -do- Manufacturer approved source Approved datasheet IEC 60502-1/IEC 60228 & Appd Datasheet	Inspection Report/ Test Cert -do- COC/ Test Cert -do- -do-	2/3 - 2/3 - 2/3 - 2/3 -	1/2 1/2 1 1 1
1.2	XLPE Compound for insulation	GENERAL : 1. Physical properties 2. Elec.Properties SPECIFIC CHECKS : a) Make b) Type/ Grade c) Shelf life/ Storage condition	MA MA MA MA	Physical Tests Electrical Tests Verify -do- -do-	Sample/ Batch Sample/ Batch 100% -do- -do-	IEC 60502-1 & Appd Datasheet -do- Manufacturer approved source Approved datasheet Compound Manufacturer std.	IEC 60502-1 & Appd Datasheet -do- Manufacturer approved source Approved datasheet Compound Manufacturer std.	Inspection Report/ Test Cert -do- COC/ Test Cert -do- -do-	2/3 - 2/3 - 2/3 - 2/3 -	1/2 1/2 1 1 1
BHEL										
PARTICULARS										
NAME										
SIGNATURE										
DATE										
BIDDER/VENDOR										
BIDDER'S/VENDOR'S COMPANY SEAL										

STANDARD QUALITY PLAN		CUSTOMER :		SPECIFICATION		SPECIFICATION				
BIDDER/ VENDOR:		SYSTEM		QUALITY PLAN		NUMBER:				
BIDDER/ VENDOR:		SYSTEM		NUMBER: EDN-1306-QAP-003, R0		TITLE:				
SHEET 17 OF 24		SYSTEM		ITEM : LT XLPE Insulated,Armoured & FRLS PVC sheathed Power Cables		TITLE:				
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.3	PVC Compound (for sheath)	GENERAL : 1. Physical properties 2. Elec.Properties 3. FRLS Properties (as applicable) SPECIFIC CHECKS : a) Make b) Type/ Grade c) Shelf life/ Storage condition	MA MA CR	Physical Tests Electrical Tests Chemical/ Environ.	Sample/ Batch Sample/ Batch Sample/ Batch	IEC 60502-1 & Appd Datasheet -do- -do-	IEC 60502-1 & Appd Datasheet -do- -do-	Inspection Report/ Test Cert. -do- -do-	2/3 2/3 2/3	1/2 1/2 1/2
1.4	Fillers (as applicable)	1. Make 2. Type/ Grade	MA MA	Verify -do- -do-	100% -do- -do-	Manufacturer approved source Approved datasheet Compound Manufacturer std.	Manufacturer approved source Approved datasheet Compound Manufacturer std.	COC/ Test Cert. -do- -do-	2/3 2/3 2/3	1 1 1
NOT APPLICABLE (Fillers material chosen shall be compatible with the temperature rating of the cable and shall have no deleterious effect on any other component of the cable)										
BHEL										
PARTICULARS			BIDDER/VENDOR							
NAME										
SIGNATURE										
DATE										
BIDDER/ VENDORS COMPANY SEAL										

STANDARD QUALITY PLAN		CUSTOMER :		QUALITY PLAN				SPECIFICATION		
BIDDER/ VENDOR:		SYSTEM		NUMBER: EDN-1306-QAP-003, R0				NUMBER: PS/408/2067		
SHEET 18 OF 24		CAT.		ITEM : LT XLPE Insulated,Armoured & FRLS PVC sheathed Power Cables				SPECIFICATION TITLE: INSULATED ARMoured AND FRLS PVC SHEATHED COPPER CABLE		
SL. NO.	COMPONENT/ OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	
1	2	3	4	5	6	7	8	9	10	
									W V	
1.5	Galvanised steel wire/strip for Armour (Not applicable)	GENERAL : 1. Make 2. Dimension 3. Phy and Elec. Properties 4. Galvanization Quality	MA MA MA MA	Verify Measurement Physical & Electrical Tests Galv. Tests	Manufacturer std. -do- Sample* -do-	Manufacturer approved source IEC 60502-1 & Appd Datasheet -do- IEC 60502-1 & Mfr. Std.	Manufacturer approved source IEC 60502-1 & Appd Datasheet -do- IEC 60502-1 & Mfr. Std.	Inspection Report/ Test Cert. -do- -do- -do-	2/3 - 2/3 - 2/3 - 2/3 -	1 2 2 2
1.6	Wooden Drum	1. Phy. & Constructional checks 2. Anti termite treatment	MA MA	Visual Chem.	Mfr's Plant Std. Mfr's Plant Std.	Relevant IEC Mfr's Plant Std.	Relevant IEC Mfr's Plant Std.	Inspection Report/ Test Cert. COC	2/3 - 2/3	1 1
1.7	Steel Drum #	1. Dimension 2. Surface finish	MA MA	Meas. Meas.	Mfr's Plant Std. -do-	Approved drawing of steel drum / BHEL specification Surface shall be smooth	Approved drawing of steel drum / BHEL specification Surface shall be smooth	Inspection Report/ Test Cert. -do-	2/3 - 2/3	1 1
										* Sample from each armour size/ Batch / Lot
										# (If Applicable)
BHEL										
PARTICULARS										
NAME										
SIGNATURE										
DATE										
BIDDER'S/VENDORS COMPANY SEAL										

STANDARD QUALITY PLAN		CUSTOMER :		SPECIFICATION NUMBER: PS/408/2067						
BIDDER/ VENDOR:		BIDDER/ VENDOR:		SPECIFICATION TITLE:						
SHEET 19 OF 24		ITEM : LT XLPE Insulated Armoured & FRLS PVC sheathed Power Cables		PURCHASE SPEC FOR XLPE INSULATED ARMORED AND FRLS PVC SHEATHED COPPER CABLE						
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	SYSTEM CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS
1	2	3	4	5	6	7	8	9	10	11
2.0	IN PROCESS									
2.1	Wire Drawing	1. Size 2. Surface finish 3. % of Elongation	MA MA MA	Dimensional Visual Mechanical	Plant Mfg. Std. -do- -do-	IEC 60228, IEC 60502-1 & Appd. Datasheet Surface shall be smooth IEC 60228, IEC 60502-1 & Appd. Datasheet	IEC 60228, IEC 60502-1 & Appd. Datasheet Surface shall be smooth IEC 60228, IEC 60502-1 & Appd. Datasheet	Inspection Report -do- -do-	2 - 2 - 2 -	1 - 1 - 1
2.2	Stranding of wires	1. No. of wires 2. Resistance 3. Sequence, lay length & Direction 4. Surface Finish 5. Dimension	MA CR MA MA MA	Counting Electrical Visual, Meas. Visual Measurement	Plant Mfg. Std. -do- One Sample of each size/ lot 100% One Sample of each size/ lot	IEC 60228, IEC 60502-1 & Appd. Datasheet Mfrs Std. / Appd. Datasheet Surface shall be smooth IEC 60228, IEC 60502-1 & Appd. Datasheet	IEC 60228, IEC 60502-1 & Appd. Datasheet -do- Mfrs Std. / Appd. Datasheet Surface shall be smooth IEC 60228, IEC 60502-1 & Appd. Datasheet	Inspection Report -do- -do- -do- -do-	2 - 2 - 2 -	- - - - -
2.3	Core Insulation (XLPE) (No repair permitted)	1. Surface finish 2. Eccentricity & Ovality # 3. Insulation Thickness 4. Dia over insulation 5. Tensile Strength & % Elongation 6. Spark Test or Water immersion test	MA CR CR MA MA CR	Visual Measurement Measurement Measurement Mechanical Electrical	100% One Sample of each size/ lot -do- -do- 100% 100%	Free from bulging, burnt particles, lumps, cuts & scratches IEC 60502-1 & Appd. Datasheet -do- -do- -do- Mnfr's Std	Free from bulging, burnt particles, lumps, cuts & scratches IEC 60502-1 & Appd. Datasheet -do- -do- -do- Mnfr's Std	Inspection Report -do- -do- -do- -do-	2 - 2 - 2 - 2 -	1 - - - - - 1 # To be checked at starting & finished end of extruded length.
BHEL		PARTICULARS		BIDDER/VENDOR						
		NAME								
		SIGNATURE								
		DATE								
						BIDDER'S/VENDORS COMPANY SEAL				

		STANDARD QUALITY PLAN		CUSTOMER :		SPECIFICATION PS/408/2067				
SHEET 20 OF 24		BIDDER/ VENDOR/ SYSTEM CAT.		QUALITY PLAN NUMBER: EDN-1306-QAP-003_R0		SPECIFICATION TITLE: INSULATED ARMORED AND FRLS PVC SHEATHED COPPER CABLE				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	4	5	6	7	8	9	10	11
			TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY REMARKS		
								P	W	V
1			3							
2.4	Core Laying	1. Dia over laid up core 2. Sequence of lay & direction 3. Lay Length	MA MA MA	Measurement Visual & Meas. Measurement	One Sample of each size/ lot -do- -do-	IEC 60502-1 & Appd. Datasheet IEC 60502-1 & Mfr. Std. -do-	IEC 60502-1 & Appd. Datasheet IEC 60502-1 & Mfr. Std. -do-	Inspection Report -do- -do-	2 2 2	- - -
2.5	InnerSheath Extrusion (as applicable)	1. Surface finish 2. Thickness 3. Dia over inner sheath	MA CR MA	Visual Measurement -do-	100% One Sample of each size/ lot -do-	Surface shall be smooth IEC 60502-1 & Appd. Datasheet -do-	Surface shall be smooth IEC 60502-1 & Appd. Datasheet -do-	Inspection Report -do- -do-	2 2 2	- - -
2.6	Armour (as applicable)	1. No. of wires/Strips 2. Lay length & Direction 3. Dia over armouring 4. Coverage	MA MA MA MA	Counting Visual & Meas. Measurement Measurement	At the start of the process -do- -do- -do-	IEC 60502-1 & Appd. Datasheet IEC 60502-1 & Mfr. Std. IEC 60502-1 & Appd. Datasheet -do-	IEC 60502-1 & Appd. Datasheet IEC 60502-1 & Mfr. Std. IEC 60502-1 & Appd. Datasheet -do-	Inspection Report -do- -do- -do-	2 2 2 2	- - - -
2.7	Outer Sheath Extrusion (No repair permitted)	1. Surface finish 2. Sheath Thickness 3. Dia over outer sheath 4. Embossing/ Sequential Marking	MA CR MA MA	Visual Measurement -do- Visual	100% One Sample of each size/ lot -do- 100%	Surface shall be smooth IEC 60502-1 & Appd. Datasheet -do- Approved data sheet	Surface shall be smooth IEC 60502-1 & Appd. Datasheet -do- Approved data sheet	Inspection Report -do- -do- -do-	2 2 2 2	- - - -
BHEL			PARTICULARS		BIDDER/VENDOR					
			NAME							
			SIGNATURE							
			DATE							
							BIDDER'S/VENDORS COMPANY SEAL			

STANDARD QUALITY PLAN		CUSTOMER :				QUALITY PLAN			SPECIFICATION	
SHEET 21 OF 24		BIDDER/ VENDOR:				NUMBER: EDN-1306-QAP-003, R0			NUMBER: PS408/2067	
COMPONENT/OPERATION		SYSTEM CAT.				ITEM: LT XLPE Insulated Armoured & FRLS PVC sheathed Power Cables			SPECIFICATION TITLE:	
SL. NO.	CHARACTERISTIC CHECK	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY		REMARKS	
1	2	3	4	5	6	7	8	9	10	11
3.0	Finished Cable (INTERNAL)	1. Routine Test (Refer Note-F)	CR	Electrical Tests & Measurement	100%	IEC 60502-1 & Appd. Datasheet	IEC 60502-1 & Appd. Datasheet	Test Report	2	1
4.0	Final Inspection (EXTERNAL)	1. Finish	MA	Visual	One drum in each Lot	IEC 60502-1 & Appd. Datasheet	Free from Porosity, Bulging, Burnt particles,lumps, cuts & scratches	Test Report	2	1
		2. Length	MA	Measurement	-do-	-do-	Approved Data Sheet	-do-	2	1
		3. Dimension	MA	-do-	As per IS	-do-	-do-	-do-	2	1
		4. Armouring - Coverage & No.of Wires/Strips	MA	Visual & Meas.	-do-	-do-	-do-	-do-	2	1
		5. Marking & Colour Coding	MA	Visual	As per IS	-do-	Approved Data Sheet	-do-	2	1
		6. Sample 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
5.0	Packing	Sealing Identification	MA	Visual	100%	As per relevant IEC	As per relevant IEC	-do-	2	1

NOTES:-

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

(B) NO REPAIR OF CORE INSULATION PERMITTED

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

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

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

(F) FOR LIST OF ROUTINE, TYPE & SAMPLE TESTS, REFER ANNEXURE TO QP ENCLOSED.

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

BHEL	PARTICULARS	BIDDER/ VENDOR
	NAME	
	SIGNATURE	
	DATE	
	BIDDER/SVENDORS COMPANY SEAL	

	PURCHASE SPECIFICATION FOR XLPE INSULATED, ARMoured AND FRLS PVC SHEATHED COPPER CABLE	SPECIFICATION NO. PS/408/2067	
		ANNEXURE-IV	
	ANNEXURE TO STANDARD QUALITY PLAN	REVISION 0	DATE: 15.07.2019
		SHEET 22 OF 24	

TYPE/ SAMPLE/ 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 one size of cable for every lot and type of cable (CU conductor)
 - b) Flammability Test to be conducted only on one sample/ lot.

B. Sample Test Conduction:

1. Tests for which "S" is indicated in the 'Test Conduction Required As' column below shall be conducted as Sample tests.
2. Sampling:
Sampling for sample tests shall be as per IEC 60502-1.
3. Flammability Test to be conducted only on one sample/ lot.

C. Routine Test Conduction:

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

<u>S. No.</u>	<u>TEST</u>	<u>APPLICABLE FOR</u>	<u>TEST CONDUCTION REQUIRED AS</u>	<u>REFERENCE STANDARD</u>
1.0	Tests for Conductor			
I.	Resistance test	For Cu	T, S, R	IEC 60502-1/ IEC-60228
II.	Conductor Examination	For Cu	S	IEC 60502-1
2.0	Tests for Armour Wires/Strips			
I.	Measurement of dimensions	Applicable for Aluminium wire	T,S	IEC 60502-1
II.	Tensile test	Applicable for Aluminium wire	T, S	Relevant IEC
III.	Resistivity test	Applicable for Aluminium wire	T, S	Relevant IEC
IV.	Wrapping Test	For Aluminium wires only	T	Relevant IEC
3.0	Physical Tests for XLPE Insulation & PVC sheath			
I.	Test for thickness	Applicable for XLPE insulation, PVC inner sheath & PVC outer sheath	T, S	IEC 60502-1/ IEC-60811-201/ IEC-60811-202

	PURCHASE SPECIFICATION FOR XLPE INSULATED, ARMoured AND FRLS PVC SHEATHED COPPER CABLE		SPECIFICATION NO. PS/408/2067	
			ANNEXURE-IV	
			REVISION 0	DATE: 15.07.2019
	ANNEXURE TO STANDARD QUALITY PLAN		SHEET 23 OF 24	

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD
II.	Tensile strength and elongation test at break	Applicable for XLPE insulation, PVC inner sheath & PVC outer sheath		
(a)	Before ageing		T, S	IEC 60502-1/ IEC-60811-401/ IEC-60811-501
(b)	After ageing		T, S	IEC 60502-1/ IEC-60811-401/ IEC-60811-501
III.	Ageing in air oven	Applicable for XLPE insulation, PVC inner sheath & PVC outer sheath	T	IEC 60502-1/ IEC-60811-401
IV.	Loss of mass in air oven test	For PVC inner sheath & PVC outer sheath	T	IEC 60502-1/ IEC-60811-409
V.	Hot deformation test	For PVC inner sheath & PVC outer sheath	T	IEC 60502-1/ IEC-60811-508
VI.	Behaviour at low temperature	For PVC inner sheath & PVC outer sheath	T	IEC 60502-1/ IEC-60811-504 IEC-60811-505 IEC-60811-506
VII.	Heat shock test	For PVC inner sheath & PVC outer sheath	T	IEC 60502-1/ IEC-60811-509
VIII.	Shrinkage test	For XLPE insulation & PVC outer sheath only	T	IEC 60502-1/ IEC-60811-502/ IEC-60811-503
IX.	Thermal stability test	For PVC outer sheath only	T	Relevant IEC
X.	Hot set test	For XLPE insulation only	T, S	IEC 60502-1
XI.	Water absorption (gravimetric) test	For XLPE insulation only	T	IEC 60502-1/ IEC 60811-1-3
4.0	Improved Fire performance (FRLS) Tests			
I.	Oxygen index test	For PVC outer sheath only	T, S	Relevant IEC / ASTM D 2863
II.	Smoke density test	For PVC outer sheath only	T	IEC 60502-1/ IEC 61034-2 / ASTM D 2843
III.	Acid gas generation test	For PVC outer sheath only	T, S	IEC 60502-1/ IEC 60754-1
IV.	Temperature Index Test	For PVC outer sheath only	T	Relevant IEC / ASTM D 2863
5.0	Flammability Tests			
I.	Flammability test for single cable	For complete cable	T, S	IEC:60332 Part-1
II.	Swedish chimney test	For complete cable	S	SEN SS 424 1475 (Class F3)
III.	Flammability test for bunched cable	For complete cable	S	IEC -60332 part-3 CAT-B

	PURCHASE SPECIFICATION FOR XLPE INSULATED, ARMoured AND FRLS PVC SHEATHED COPPER CABLE		SPECIFICATION NO. PS/408/2067	
			ANNEXURE-IV	
	ANNEXURE TO STANDARD QUALITY PLAN		REVISION 0	DATE: 15.07.2019
			SHEET 24 OF 24	

<u>S. No.</u>	<u>TEST</u>	<u>APPLICABLE FOR</u>	<u>TEST CONDUCTION REQUIRED AS</u>	<u>REFERENCE STANDARD</u>
IV	Grouped Vertical Cables under fire condition		S	IEEE 383
6.0	Electrical Tests			
I.	AC voltage Test for 5 min	For complete cable	T, S, R	IEC 60502-1
II.	Insulation Resistance Test At ambient temperature	For complete cable	T, S	IEC 60502-1
III.	Insulation Resistance Test At maximum conductor temperature in normal operation	For complete cable	T, S	IEC 60502-1
IV.	High voltage test for 4 hour	For complete cable	T, S	IEC 60502-1

Note: Moreover, type test certificate shall be provided, proving that the cable type has successfully passed type tests as required by the applicable standards within five years from the award of PO. Otherwise these tests have to be repeated.