

810050/2022/PS-PEM-EL
BOQ OF LT XLPE POWER CABLES FOR 2x660MW KHURJA TG T

1.1KV, Al conductor, XLPE insulated, Galvanised Steel Round/Formed Wire Armoured for multi-core cables (Non Magnetic Hard drawn Aluminium Round/Formed Wire Armoured conforming to H4 grade for single core cables), INNER SHEATH: Extruded PVC compound conforming to type ST2 of IS: 5831 for multicore cable & for single core cables, OVERALL SHEATH: Extruded FRLS PVC compound conforming to type ST2 of IS: 5831 & black in colour.

A)

S. No.	ITEM CODE	CABLE SIZE [No. of cores - Cross section Area (sq.mm)]	UNIT	QUANTITY (Metre)	DRUM LENGTH
1	507-28220-A	1C - 300- AL ARMoured	MTR	6000	1000
2	507-28007-A	1C - 630- AL ARMoured	MTR	25500	750
3	507-28041-A	3C - 150- AL ARMoured	MTR	2250	750
4	507-28045-A	3C - 240- AL ARMoured	MTR	5250	750
5	507-28085-A	3.5C - 240-AL ARMoured	MTR	2250	750
6	507-28027-A	2C - 95- AL ARMoured	MTR	7500	750
7	507-28037-A	3.5C - 95- AL ARMoured	MTR	2250	750
8	507-28051-A	3C - 95- AL ARMoured	MTR	1500	750
9	507-28035-A	3.5C - 50- AL ARMoured	MTR	22500	750
10	507-28049-A	3C - 50- AL ARMoured	MTR	3000	750
11	507-28011-A	2C - 10- AL ARMoured	MTR	2250	750
12	507-28039-A	3C - 10- AL ARMoured	MTR	13500	750
13	507-28053-A	4C - 10- AL ARMoured	MTR	2250	750
14	507-28017-A	2C - 25- AL ARMoured	MTR	1500	750
15	507-28047-A	3C - 25- AL ARMoured	MTR	16500	750
16	507-28031-A	3.5C - 25- AL ARMoured	MTR	8250	750
17	507-28124-A	2C-16 AL ARMoured	MTR	2250	750
18	507-28157-A	1CX120 - AL ARMoured	MTR	5250	750
19	507-28154-A	1CX35 - AL ARMoured	MTR	27000	750

1.1KV, Cu conductor, XLPE insulated, Galvanised Steel Round Armoured for multi-core cables, INNER SHEATH: Extruded PVC compound conforming to type ST2 of IS: 5831 for multicore cable. OVERALL SHEATH: Extruded FRLS PVC compound conforming to type ST2 of IS: 5831 & black in colour.

B)

S. No.	ITEM CODE	CABLE SIZE [No. of cores - Cross section Area (sq.mm)]	UNIT	QUANTITY (Metre)	DRUM LENGTH
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1	507-28015-A	2C - 2.5- CU ARMoured	MTR	81000	750
2	507-28043-A	3C - 2.5- CU ARMoured	MTR	109500	750

NOTES:

- 1 The standard drum length shall be 750/1000 meters as indicated above. Tolerance on individual drum length shall be $\pm 5\%$.
- 2 Overall tolerance on total dispatched quantity of each size shall be (-) 2% and (+) 0% except where the total ordered quantity is one single drum length of 750/1000m, in which case it shall be -5% to 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 (except where the total ordered quantity is one single drum length of 750/1000m). The overall tolerance limits stipulated above shall continue to apply (in case short lengths are accepted).
- 4 In case of the quantities cleared by BHEL for manufacturing are manufactured and offered for inspection by successful bidder in more than one batch, BHEL reserves the right to witness type testing on all batches without any price implications.
- 5 Unit price of cables quoted by bidder shall be inclusive of type test charges. No separate charges shall be payable for type tests.
- 6 For any clarification please refer technical specification no.PE-TS-475-507-E002.(Rev-0)

VOLUME-II

**2X660MW KHURJA TG AND ASSOCIATED
PACKAGES**

TECHNICAL SPECIFICATION

FOR

LT XLPE POWER CABLE

SPECIFICATION NO: *PE-TS-475-507-E002*

REVISION: 00



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



TECHNICAL SPECIFICATION FOR
LT XLPE POWER CABLES

2X660MW KHURJA TG AND
ASSOCIATED PACKAGES

SPECIFICATION NO. PE-TS-475-507-E002

VOLUME II

SECTION

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



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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 is no deviation with respect to specification other than those furnished in the 'schedule of deviations'.
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ-Cum-Price schedule' of the specification shall not be considered (i.e., technical description & quantities as per specification shall prevail).

BIDDER'S STAMP & SIGNATURE

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SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS



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1.0 SCOPE OF ENQUIRY

- 1.1 Design, Manufacture, Inspection and Testing at Manufacturer's works, proper packing and delivery to site of LT XLPE Power Cable conforming to this specification.
- 1.2 It is not the intent to specify herein all the details of design & manufacture of material. However, the material shall conform in all respects to high standard of design, engineering & workmanship and shall be capable of performing in continuous commercial operation at site condition.
- 1.3 General technical requirements of the LT XLPE Power cables are indicated in Section-II & Datasheet-A. Project specific technical/ quality requirements / changes are listed in Section-I.
- 1.4 The stipulation of Data Sheet-A shall prevail in case of any conflict between the stipulations of Data Sheet-A & Section-II.
- 1.5 The documents shall be in English Language and MKS system of units.

2.0 BILL OF QUANTITIES

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


3.0 SPECIFIC TECHNICAL REQUIREMENTS

S.No.	Reference Clause No. of Section- II	Specific Requirement/ Change
1.	3.1	BHEL Standard Quality Plan (PE-QP-999-507-E002) shall be read as "QP. NO. 0000-999-QOE-S-041, REV- 01". Additionally, The QP. NO. 0000-999-QOE-S-041 REV-01 shall be read in conjunction with Annexure B (Quality Assurance & Inspection). However, Type testing on cables shall be conducted as per attached BHEL QP (PE-QP-999-507-E002, R02) along with Annexure-A to QP

4.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED


- 4.1 After placement of order, documents shall be submitted for BHEL & customer's approval as specified in NIT.
- 4.2 Drawings/documents shall be submitted through Document Management System (DMS).

Note: NTPC Standard Quality Plan as enclosed in the technical specification is for reference and same shall be finalized during detailed engineering in consultation with NTPC without any price implication to BHEL. The finalized QP during detailed engineering 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.


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DATA SHEET-A

1.0	Type of Cable	Flame Retardant Low Smoke halogen (FR-LSH)
2.0	Standard applicable in general(Latest amendment to be referred if any)	IS:7098 (Part-1), IS:8130, IS:5831, IS:10810, IS:3975, ASTM:2843, ASTM:2863, IEC-754-1, IEC:60332 (Part-1), IEC:60332-3-23, IEEE:60383
3.0	Voltage Grade	1.1kV
4.0	Number of cores, cross sectional area of conductors and quantities	As per BOQ-Cum-Price Schedule
5.0	FAULT CHARACTERISTICS	
	Fault Level	50kA RMS
	Fault Clearing Time	1.0 sec
6.0	CONDUCTOR	
(a)	Material	Aluminium (With Tensile strength more than 100N/sq.mm.)
	Grade and Class	Stranded, Compacted, H2, Class 2
(b)	Standard Applicable	IS: 8130
(c)	Shape	Aluminium
		Circular/ Shaped – as per IS
(d)	Min. number and diameter of strands for main and neutral conductor [Neutral conductor cross section w.r.t main conductor shall be as per Table-2 of IS: 7098 (Part-1)]	As per Table-2 of IS: 8130
7.0	INSULATION	
(a)	Material	Cross-Linked Polyethylene(XLPE)
(b)	Standard Applicable	IS: 7098 (Part-1)
(c)	Continuous withstand temperature	90°C
(d)	Short-circuit withstand temperature	250°C
(e)	Method of application	By extrusion; sleeve extrusion not permitted.
(f)	Nominal Thickness of insulation	As per IS: 7098 (Part-1)
8.0	CORE IDENTIFICATION	<p>Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted:</p> <p>1 core - Red, Black, Yellow or Blue</p> <p>2 core - Red & Black</p> <p>3 core - Red, Yellow & Blue</p> <p>4 core - Red, Yellow, Blue and Black</p> <p>For reduced neutral conductors, the core shall be black</p>
9.0	INNER SHEATH	
(a)	Material	Extruded PVC Type ST-2
(b)	Standard Applicable	IS: 7098 (Part-1) & IS: 5831
(c)	Colour	Black
(d)	Whether FR-LSH	No


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(e)	Inner sheath applicable for single core cable	Yes
(f)	Fillers	Acceptable
(g)	Material of fillers (if permitted)	Same as inner sheath (Material of filler to be compatible with that of inner sheath)
(h)	Method of application	
(1)	Multi-core cables:	
(i)	With fillers	Pressure/ Vacuum extruded
(ii)	Without fillers	Pressure extruded
(2)	Single-core cables:	NOT APPLICABLE
10.0	ARMOUR	
(a)	Applicable	Yes (As specified in BOQ cum price schedule)
(b)	Material:	Wherever armouring is applicable
(i)	Single core cables	Non Magnetic Hard drawn Aluminium Round/Formed Wire H4 grade to IS: 8130 (as specified in BOQ cum price schedule)
(ii)	Multi-core cables	Galvanised Steel Round Wire OR Galvanised Steel Formed Wire/Strip, conforming to (i) Type 'b' as per Table-6 of IS 7098 Part-I and (ii) IS 3975 (as specified in BOQ cum price schedule)
(iii)	Standard Applicable	Dimension as per IS: 7098 (Part-1) Table-6 and tolerance on dimension as per IS:3975
(c)	Minimum Coverage	90%
(d)	Gap between armour wires	Shall not exceed one armour wire space (No cross-over/ over-riding)
(e)	Breaking load of joint	95 % of normal armour
(f)	Paint on joint	Zinc rich paint shall be applied on armour joint surface of G.S. wire / formed wire
11.0	OUTERSHEATH	
(a)	Material	PVC Type ST2 as per IS: 5831
(b)	Colour	Black
(c)	Whether FR-LSH	Yes
(d)	Method of application	Extruded
(e)	Thickness of outer sheath	As per Table-8 of IS: 7098 (Part-1)
(f)	Marking	<p>Cable size (cross section area and no. of cores), voltage grade and Reference IS @ 5m (by embossing)</p> <p>Word "XLPE", "FR-LSH" @ 5m (by embossing)</p> <p>Manufacturer's name and/ or trade name, and year of manufacture @ 5m (by embossing)</p> <p>'BHEL' and 'CUSTOMER' name @ 5m (by embossing)</p> <p>Progressive sequential marking of length of the cable in metres @ 1m (by embossing/ printing)</p> <p>The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.</p>
12.0	FR-LS CHARACTERISTICS	
(a)	Oxygen index	Min 29 (As per IS 7098-I /ASTMD 2863)
(b)	Temperature index	Min. 250°C(As per IS 7098-I /ASTMD 2863)

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(c)	Acid gas generation	Max. 20% by weight (As per IS 7098-I /IEC-60754-1)
(d)	Smoke density rating	Max. 60% (As per IS 7098-I /ASTM D 2843)
(e)	Flammability Test	
(i)	Flammability test for single cable	YES As per IEC-60332 Part-1
(ii)	Flammability test for bunched cables	YES As per IEC-60332 Part-3-23, CAT-B
(iii)	Flammability test as per IEEE: 60383	YES
(iv)	As per Swedish Chimney test SEN-SS-424-1475-F3	YES
(f)	Special Tests	
I.	Hydrolytic Stability Test	No/ Refer Cl. 3.4 of Sec-II
II.	Ultraviolet Radiation Test	No/ Refer Cl. 3.4 of Sec-II
13.0	Anti-rodent and Termite repulsion Test	YES
14.0	Anti-Fungal Test	No
15.0	TOLERANCE ON OUTER DIAMETER	$\pm 2\text{mm}$
16.0	MINIMUM BENDING RADIUS	
(a)	Single core cables	15 x O.D.
(b)	Multi core cables	12 x O.D.
17.0	SAFE PULLING FORCE	
(a)	Aluminium conductor cable	30 N/ sq. mm.
(b)	Copper conductor cable (if applicable)	50 N/ sq. mm
18.0	CABLE DRUMS	
(a)	Type of Drum	Wooden as per IS 10418
(b)	Standard drum length	750m (\pm) 5% / 1000m (\pm) 5%. (as specified in BOQ-Cum-Priced Schedule)
(c)	Painting	Entire surface to be painted
(d)	Outermost Layer	To be covered with waterproof polyethylene
(e)	Construction details	<i>Clause no 4.2 of Section-II of this technical specification</i>
(f)	Particular details on Drum	Clause no 4.3 of Section-II of this technical specification. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.
(g)	Cable packing	Please refer Clause no 4.2 of Section-II of this technical specification. 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. (Refer typical drawing of cable drum packing, attached in section -II)
19.0	Sea Worthy packing	No

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DATASHEET C

GUARANTEED TECHNICAL PARTICULARS
(TO BE SUBMITTED BY SUCCESSFUL BIDDER)

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

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

NAME OF VENDOR

NAME	SIGNATURE	DATE

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

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

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SECTION-II

STANDARD TECHNICAL REQUIREMENTS



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1.0 CODES AND STANDARDS

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

2.0 TECHNICAL REQUIREMENTS

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

3.0 QUALITY ASSURANCE, TESTING & INSPECTION

- 3.1 Bidder shall confirm compliance with the BHEL Standard Quality Plan (PE-QP-999-507-E002, Rev-02) as attached with the specification without any deviations. At contract stage (project specific), the successful bidder shall submit the same QP for BHEL/ ultimate customer's approval. In case bidder has reference QP agreed with ultimate customer, same can be submitted for specific project after award of contract for BHEL/ultimate customer's approval. There shall be no commercial implication to BHEL on account of minor changes in QP during contract stage.
- 3.2 All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan.
- 3.3 Type testing, routine / acceptance testing and special testing requirements shall be as per Annexure –A to QAP. Charges for all these tests for all the equipments & components shall be deemed to be included in the bid price (except UV Radiation & Hydraulic Stability test).
- 3.4 The charges of UV Radiation test & Hydrolytic Stability test (if applicable) shall be reimbursed extra at actual against original money receipt of Govt. Lab. (CPRI/ ERDA etc).
- 3.5 Cost of cables consumed for testing shall be to bidder's account.

4.0 PACKING

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



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



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

Sl. No		Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
						M	C/N				D	M	C	N	
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 cable drum. 2) Cable manufacturer to maintain all quality control records identified as per all QP stages enumerated below whether it is identified for NTPC verification or witness or not.															
A Raw material/ Brought out Items															
1.01	Aluminum	1.Make	MA	Verify	100%	--		MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	QCR		V	--	--	
		2. Resistivity	MA	Elect	As per Cable Mnfr Std.	--		IS5082	IS5082	--do--		P	--	--	
1.02	PVC / XLPE/compound for insulation	1. Make	MA	Verify	--do--	100%		MANUFACTURER APPROVED SOURCES	MANUFACTURER APPROVED SOURCES	--do--		V	V	--	
		2. Type/ Grade	MA	Verify	100%	100%		NTPC ADS	NTPC ADS	--do--		V	V	V	
		3. All acceptance test as per manufacturer norms including thermal stability test for PVC insulation	MA	Verify	As per manufacturer norms	As per manufacturer norms		NTPC ADS	NTPC ADS	--do--		V	V	V	Refer note 1
1.03	PVC Compound for Inner sheath	1. Make	MA	Verify	--do--	--do--		MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	--do--		V	V	V	
		2. Type/ Grade	MA	Verify	--do--	--do--		NTPC ADS	NTPC ADS	--do--		V	V	V	
1.04	Steel wire / Formed Wire (As applicable)	1. Make	MA	Verify	--do--	--do--		MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	--do--		V	V	V	
		2. Dimension	MA	Meas	1 sample from each size / lot	--		NTPC APPROVED DATA SHEET & IS 3975	NTPC APPROVED DATA SHEET & IS 3975	--do--		P	--	--	
		3. All acceptance tests as per IS 3975	MA	Verify	As per IS 3975	--		IS 3975	IS 3975	Supplier TC		V	V	--	
1.05	PVC compound for Sheath	1. Make	MA	Verify	As per manufacturer norms	100%		MANUFACTURER APPROVED sources	MANUFACTURER APPROVED sources	QCR		V	V	--	
		2. Type / Grade	MA	Verify	100%	100%		NTPC ADS	NTPC ADS	QCR		V	V	V	

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FORMAT NO:QS-01-QAI-P-10/F3-R1

		Item: 1.1 KV Power (XLPE & PVC) Insulated ERLS cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)			QP. NO. 0000-999- QOE- S-041 REV-01 DATE : Page 2 of 9		REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR					
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
		3. All acceptance test as per manufacturer norms	MA	Verify	As per manufacturer norms	As per manufacturer norms	NTPC ADS	NTPC ADS	QCR		V	V	V	Refer note 1
		4. Thermal Stability	MA	Chem	One sample / Batch	--	NTPC ADS	NTPC ADS	QCR		P	--	--	
		5. Oxygen Index	MA	Chem	--do--	--	NTPC ADS/ IS 10810 Part 58	NTPC ADS/ IS 10810 Part 58	--do--		P	--	--	
		6. Acid Gas Emission	MA	Chem	One sample / Batch	--	NTPC ADS / IEC60754	NTPC ADS / IEC60754	QCR		P	--	--	
1.06	Wooden Drum	1. Dimension	MI	Meas	Manuf. Std.	--	IS 10418	IS10418	--do--		P	--	--	
		2. Anti termite treatment	MI	Chem	Cable manuf. std	--	CABLE MANUF. STD.	CABLE MANUF. STD.	COC		V	V	V	COC from drum manuf.
1.07	Steel Drum	1. Dimension	MI	Meas	--do--	--	--do--	--do--	QCR		P	--	--	
		2. Surface finish	MI	Meas	--do--	--	--do--	--do--	--do--		P	--	--	
B Process & Stage Inspection														
2.01	Wire Drawing	1.Surface finish	MA	Visual	One sample/Settin g of each size	--	SHOULD BE SMOOTH & FREE FROM SCRATCHES	SHOULD BE SMOOTH & FREE FROM SCRATCHES	QCR		P	--	--	
		2. Wire Diameter	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		3. Tensile test	CR	Mech	--do--	--do--	--do--	--do--	--do--		P	V	V	Refer Sl. No.3.03(iii)
		4. Wrapping test	CR	Mech	--do--	--do--	--do--	--do--	--do--		P	V	V	--do--
2.02	Bunching / stranding	1. No. of wires	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		2.Dia of wire	MA	Meas	--do--	--	--do--	--do--	--do--		P	--	--	
		3. Dimension of Conductor	MA	Meas	--do--	--	--do--	--do--	--do--		P	--	--	
		4.Direction of lay	MA	Visual	--do--	--	--do--	--do--	--do--		P	--	--	
		5.Records of strand breakage / welding during conductor stranding	MA	Verify	--do--	--	IS 8130	IS8130	--do--		P	--	--	
		6.Surface finish	MA	Visual	--do--	-	--do--	--do--	--do--		P	--	--	
		7. DC Resistance	CR	Meas	--do--	-	IS8130/NTPC ADS	IS8130/ NTPC ADS	--do--		P	--	--	
2.03	Insulation extrusion	1. Surface finish	MA	Visual	One sample/Settin g of each size	-	NTPC spec	SHOULD BE SMOOTH. NO POROSITY IS PERMITTED.	QCR		P	--	--	XLPE/ PVC compound shall be preferably loaded in to extruder by suction method.

Page 2 of 9

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
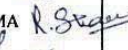
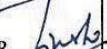
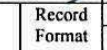


FORMAT NO:QS-01-QA1-P-10/F3-R1

<div>एनटीपीसी NTPC</div>		Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)			QP. NO. 0000-999- QOE- S-041 REV-01 DATE : Page 3 of 9		REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR		APPROVED BY K K OJHA			
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
1		2.Colour of cores	MA	Visual	One sample/Settng of each size	-	NTPC ADS	NTPC ADS	QCR		P	--	--	
		3.Thickness	CR	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		4.Spark Test	CR	Elect	100%	100%	CABLE MANUF. STD.	No FAILURE	--do --		P	V	V	1.Spark test failure record is to be verified. 2.Core repairing not permitted
		5. Hot Set	CR	Mech	One sample/Settng of each size	--	IS 7098- Part I	IS 7098- Part I	--do--		P	--	--	Sample is to be taken from both top & bottom end
2.04	Laying up	1. Core sequence	MA	Visual	--do--	--	IS 1554 (Part I) & IS 7098- Part I	IS 1554 (Part I) & IS 7098- Part I	--do--		P	--	--	
		2. Direction of lay	MA	Visual	--do--	--	--do--	--do--	--do--		P	--	--	
		3. Dia over laid up core	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
2.05	Inner Sheath	1.Colour	MA	Visual	-do--	-	--do--	--do--	--do--		P	--	--	
		2. Surface Finish	MA	Visual	100%	-	NTPC SPECIFICATION	FISH EYE, BLOW HOLE NOT PERMITTED	--do--		P	--	-	
		3.Thickness	MA	Meas	One sample/Settng of each size	-	NTPC ADS	NTPC ADS	--do--		P	--	--	
		4.Dia over inner sheath	MI	Meas	--do--	-	--do--	--do--	--do--		P	--	--	
2.06	Armouring (As Applicable)	1.Dimension	MA	Meas	--do--	-	--do--	--do--	--do--		P	--	--	
		2.No. of wires / strip	MA	Meas.	--do--	-	--do--	--do--	--do--		P	--	--	
		3. Direction of lay	MA	Visual	--do--	--	IS 1554 (Part I) & IS 7098- Part I	IS 1554 (Part I) & IS 7098- Part I	QCR		P	--	--	

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FORMAT NO:QS-01-QA1-P-10/F3-R1

		Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART I, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)			QP. NO. 0000-999- QOE- S-041 REV-01 DATE : Page 4 of 9		REVIEWED BY AMAN PANDEY  RAJESH SHARMA  S K LAI  DINESH KUMAR 		APPROVED BY  K.K. OJHA 			
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
		4.Coverage & Quality of armouring	MA	Meas.	100%	--	Min. area of coverage of armouring shall be 90%. The gap between amour wires / formed wires shall not exceed one amour wire/ formed wire space & there shall be no cross over/ over riding of amour wire / formed wire. Zn rich paint shall be applied on amour joint surface of G.S. Wire /formed wire. The breaking load of amour wire joint shall not be less than 95% of that amour wire / formed wire. (As per NTPC specification)		QCR		P	--	--	
		5 Dia over armouring	MA	Meas.	One sample/Settin g of each size	--	NTPC ADS		--do--		P	--	--	--
2.07	Outer Sheath	1. Surface finish	MA	Visual	100%	--	Pimple, Fish Eye, Burnt particles, Blow Hole not permitted. Repairing on outer sheath not permitted. (As per NTPC specification)		--do--		P	--	--	PVC FRLS compound shall be preferably loaded in to extruder by suction method.
		2.Colour of sheath	MA	Visual	One sample/Settin g of each size	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		3. Dia over outer sheath	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	--	
		4.Thickness of outer sheath	CR	Meas	--do--	-	--do--	--do--	--do--		P	--	--	
		5. Embossing quality	MA	Visual	100%	-	Drum No.,IS1554-I & IS7098-1,Cable size, Voltage grade & Words "FRLS" at every 5 meter is to be embossed. Embossing shall be automatic, in line & marking shall be legible & indelible. (As per NTPC specification)		--do--		P	--	--	Drum No. on Cable may be embossed/printed
		6. Sequential marking	MA	Visual	Full length	--	Sequential marking of length of cable in meter at every one meter is to be embossed / printed. Embossing / printing shall be progressive, automatic, in line & marking shall be legible & indelible. (A s per NTPC specification) In addition, Drum No. is also to be embossed/printed on full cable length		--do--		P	--	--	
C	Finished Cables													
3.01	Type test reports clearance from NTPC	All type tests as per NTPC specification	CR	Doc.	100%	100%	NTPC SPECIFICATION / NTPC ADS / IS 1554 (PartI) & IS 7098- Part I	NTPC SPECIFICATION / NTPC ADS / IS 1554 (PartI) & IS	--do--	✓	P	V	V	

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FORMAT NO:QS-01-QAI-P-10/F3-R1


Engineering		Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART I, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)		QP. NO. 0000-999- QOE- S-041 REV-01 DATE : Page 5 of 9		7098- Part I REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR		APPROVED BY K K OJHA				
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
3.02	Routine Tests	1.High Voltage test at room temperature	CR	Elect	100%	100%	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	Test certificate	✓	P	W	V	Refer note 2
		2.Conductor Resistance	CR	Elect	100%	100%	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	Test certificate	✓	P	W	V	Refer note 2
3.03	Acceptance Tests													
3.03 (i)	Construction of finished Cable	1. OD of Cable	MA	Meas.	Each type & size of cables as per sampling plan of IS 1554 (Part I) & IS 7098- Part I		NTPC ADS	NTPC ADS	--do--	✓	P	W	W	
		2. Laying of core	CR	Visual	--do--		NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	NTPC ADS / IS 1554 (Part I) & IS 7098- Part I	--do--	✓	P	W	W	
		3. Core Identification	CR	Visual	--do--		--do--	--do--	--do--	✓	P	W	W	
		4. Colour of outer sheath	MA	Visual	Each type & size of cables as per sampling plan of IS 1554 (Part I) & IS 7098- Part I		NTPC ADS	NTPC ADS	--do--	✓	P	W	W	
		5. Inner sheath thickness	CR	Meas	- do -		--do--	--do--	--do--	✓	P	W	W	
		6. Inner sheath colour	MA	Visual	- do -		- do -	- do -	--do--	✓	P	W	W	
3.03 (ii)	Armour wires/ Formed wires (if applicable)	1.Dimensions	CR	Meas	--do--		NTPC ADS /IS1554(PartI)/IS3975	NTPC ADS /IS1554(PartI) /IS3975	--do--	✓	P	W	W	
		2. No. of wires/ formed wire	CR	Mech	-- do --		--do--	--do--	--do--	✓	P	W	W	
		3. Tensile test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	V	V	
		4. Elongation test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	V	V	
		5.Torsion test (for round wires only)	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 (Part I) & IS 7098- Part I		--do--	--do--	--do--	✓	P	V	V	
		6. Wrapping test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	V	V	
		7. Resistance test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	V	V	

Page 5 of 9

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FORMAT NO:QS-01-QA1-P-10/F3-R1

		Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-1 AND NTPC TECHNICAL SPECIFICATION)			QP. NO. 0000-999- QOE- S-041 REV-01 DATE : Page 6 of 9		REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR		APPROVED BY K K OJHA Approved			
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
		8.Mass of Zinc coating	CR	Meas	--do--		--do--	--do--	--do--	✓	P	V	V	
		9. Uniformity of Zinc Coating	CR	Chem.	Each type & size of cables as per sampling plan of IS 1554 (Part I) & IS 7098-Part I		NTPC ADS /IS1554(PartI)/IS3975	NTPC ADS /IS1554(PartI) /IS3975	Test certificate	✓	P	V	V	
		10.Adhesion test	CR	Mech	--do--		--do--	--do--	--do--	✓	P	V	V	
		11.Freedom from defects	CR	Visual	--do--		--do--	--do--	--do--	✓	P	V	V	
3.03 (iii)	Conductor	1.Resistance Test	CR	Elect	--do--		--do--	--do--	--do--	✓	P	W	W	
		2.Tensile test (For aluminum conductor only)	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 (Part I)/7098(Part-1)		NTPC ADS/ IS 8130	NTPC ADS/ IS 8130	--do--	✓	P	W	W	Test report of manufacturer to be reviewed as per SI. No. 2.01 for Tensile test & wrapping test (for Aluminum) in case this test is not applicable for cable under inspection as per IS 8130 cl. 6.2
		3.Wrapping test (For aluminum conductor only)	CR	Mech	--do--		--do--	--do--	--do--	✓	P	P	W	--do--
3.03 (iv)	PVC / XLPE Insulation & PVC Sheath	1.Thickness of insulation & sheath	CR	Meas.	--do--		NTPC ADS/ IS 1554(PartI) & IS 7098-Part I	NTPC ADS/ IS 1554(PartI) & IS 7098-Part I	--do--	✓	P	W	W	

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FORMAT NO:QS-01-QAI-P-10/F3-R1

Sl. No		Component & Operations	Characteristics	Class	Type of check	Quantum of check M C/N	Reference Document	Acceptance Norms	Record Format	Agency				Remarks	
1		2	3	4	5	6	7	8	9	10	D*	M	C	N	11
			2.Tensile strength & elongation at break of insulation & outer sheath	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 (Part 1)/IS7098(Part-1)	NTPC ADS/ IS 1554(PartI) & IS 7098 Part I	NTPC ADS/ IS 1554(PartI) & IS 7098 Part I	Test Certificate	✓	P	W	W		
			3.Tensile strength & elongation of PVC at break of insulation & outer sheath (Ageing Test)	CR	Mech	One sample per batch of offered lot irrespective of sizes	--do--	--do--	--do--	✓	P	V	V	MTR for Ageing Test of the offered lot shall be verified	
			3a. Tensile strength & elongation of XLPE at break of insulation (Ageing Test)	CR	Mech	--do--	NTPC ADS/ IS 7098 Part I	NTPC ADS/ IS 7098 Part I	--do--	✓	P	V	V	MTR for Ageing Test of the offered lot shall be verified	
			4. Insulation resistance (Volume resistivity method)	CR	Elect	Each type & size of cables as per sampling plan of IS 1554 (Part I) & IS 7098- Part I	--do--	NTPC ADS/ IS 1554(PartI) & IS 7098 Part I	--do--	✓	P	W	W		
			5.High voltage test at room temperature	CR	Elect	Each type & size of cables as per sampling plan of IS 1554 (Part I) & IS 7098- Part I	--do--	--do--	--do--	✓	P	W	W		
			6.Thermal stability on PVC Insulation and outer sheath	CR	Chem	One sample of each offered lot of all offered sizes	--do--	--do--	--do--	✓	P	W	W		
			7. Hot Set Test (for XLPE Insulation only)	CR	Elect	Each type & size of cables as per sampling plan of IS 1554 (Part I) & IS 7098- Part I	NTPC ADS/ IS 1554(PartI) & IS 7098 Part I	--do--	--do--	✓	P	W	W		
			8.Oxygen index Test on outer sheath	CR	Chem	One sample of each offered lot of all offered sizes	NTPC ADS / IS10810 Part 58	NTPC A.D.S / IS10810 Part 58	Test certificate	✓	P	W	W	Refer Note 3	

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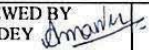
FORMAT NO-QS.01.04.10/01.01

		Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables	STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)				QP. NO. 0000-999- QOE- S-041 REV-01 DATE : Page 8 of 9		REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR		APPROVED BY K K OJHA 			
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
		9.Smoke density rating test on outer sheath	CR	Chem	--do--		NTPC ADS & ASTMD2843	NTPC ADS	--do--	✓	P	W	W	Refer Note 3 Refer Note 3
		10.Acid gas generation test on outer sheath	CR	Chem	--do--		NTPC ADS & IEC 60754-1	NTPC ADS	Test Certificate	✓	P	W	W	
		11.Flammability test on completed cable	CR	Chem	Refer Note 4	Refer Note 4	NTPC ADS & IEC 60332 Part-3 (Category-B)	NTPC ADS	--do--	✓	P	W	W	
		12.Surface finish & length measurement.	CR	Visual & Meas	100% (COC from Manufacturer to be submitted for surface finish as per specification's requirement)	one length of each offered lot of 50 drums of all sizes	(1) IS1554-1 & IS7098-1, Cable size, Voltage grade & Words "FRLS" at every 5 meter is to be embossed. Embossing shall be automatic, in line & marking shall be legible & indelible. (2) Sequential marking of length of cable in meter at every one meter is to be embossed / printed. Embossing / printing shall be progressive, automatic, in line & marking shall be legible & indelible		--do--	✓	P	W	W	Pimple, Fish Eye, Burnt particles, Blow Hole etc. not permitted. Repairing on outer sheath not permitted.
		13. Sequence of cores armour coverage, gap between two consecutive armour/ formed wire	CR	Visual & Meas	One length of each size	One length of each size	Min. area of coverage of armouring shall be 90%. The gap between armour wires / formed wires shall not exceed one armour wire/ formed wire space & there shall be no cross over/ over riding of armour wire / formed wire. Zn rich paint shall be applied on armour joint surface of G.S. Wire /formed wire		--do--	✓	P	W	W	
4	Packing	1. Sealing	MA	Visual	100%	100%	(1)IS1554(Part-I) & IS 7098-Part I (2) The surface of the drum and the outer most cable layer shall be covered with water proof cover. (3) Both the ends of cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by "U" nails.		QCR	✓	P	--	--	
4.01	Identification	NTPC Sealing	MA	Visual	100%	100%	Sealing shall be visible		QCR	✓	P	V	V	

LEGEND:- *RECORDS, IDENTIFIED WITH "TICK" UNDER COLUMN "D" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.



-M:MANUFACTURER/SUPPLIER, C:MAIN SUPPLIER, N:NTPC, P:PERFORM W:WITNESS,V:VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W"



FORMAT NO:QS-01-QAI-P-10/F3-R1


		Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)		QP. NO. 0000-999- QOE- S-041 REV-01 DATE : Page 9 of 9		REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR		APPROVED BY  K K OJHA				
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency				Remarks
1	2	3	4	5	M	C/N	7	8	9	D*	M	C	N	11
Notes:														
1)		If the compound manufacturer is carrying out Ageing test, test report of compound manufacturer is to be reviewed. If the compound manufacturer is not carrying out ageing test, then cable manufacturer is to carry out ageing test & test report is to be reviewed (quantum of ageing test sample shall be one sample /batch)												
2)		2(a) In case of manufacturers / supplier who have supplied cables in the past through Corporate Centre:- Routine Test of manufacturer internal test report are to be verified by NTPC at the time of final inspection. 2(b) In case of manufacturers / supplier WHO HAVE NOT SUPPLIED cables in the past through Corporate Centre:- Routine Test are to be witnessed by Main Contractor on 100% basis. This is in addition to manufacturer internal test report to be verified by NTPC at the time of final inspection. Same is to be verified by NTPC												
3)		1. For Smoke Density rating test: if the test result without conditioning is within (-)10% of the maximum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection. 2. For Acid Gas Generation test: if the test result without conditioning is within (-)10% of the maximum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection. 3. For Oxygen Index test: if the test result without conditioning is within (+)7% of the minimum specified value, then, retesting is to be carried out with conditioning of samples as per standard and the test results after conditioning shall be final for acceptance/rejection. 4. In case the test results without conditioning do not meet the maximum/minimum specified value, the manufacturer may exercise the option of retesting the samples after conditioning as per standard.												
4)		For PVC insulated LT power cable :- For cables with OD less than equal to 30 mm, any size of cable may be clubbed together. For cables where OD is more than 30 mm, clubbing to be done for cables having similar ODs. For XLPE insulated LT Power cable: Clubbing to be done for cables having similar ODs.												
LEGEND:		NTPC ADS: NTPC approved data sheet, QCR: quality control records of cable manufacturer, CABLE MANUF STD- cable manufacturer's internal plant standard, MI: minor, MA: major, CR: critical, COC- certificate of conformance												

ANNEXURE-B

CLAUSE NO.		QUALITY ASSURANCE															
LT Power Cables																	
Attributes / Characteristics	Item / Components / Sub System Assembly	Make, Type & T.C as per relevant standard	Dimension/surface finish	Mechanical properties	Chemical Composition	Spark Test(as applicable)	Electrical properties	Hot Set Test/ Eccentricity & Ovality	Lay length & Sequence	Armour coverage, cross over, looseness, gap between two wires	Sequential marking/ Batch marking/ surface finish/ cable length	T.S & elongation before & after ageing on outer sheath & insulation	Thermal stability	Anti termite coating on wooden	Constructional requirements feature as per NTPC specification	Routine & Acceptance Tests as per relevant standard & NTPC specification	FRLS Tests
	Aluminum (IS-8130) Y YYY Y																
	XLPE Compound (IS-7098) Y Y YY Y																
	PVC insulation Compound (IS: 5831) Y Y Y Y Y																
	FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1)	Y Y	Y Y	Y													
	Extrusion & curing /Manufacturing of Core (PVC / XLPE)	Y Y Y	Y														
	Core Laying Y																
	Armour wire/strip Y YY																
	Inner sheath Y Y																
	Armouring Y Y																
	Outer Sheathing Y Y																
	Power Cable (Finished) (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1, IEC 60332 part III cat B)	Y Y Y	Y Y	Y Y	Y Y												
	Wooden drum(IS-10418) /Steel Drum Y YY																
Notes: 1. This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents. 2. Make of all major Bought out items will be subject to NTPC approval.																	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES				TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. : THDC/RKSH/CC-9915-371				SUB-SECTION-E-16 LT POWER CABLE				PAGE 1 OF 4					

CLAUSE NO.	 QUALITY ASSURANCE 
ROUTINE TESTS Following routine tests shall be carried out on each drum of finished cables for all types (PVC / XLPE insulated) & sizes.	
1)	Conductor Resistance test
2)	High voltage test
ACCEPTANCE TESTS Following Acceptance tests shall be carried out on each size of each type (PVC / XLPE insulated) of cables, in the offered lot.	
A) For Conductor (as per sampling plan mentioned in IS: 1554 / 7098)	
1)	Annealing test (Copper)
2)	Tensile Test (Aluminum)
3)	Wrapping Test (Aluminum)
4)	Resistance test
B) For Armour Wires / Formed Wires (If applicable) (as per sampling plan mentioned in IS: 1554 / 7098)	
1.	Measurement of Dimensions
2.	Tensile Tests
3.	Elongation Test
4.	Torsion Test For Round wires only
5.	Wrapping Test
6.	Resistance Test
7.	Mass of Zinc coating test For G S wires / Formed wires only
8.	Uniformity of Zinc coating For G S wires / Formed wires only
9.	Adhesion test For G S wires / Formed wires only
10.	Freedom from surface defects
C) For PVC / XLPE insulation & PVC Sheath (as per sampling plan mentioned in IS: 1554 / 7098)	
1)	Test for thickness
2)	Tensile strength & Elongation before ageing (for tests after ageing see “D”)
3)	Hot set test (For XLPE insulation)
D) Ageing test:	
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. : THDC/RKSH/CC-9915-371
SUB-SECTION-E-16 LT POWER CABLE	PAGE 2 OF 4

CLAUSE NO.		QUALITY ASSURANCE						
				insulated, unarmoured XLPE insulated) will be bunched together, as per calculations in line with the IEC. All sizes of PVC & XLPE insulated, armoured & unarmoured cables shall be covered. For one particular type, cables with OD less than or equal to 30 mm shall be clubbed together in touching formation while cables with OD greater than 30 mm shall be clubbed together leaving a gap equal to OD of cable having least diameter. Cable OD shall be taken as nominal overall diameter as per NTPC approved datasheet.				
H) Following tests shall be carried on one length of each size of each type (PVC / XLPE insulated) of offered lot:								
1)				Constructional / dimensional check, surface finish, length measurement, sequence of cores, armour coverage, Gap between two consecutive armour wires / formed wires, Sequential marking, drum / Batch (outer sheath extrusion batch)number marking on sheath				
2)				Measurement of Eccentricity & Ovality				
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES			TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO. : THDC/RKSH/CC-9915-371			SUB-SECTION-E-16 LT POWER CABLE		PAGE 4 OF 4

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN				SPEC. NO. PE-TS-475-507-E002		DATE:	
			CUSTOMER : NTPC				QP NO.: PE-QP-999-507-E002, REV 02.			
			PROJECT: 2X660MW KHURJA TG & ASSOCIATED PEQ				PO NO.:			
			ITEM: LT XLPE POWER CABLE		SYSTEM: CABLE		SECTION: II		SHEET 10 OF 12	


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

4.0	Final Inspection (EXTERNAL)													
		6. Type Tests (Refer Note-H)	CR	Physical & Electrical Tests	Sample #	Sample #	#	#	TEST REPORT	✓	P	W	W	# REFER ANNEXURE-A TO QP

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	<i>Manish</i> 18-03-2020	VIKAS KUMAR SINGH	Checked by:	<i>Kunal Gandhi</i> 19/3/20	KUNAL GANDHI
Reviewed by:	<i>Manish</i> 18/03/20	MANISH SHUKLA	Reviewed by:	<i>Ritesh Kumar</i> 19/3/20	RITESH KUMAR JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN				SPEC. NO.: TS-475-507-E002		DATE: 37	
			CUSTOMER : NTPC				QP NO.: PE-QP-999-507-E002, REV 02.		810	
			PROJECT: 2X660MW KHURJA TG & ASSOCIATED PKG				PO NO.:			
			ITEM: LT XLPE POWER CABLE		SYSTEM: CABLE		SECTION: II		SHEET 12 OF 12	
SI. No.	COMPONENTS & OPERATIONS	CHARACTERISTICS	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

*RECORDS, IDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,

** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, C: CUSTOMER,

P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE

MA: MAJOR, MI: MINOR, CR: CRITICAL


D: DOCUMENTATION

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	<i>[Signature]</i> 18.03.2020	VIKAS KUMAR SINGH	Checked by:	<i>[Signature]</i> 19/3/20	KUNAL GANDHI
Reviewed by:	<i>[Signature]</i> 18/03/20	MANISH SHUKLA	Reviewed by:	<i>[Signature]</i> 19/3/20	RITESH KUMAR JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

810050/2022/PS-PEM-EL

	ANNEXURE-A TO QP	CUSTOMER: NTPC	PROJECT TITLE 2X660MW KHURJA TG	SPECIFICATION NUMBER: PE-TS-475-507-E002 R0
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E002, R02	SPECIFICATION TITLE:
	SHEET 1 OF 3	SYSTEM: CABLE	ITEM: LT XLPE POWER CABLE	DOC. NO.

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS

A. Type Test Conduction:

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

B. Acceptance Test Conduction:

- Tests for which "A" is indicated in the 'Test Conduction Required As' column below shall be conducted as Acceptance tests.
- Sampling:
Sampling for acceptance tests shall be as per Appendix-B (Clause 15.2.2) of IS: 7098 Part-I.
- Flammability Test to be conducted only on one sample/ lot.

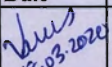
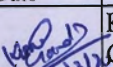
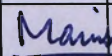
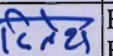
C. Routine Test Conduction:

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

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

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


S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
1.0	Tests for Conductor				
I.	Annealing test	For copper conductor only	T, A	IS 10810 Pt 1	<u>Internal in process Test Report to be furnished for acceptance test</u>
II.	Tensile test	For aluminium conductor only (Not applicable for compacted circular or shaped conductor)	T, A	IS 10810 Pt 2	
III.	Wrapping test	For aluminium conductor only (Not applicable for compacted circular or shaped conductor)	T, A	IS 10810 Pt 3	
IV.	Resistance test	For Al/Cu	T, A, R	IS 10810 Pt 5	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	 18.03.2022	VIKAS KUMAR SINGH	Checked by:	 18/3/22	KUNAL GANDHI
Reviewed by:	 18.03.22	MANISH SHUKLA	Reviewed by:	 18.03.22	RITESH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

810050/2022/PS-PEM-EL

	ANNEXURE-A TO QP	CUSTOMER: NTPC	PROJECT TITLE: 2X660MW KHUEJA TG	SPECIFICATION NUMBER: PE-TS-475-507-E002 R0
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E002, R02	SPECIFICATION TITLE:
	SHEET 2 OF 3	SYSTEM: CABLE	ITEM: LT XLPE POWER CABLE	DOC. NO.

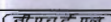
S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
2.0	Tests for Armour Wires/Strips				
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	T,A	IS 10810 Pt 36	
II.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	T, A	IS 10810 Pt 37	
III.	Elongation at break test	Applicable for GS wire/Strip only	T, A	IS 10810 Pt 37	
IV.	Torsion test	For GS round wire only	T, A	IS 10810 Pt 38	
V.	Winding / Adhesion Test	For GS strip only	T, A	IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Aluminium wire & GS wire	T, A	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 41	
IX.	Wrapping Test	Applicable for Aluminium wire & GS wire	A	IS 10810 Pt 3	
3.0	Physical Tests for XLPE Insulation & PVC sheath				
I.	Test for thickness	Applicable for XLPE insulation, PVC inner sheath & PVC outer sheath	T, A	IS 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for XLPE insulation & PVC outer sheath			
(a)	Before ageing		T, A	IS 10810 Pt 7	
(b)	After ageing		T, A	IS 10810 Pt 7	
III.	Ageing in air oven	Applicable for XLPE insulation & PVC outer sheath	T	IS 10810 Pt 11	
IV.	Loss of mass in air oven test	For PVC outer sheath only	T	IS 10810 Pt 10	
V.	Hot deformation test	For PVC outer sheath only	T	IS 10810 Pt 15	
VI.	Heat shock test	For PVC outer sheath only	T	IS 10810 Pt 14	
VII.	Shrinkage test	For XLPE insulation & PVC outer sheath only	T	IS 10810 Pt 12	
VIII.	Thermal stability test	For PVC outer sheath only	T	IS 10810 Pt 60	
IX.	Hot set test	For XLPE insulation only	T, A	IS 10810 Pt 30	
X.	Water absorption (gravimetric) test	For XLPE insulation only	T	IS 10810 Pt 33	
4.0	Improved Fire performance (FR-LSH) Tests				

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	<i>[Signature]</i>	VIKAS KUMAR SINGH	Checked by:	<i>[Signature]</i>	KUNAL GANDHI
Reviewed by:	<i>[Signature]</i>	MANISH SHUKLA	Reviewed by:	<i>[Signature]</i>	RITESH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

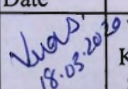
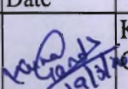
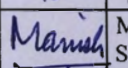
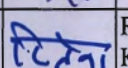
810050/2022/PS-PEM-EL

	ANNEXURE-A TO QP	CUSTOMER: NTPC	PROJECT TITLE 2X660MW KHURJA TG	SPECIFICATION NUMBER: PE-TS-475-507-E002	R0
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E002, R02	SPECIFICATION TITLE:	
	SHEET 3 OF 3	SYSTEM: CABLE	ITEM: LT XLPE POWER CABLE	DOC. NO.	

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
I.	Oxygen index test	For PVC outer sheath only	T, A	IS 10810 Pt 58 / ASTM D 2863/ NES 715-I	<u>Applicable for Inner Sheath also, if the same is indicated in Datasheet-A</u>
II.	Smoke density test	For PVC outer sheath only	T	IS 10810 Pt 63 / ASTM D 2843	
III.	Acid gas generation test	For PVC outer sheath only	T, A	IS 10810 Pt 59 / IEC-754-1	
IV.	Temperature Index Test	For PVC outer sheath only	T	IS 10810 Pt 64 / ASTM D 2863	
5.0	Flammability Tests				
I.	Flammability test for bunched cables	For complete cable	T	IS 10810 Pt 62/ IEC-60332 (Part-3-23-Cat-B)	<u>Test & Category applicable as indicated in Datasheet-A</u>
II.	Flammability test for single cable	For complete cable	T,A	IS: 10810 Pt 61 / IEC:60332 Part-1	
III.	Swedish chimney test	For complete cable	A	SEN SS 424 1475 (Class F3)	
IV.	Flammability test	For complete cable	A	IEEE: 60383	
6.0	Electrical Tests				
I.	High Voltage Test	For complete cable	T, A, R	IS 10810 Pt 45	
II.	Insulation Resistance Test (Volume resistivity method)	For complete cable	T, A	IS 10810 Pt 43	
7.0	Anti-rodent and Termite Repulsion test	For PVC outer sheath only	A	Refer Note	<u>Test applicable if indicated in Datasheet-A</u>
8.0	Anti-Fungal Test	For PVC outer sheath only	A	--	
9.0	Special Tests				
I.	Hydrolytic Stability Test	For complete cable	**	ASTM D 3137:81	<u>Test applicable if indicated in Datasheet-A</u>
II.	Ultraviolet Radiation Test	For complete cable	**	BS EN ISO 4892-2	

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

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


BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		VIKAS KUMAR SINGH	Checked by:		KUNAL GANDHI
Reviewed by:		MANISH SHUKLA	Reviewed by:		RITESH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			



810050/2022/PS-PEM-EL

	PRE-QUALIFICATION REQUIREMENTS OF LT XLPE POWER CABLE FOR 2X660MW KHURJA TG & ASSOCIATED PACKAGES	PE-PQ-475-507-E002
		REVISION NO. 0 DATE 27/04/2022
		SHEET NO. 1 OF 1

ITEMS : LT XLPE POWER CABLE	
SCOPE : Supply : YES; Erection & Commissioning : NO;	
1.0	Vendor should be a manufacturer of LT power cables.
2.0	Availability of test reports of tests on LT 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 100 km of LT power cables per month.
4.0	Manufactured and supplied at least one (1) km of FRLS cables.
5.0	Manufactured and supplied LT 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 and supplied at least 300 km of LT Power cables in one or more orders and at least 60 km in one single order.
7.0	Minimum two (2) nos. purchase orders for LT XLPE power cable shall be submitted which should not be more than five (5) years old from the date of techno- commercial bid opening for establishing continuity in business.

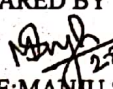
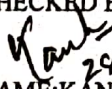
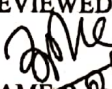
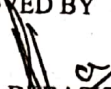
NOTES:

1. Consideration of bidder's offer is subject to NTPC approval.

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.

PREPARED BY  NAME: MANU SINGH DESIGNATION: DY MANAGER	CHECKED BY  NAME: KANHAIYA KUMAR DESIGNATION: SR.MGR	REVIEWED BY  NAME: OMKAR KUMAR DESIGNATION: DGM	APPROVED BY  NAME: DEBASIS SARATH DESIGNATION: DH-ELECT (AGM)
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