

Recd. No. 1264240/2023-PS-PEM-PGIII
1365635/2023-PS-PEM-PGIII

ANNEXURE 1 - 3X800 MW PATRATU TPS - DELIVERY SCHEDULE - LT XLPE POWER CABLE

Sl. No.	Package Name	DEPTT	BHEL Drawing No	Drawing Title	Primary/Secondary	BHEL Inputs	Drg Sch for Vendors	Standard Delivery Terms for Supply Portion
1	LT XLPE POWER CABLE	ELECT	PE-V0-XXX-507-E113	CROSS SECTION DRGS. - LT XLPE POWER CABLES	Primary		R-0 within 7 days from PO & subsequent revisions within 5 days of comments received from BHEL.	Delivery completion for PO Quantity shall be "180" days from PO date. Supplier to complete the package engineering in time and get the applicable engineering Drgs. /docs approved from BHEL/End Customer before start of manufacturing and supply. BHEL shall furnish comments / approval on each submission / re-submission of drawing/documents within 18 days from receipt of same.
			PE-V0-XXX-507-E913	QUALITY PLAN - LT XLPE POWER CABLES				
			PE-V0-XXX-507-E111	TECHNICAL DATA SHEET - LT XLPE POWER CABLES				
			PE-V0-XXX-507-E114	TYPE TEST CERTIFICATES - LT XLPE POWER CABLES	Primary			Subsequent Lots, if any (released within validity of contract under Qty. var. clause): Supply within "120" days from the date of Quantity clearance by BHEL.

Notes :-

- The end period specified is for completion of the deliveries. Deliveries to start progressively so as to meet the completion schedule.
- The delivery conditions specified are for contractual LD purposes, however BHEL may ask for early deliveries without any compensation thereof.
- Drawings /documents submission/re-submission schedule shall be as indicated in NIT which shall be used for progress monitoring purpose and required course correction, if any. Wherever schedule of drawings/documents submission / re-submission is stipulated in the Technical Specifications, same shall be superseded by delivery specified in NIT.

4. Delivery Extension: Extension of contractual delivery time

Delivery time mentioned in the NIT includes Engineering completion time (time for drawing/document submission/resubmission by the vendor and review/approval of the same by the BHEL\End customer), manufacturing, inspection, Packing and dispatch time. Due diligence is to be exhibited by the vendor to ensure timely completion of engineering and supply.

During the execution of the contract, time loss occurred owing to the reason attributable to BHEL besides force majeure shall be considered for delivery time extension to the vendor as given below:-

- Delay in providing comments/ approval on Primary drawing/documents beyond 18 days or as specified in drawing/ documents submission/re-submission schedule enclosed with NIT for each iteration.
- Time Loss in approval of the drawing/document as a result of increase in the iteration not attributable to the vendor as certified by BHEL. Time extension equivalent to the resubmission time specified in the NIT and consequential increase in the approval time shall be applicable.
- Delay in providing engineering input/material by BHEL.
- Delay in deputing inspector for inspection and delay in release of MDCC in line with GCC/ GEM ATC terms.
- Any HOLD put by BHEL for whatever reasons.

Note: No delay analysis will be applicable if supply is completed within delivery schedule as specified in Purchase order.

5. Validity of contract:

5.a) Validity of the contract for main supply including subsequent lots:

Contract shall be valid for 730 days from the PO date. However, delay at vendor's end (if any) shall be added to the validity period and contract validity shall get extended by the delay period at vendor's end.

For example: Delivery period: A (in days)

Delay at vendor's end: B (in days)

Contract validity: 730+B (in days)

Note: B is the Vendor delay days beyond contractual delivery period "A" / extended delivery period owing to time taken by BHEL at point no. 3 above.

5.b) Subsequent lots including quantity variation released within contractual validity period, to be supplied by vendor/supplier at PO rates, terms and condition.

5.c) Execution of the contract beyond contract validity period or PO delivery date whichever is later shall be decided on mutual consent basis.

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BOQ CUM PRICE SCHEDULE OF LT XLPE POWER CABLE

(A.0) 1.1KV, Al conductor, XLPE insulated. Unarmoured. INNER SHEATH: Extruded PVC compound conforming to type ST2 of IS: 5831 for multicore cable. Single core cables shall have no inner sheath. OVERALL SHEATH: extruded overall FRLSH PVC compound conforming to type ST2 of IS: 5831, black in colour.

S. NO.	ITEM CODE	Cable Size (No. of cores x Cross section Area (sq.mm))	Order Quantity (meters)	Drum length (meters)	HSN code	Unit price (Ex-works) Rs.	Total price (Ex-works) Rs.
A1	507-28175-A	1C - 300 AL UNARMoured	41250	750	8544		
A2	507-28008-A	1C - 630 AL UNARMoured	14250	750	8544		
A3	507-28042-A	3C - 150 AL UNARMoured	10500	750	8544		
A4	507-28046-A	3C - 240 AL UNARMoured	78750	750	8544		

Notes :

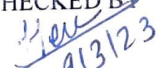
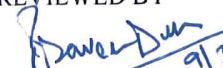
- Quantities indicated above shall be known as Order Quantities. The variation in quantities shall be as per NIT.
- The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ-Cum-Price Schedule enclosed with this specification. The unit prices shall apply for adjustment of variation in quantity as stipulated above.
- Quantity indicated above shall be cleared for manufacturing along with LOI. However, manufacturing of the cables shall be taken up by the successful bidder only after approval of technical and quality documentation. Subsequent lots shall be cleared for manufacture based on progress of engineering and site requirements.
- Overall tolerance on total dispatched quantity of each size shall be (-) 2% and (+) 0% . Cables consumed for testing and inspection shall be to bidder's account.
- Standard drum length shall be 750m. Tolerance on individual drum length shall be $\pm 5\%$. For each individual cable size, one short length of not less than 200m may be accepted only in the final drum length to complete the supply. The overall tolerance limits stipulated above shall continue to apply (in case short lengths are accepted).
- In case the quantities cleared by BHEL for manufacturing (in a lot) are manufactured and offered for inspection by successful bidder in more than one batch, BHEL reserves the right to witness type testing on all batches without any price implication.
- Bidder shall quote for all sizes/types of cables as per specification, failing which their offer shall be rejected.
- Delivery schedule of ordered quantity and subsequent lots if any shall be as per NIT.

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	PRE-QUALIFICATION REQUIREMENTS OF LT XLPE POWER CABLE FOR 3X800MW PATRATU TPS PHASE-1	PE-PQ-434-507-E001
		REVISION NO. 0 DATE 07/03/2023
		SHEET NO. 1 OF 2

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 50 km of LT power cables per month.
4.0	Manufactured and supplied at least one (1) km of FRLS cables prior to the date of 08.09.18.
5.0	(a) Manufactured and supplied 1.1kv or higher-grade cable of minimum 630 sq. mm conductor prior to the date of 08.09.18. (b) Manufactured and supplied LT power cables size of minimum 240 sq. mm for 3/3.5 core.
6.0	(a) Manufactured and supplied at least 100 km of aluminium conductor, XLPE insulated, PVC sheathed power cables of 1.1kV or higher grade in one single contract prior to the date of 08.09.18. (b) Manufactured and supplied at least 100 km of aluminium conductor, PVC insulated, PVC sheathed power cables of 1.1kV or higher grade in one single contract prior to the date of 08.09.18.
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.

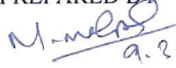
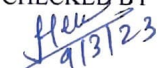
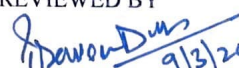
PREPARED BY  NAME:MANMOHAN MAHAPATRA DESIGNATION: MANAGER	CHECKED BY  NAME:HEMA KUSHWAHA DESIGNATION: SR. MANAGER	REVIEWED BY  NAME: PRAVEEN DUTTA DESIGNATION: AGM	APPROVED BY  NAME: DEBASISA RATH DESIGNATION: DH-ELECT(AGM)
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	PRE-QUALIFICATION REQUIREMENTS OF LT XLPE POWER CABLE FOR 3X800MW PATRATU TPS PHASE-1	PE-PQ-434-507-E001
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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.
5. Cable quantities mentioned in clause no. 4, 5(a), 6 (a) & 6 (b) are as per NTPC provenness requirement.

PREPARED BY  NAME: MANMOHAN MAHAPATRA DESIGNATION: MANAGER	CHECKED BY  NAME: HEMA KUSHWAHA DESIGNATION: SR. MANAGER	REVIEWED BY  NAME: PRAVEEN DUTTA DESIGNATION: AGM	APPROVED BY  NAME: DEBASISA RATH DESIGNATION: DH-ELECT (AGM)
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VOLUME II**3 X 800 MW NTPC PATRATU TPP****TECHNICAL SPECIFICATION****FOR*****LT XLPE POWER CABLES*****SPECIFICATION NO: *PE-TS-434-507-E001******REVISION: 00*****BHARAT HEAVY ELECTRICALS LIMITED****POWER SECTOR****PROJECT ENGINEERING MANAGEMENT****NOIDA, UP (INDIA) – 201301**

Receipt No. 1365613/2023/PS-PEM-PGIII

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		VOLUME II	
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TOTAL NO. OF SHEETS=		27
(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 are no deviation with respect to specification other than those furnished in the 'schedule of deviations'
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ-Cum-Price schedule' of the specification shall not be considered (i.e., technical description & quantities as per the 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 CABLES conforming to this specification.
- 1.2 General technical requirements of the LT XLPE Power cables are indicated in Section-II. Project specific technical/ quality requirements / changes are listed in Section-I.
- 1.3 The stipulations of Section-I, followed by those of Data Sheet-A shall prevail in case of any conflict between the stipulations of Section-I, Data Sheet - A & Section-II.
- 1.4 The documents shall be in English Language and MKS system of units.

2.0 BILL OF QUANTITIES:

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

3.0 SPECIFIC TECHNICAL REQUIREMENTS

<u>S.No.</u>	<u>Reference Clause No. of Section- II</u>	<u>Specific Requirement/ Change</u>
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).

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).
- 4.3 After receiving LOI, the vendor shall submit drawings/documents in requisite number of copies as per NIT.

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**CABLE DETAILS OF LT XLPE POWER CABLES**

1.0	Type of Cable	Flame Retardant Low Smoke (FR-LSH)
2.0	Standard applicable in general(Latest amendment to be referred if any)	IS:7098 (Part-1), IS:8130, IS:5831, IS:10810, IS:3975, ASTMD:2843, ASTMD:2863, IEC-754-1,IEC:60332-3-23, IEEE:60383,IS-10418
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
	Fault Clearing Time	1 sec
6.0	CONDUCTOR	
(a)	Material	Aluminium (With Tensile strength more than 100N/sq.mm.)
	Grade and Class	Stranded, H2, Class 2
(b)	Standard Applicable	IS: 8130
(c)	Shape	Compacted 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	Following colour scheme shall be adopted. 1 core - Red, Black, Yellow or Blue 2 core - Red & Black 3 core - Red, Yellow & Blue 4 core - Red, Yellow, Blue and Black. For reduced neutral conductors, the core shall be black.
9.0	INNER SHEATH	
(a)	Material	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	NO
(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:	NA
10.0	ARMOUR	
(a)	Applicable	NA
(b)	Material:	
(i)	Single core cables	
(ii)	Multi-core cables	
(iii)	Standard Applicable	
(c)	Minimum Coverage	
(d)	Gap between armour wires	
(e)	Breaking load of joint	
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	Cable size (cross section area and no. of cores) and voltage grade @ 5m (by embossing) Word "XLPE" "FR-LSH" etc, @ 5m (by embossing) Manufacturer's name and/ or trade name, and year of manufacture @ 5m (by embossing) 'BHEL-PEM' and 'NTPC' Name @5m (by embossing) Progressive sequential marking @ 1m (by embossing/ printing). The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.
12.0	FR-LSH CHARACTERISTICS	
(a)	Oxygen index	Min 29 (As per IS 10810 part-58), ASTM D 2863
(b)	Temperature index	Min. 250°C(As per ASTM D 2863)
(c)	Acid gas generation	Max. 20% by weight (As per IEC-60754-1)
(d)	Smoke density rating	Max. 60% (As per ASTM D 2843)
(e)	Flammability Test	
(i)	Flammability test for all cables	As per: IEC-60332 Part-3, CAT-B
13.0	TOLERANCE ON OUTER DIAMETER	± 2mm
14.0	MINIMUM BENDING RADIUS	
(a)	Single core cables	15 x O.D.
(b)	Multi core cables	12 x O.D.

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15.0	SAFE PULLING FORCE	
(a)	Aluminium conductor cable	30 N/ sq. mm.
(b)	Copper conductor cable	50 N/ sq. mm.
16.0	CABLE DRUMS	
(a)	Type of Drum	Wooden as per IS 10418.
(b)	Standard drum length	750m (±) 5%
(c)	Painting	Entire surface to be painted
(d)	Wooden Drum	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.
(e)	Particular information on Drum	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.

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DATASHEET C

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

S.No.		Unit	Description
1.0	General	-	
1.1	Name of manufacturer	-	
1.2	Place of Manufacture	-	
2.0	Standards Applicable		
2.1	IS: 7098 Part-I For general specification of XLPE Cables	-	YES
2.2	IS: 8130 For conductor material	-	YES
2.3	IS: 5831 For material of inner sheath & outer sheath.	-	YES
2.4	IS: 3975 / IS: 8130 For armour of 3 core/ single core cables	-	YES
2.5	IS: 10810 For method of tests	-	YES
2.6	IS:10418 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		
4.0	CHARACTERISTICS OF FRLS SHEATH		
	(a) Oxygen index		
NAME OF VENDOR		SEAL	REV.
NAME	SIGNATURE		
	DATE		

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	(b) Temperature index		
	(c) Acid gas generation		
	(d) Smoke density rating		
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	
	(c) Method of application	-	
	1. Multi-core cables		
	(i) With fillers		
	(ii) With out fillers	Pressure Extruded	
	2. Single core cables		
	d) Type and shape of fillers (if used)		

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

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	e) Colour		
6.9	ARMOUR		
	(a) Material		
	(i) Single core cables		
	(ii) Multi-core cables		
	(b) Size/ dimensions		
	(c) Minimum no. of wires /formed wires		
	(d) Tolerance on formed wire dimension		
	(e) Maximum resistivity of GS formed wire		
	(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 & Fillers)	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 for armour earthed at one end and at both ends.

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	DOCUMENT TITLE TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES	SPECIFICATION NO. PE-TS-434-507-E001	
		VOLUME II	
		SECTION II	
		REVISION 00	DATE: 13.03.2023

SECTION – II

GENERAL TECHNICAL SPECIFICATION

	DOCUMENT TITLE TECHNICAL SPECIFICATION FOR LT XLPE POWER CABLES	SPECIFICATION NO. PE-TS-434-507-E001	
		VOLUME II	
		SECTION II	
		REVISION 00	DATE: 13.03.2023
		SHEET 1 OF 1	

1.0 TECHNICAL REQUIREMENTS

- 1.1 Technical requirements for LT XLPE POWER CABLES shall be as indicated in this section, in addition to those specified in Section I & Datasheet-A.
- 1.2 It is not the intent to specify herein all the details of design & manufacture. However, the equipment shall conform in all respects to high standards of design engineering and workmanship and shall be capable of performing in continuous commercial operation at site conditions.

2.0 CODES & STANDARDS

- 2.1 The design, material, construction, manufacture, inspection, testing and performance of LT XLPE POWER CABLES shall conform to the latest revision of relevant standards and codes of practices mentioned in Data Sheet - A.
- 2.2 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

3.0 QUALITY ASSURANCE REQUIREMENTS

- 3.1 Bidder shall confirm compliance with the BHEL Standard Quality Plan (PE-QP-999-507-E002 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 -A to QP. 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 as specified in Datasheet-A.
- 4.2 In case of wooden drums, all wooden parts shall be manufactured from seasoned wood treated with copper naphthenates / zinc naphthenates (refer IS: 401). Dimensions of wooden drums shall be as per IS 10418. All ferrous parts shall be treated with suitable rust protective finish or coating to avoid rusting during transit and storage. BIS certification mark shall be stamped on each cable drum. Over the cables polyethylene sheet shall be wrapped and then sealed properly.
- 4.3 In case of Steel drums, New or practically new cable drums made of steel and painted with epoxy resin paint are to be used. Cable ends are carefully protected before packing. Over the cables polyethylene sheet shall be wrapped and then sealed properly. For Typical details of Steel drums, Annexure-B to Section-II, may be referred by the bidder. Bidder may modify, to choose appropriate dimensions of steel drums to suite various sizes/weight/ lengths of LT XLPE POWER CABLES.

NTPC STANDARD QAP

Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables

APPROVED BY

AMAN PANDEY

RAJESH SHARMA

S K LAL

DINESH KUMAR

APPROVED BY

K K OJHA

Q.P. NO. 0000-999- QOE-S-041

REV-01

DATE : 29/11/2018

Page 1 of 9

STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-1 AND NTPC TECHNICAL SPECIFICATION)

Sl. No

1

Component & Operations

2

Characteristics

3

Class

4

Type of check

5

Quantum of check

M

C/N

6

Reference Document

7

Acceptance Norms

8

Record Format

9

Agency

D

M

C

N

10

Remarks

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

IS5082

MANUFACTURER APPROVED SOURCES

IS5082

QCR

--do--

--

1.02

PVC / XLPE/compound for insulation

1. Make

MA

Verify

--do--

100%

As per Cable Mfr Std.

MANUFACTURER APPROVED SOURCES

MANUFACTURER APPROVED SOURCES

--do--

--

2. Type/ Grade

MA

Verify

100%

As per manufacturer norms

NTPC ADS

NTPC ADS

--do--

--

3. All acceptance test as per manufacturer norms including thermal stability test for PVC insulation

MA

Verify

As per manufacturer norms

NTPC ADS

NTPC ADS

--do--

Refer note 1

1.03

PVC Compound for Inner sheath

1. Make

MA

Verify

--do--

--do--

MANUFACTURER APPROVED SOURCES

MANUFACTURER APPROVED SOURCES

--do--

--

2. Type/ Grade

MA

Verify

--do--

--do--

NTPC ADS

NTPC ADS

--do--

--

1.04

Steel wire / Formed Wire (As applicable)

1. Make

MA

Verify

--do--

--do--

MANUFACTURER APPROVED SOURCES

MANUFACTURER APPROVED SOURCES

--do--

--

2. Dimension

MA

Meas

1 sample from each size / lot

NTPC APPROVED DATA SHEET & IS 3975

NTPC APPROVED DATA SHEET & IS 3975

--do--

--

3. All acceptance tests as per IS 3975

MA

Verify

As per IS 3975

IS 3975

IS 3975

Supplier TC

--

--

1.05

PVC compound for Sheath

1. Make

MA

Verify

100%

100%

MANUFACTURER APPROVED SOURCES

MANUFACTURER APPROVED SOURCES

QCR

--

--

2. Type / Grade

MA

Verify

100%

100%

NTPC ADS

NTPC ADS

QCR

--

--

Page 1 of 9

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-QAL-P-10/E3-R1

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1365613/2023/PS-PEM-PGIII

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 2 of 9		REVIEWED BY AMAN PANDEY RAJESH SHARMA S K LAL DINESH KUMAR		APPROVED BY K K QJHA	
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M	C/N	Reference Document	Acceptance Norms	Record Format	Agency D* M C N	Remarks
1	2	3	4	5	6		7	8	9	10	11
		3. All acceptance test as per manufacturer norms 4. Thermal Stability 5. Oxygen Index	MA	Verify	As per manufacturer norms One sample / Batch	--	NTPC ADS	NTPC ADS	QCR	V	Refer note 1
			MA	Chem	Chem	--	NTPC ADS / IS 10810 Part 58	NTPC ADS	QCR	P	--
			MA	Chem	Chem	--	NTPC ADS / IEC60754	NTPC ADS / IS 10810 Part 58	--do--	P	--
1.06	Wooden Drum	6. Acid Gas Emission	MA	Chem	One sample / Batch	--	NTPC ADS / IEC60754	NTPC ADS / IEC60754	QCR	P	--
		1. Dimension	MI	Meas	Manuf. Std.	--	IS 10418	IS 10418	--do--	P	--
		2. Anti termite treatment	MI	Chem	Cable manuf. std.	--	CABLE MANUF. STD.	CABLE MANUF. STD.	COC	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/Setting 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	Refer Sl. No.3.03(iii)
		4. Wrapping test	CR	Mech	--do--	--do--	--do--	--do--	--do--	P	--
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	IS 8130	--do--	P	--
		6. Surface finish	MA	Visual	--do--	--	--do--	--do--	--do--	P	--
		7. DC Resistance	CR	Meas	--do--	--	IS 8130/NTPC ADS	IS 8130/NTPC ADS	--do--	P	--
2.03	Insulation extrusion	1. Surface finish	MA	Visual	One sample/Setting 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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1365613/2023/PS-PEM-PGIII

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	
1	I	Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables											
		2. Colour of cores	4	5	6	-	7	8	9		10		11
		3. Thickness	CR	Meas	--do--	--	NTPC ADS	NTPC ADS	QCR		P	--	
		4. Spark Test	CR	Elect	100%	100%	CABLE MANUF. STD.	No FAILURE	--do--		P	--	
		5. Hot Set	CR	Mech	One sample/Settin g of each size	--	IS 7098- Part I	IS 7098- Part I	--do--		P	--	1. Spark test failure record is to be verified. 2. Core repairing not permitted
2.04	Laying up	1. Core sequence	MA	Visual	One sample/Settin g of each size	--	IS 1554 (Part I) & IS 7098- Part I	IS 1554 (Part I) & IS 7098- Part I	--do--		P	--	Sample is to be taken from both top & bottom end
		2. Direction of lay	MA	Visual	--do--	--	--do--	--do--	--do--		P	--	
2.05	Inner Sheath	3. Dia over laid up core	MA	Meas	--do--	--	NTPC ADS	NTPC ADS	--do--		P	--	
		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/Settin g of each size	-	NTPC ADS	NTPC ADS	--do--		P	--	
2.06	Armouring (As Applicable)	4. Dia over inner sheath	MI	Meas	--do--	-	--do--	--do--	--do--		P	--	
		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	--	

Page 3 of 9

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 FORMAT NO: QS-01-QA-I-P-10/T3-RI

1365613/2023/PS-PEM-PGIII

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)				Q.P. 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	--do--	P	--	--										
		3. Dia over outer sheath	MA	Meas	--do--	--	NTPC ADS	--do--	P	--	--										
		4.Thickness of outer sheath	CR	Meas	--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. (As per NTPC specification)	--do--	P	--	--										
							In addition, Drum No. is also to be embossed/printed on full cable length														
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	✓	P	V	V									

Page 4 of 9

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1365613/2023/PS-PEM-PGIII

Sl. No	Engineering 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)	Class	Type of check	Quantum of check		Reference Document	Acceptance Norms	Record Format	Agency			Remarks
					M	C/N				D*	M	N	
1	Component & Operations	Characteristics	4	5	6		7	8	9		10	11	
3.02	Routine Tests	1.High Voltage test at room temperature 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	V	Refer note 2
			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	V	Refer note 2
3.03	Acceptance Tests												
3.03 (i)	Construction of finished Cable	1. OD of Cable 2. Laying of core 3. Core Identification 4. Colour of outer sheath 5. Inner sheath thickness 6. Inner sheath colour	MA CR CR MA CR	Meas. Visual Visual Visual Meas	Each type & size of cables as per sampling plan of IS 1554 (Part I) & IS 7098- Part I --do-- --do-- --do-- --do--		NTPC ADS NTPC ADS / IS 1554 (Part I) & IS 7098- Part I --do-- NTPC ADS --do--	NTPC ADS NTPC ADS / IS 1554 (Part I) & IS 7098- Part I --do-- NTPC ADS --do--	--do-- --do-- --do-- --do-- --do--	✓ ✓ ✓ ✓ ✓	P P P P P	W W W W W	
3.03 (ii)	Armour wires/ Formed wires (if applicable)	1.Dimensions 2. No. of wires/ formed wire 3. Tensile test 4. Elongation test 5.Torsion test (for round wires only) 6. Wrapping test 7. Resistance test	CR CR CR CR CR CR CR	Meas Meas Mech Mech Mech Mech Mech	--do-- --do-- --do-- --do-- --do-- --do-- --do--		NTPC ADS / IS 1554(Part I)/IS3975 --do-- --do-- --do-- --do-- --do-- --do--	NTPC ADS / IS 1554(Part I)/IS3975 --do-- --do-- --do-- --do-- --do-- --do--	--do-- --do-- --do-- --do-- --do-- --do-- --do--	✓ ✓ ✓ ✓ ✓ ✓ ✓	P P P P P P P	W W W W W W W	

Page 5 of 9

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1365613/2023/PS-PEM-PGIII

Item: 1.1 KV Power (XLPE & PVC) Insulated FRILS cables		STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART I, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)				Q.P. 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	
Sl. No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M C/ N	Reference Document	Acceptance Norms	Record Format	D*	Agency M C N	Remarks
1	2	3	4	5	6	7	8	9	✓	10	11
		8.Mass of Zinc coating. 9.Uniformity of Zinc Coating	CR	Meas	--do--	NTPC ADS /IS1554(PartI)/IS3975	NTPC ADS /IS1554(PartI) /IS3975	Test certificate	✓	P V V	
		10.Adhesion test 11.Freedom from defects	CR	Mech Visual	--do-- --do--	--do-- --do--	--do-- --do--	--do-- --do--	✓ ✓	P V V P V V	
3.03 (iii)	Conductor	1.Resistance Test	CR	Elect	--do--	--do--	--do--	--do--	✓	P W	
		2.Tensile test (For aluminum conductor only)	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 (Part I) /IS 7098(Part-1)	NTPC ADS/ IS 8130	NTPC ADS/ IS 8130	--do--	✓	P 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	
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	

Page 6 of 9

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 FORMAT NO: QS-01-QA-IP-10/F3-R1

1365613/2023/PS-PEM-PGIII

STANDARD QUALITY PLAN (CONFORMING TO CODE: IS 1554 PART 1, IS 7098 Part-I AND NTPC TECHNICAL SPECIFICATION)										Q.P. NO. 0000-999- QOE- S-041 REV-01 DATE: Page 7 of 9		REVIEWED BY AMAN PANDEY RAJESH SHARMA SK LAL DINESH KUMAR		APPROVED BY K K OJHA	
Item: 1.1 KV Power (XLPE & PVC) Insulated FRLS cables	Component & Operations	Characteristics	Class	Type of check	Quantum of check M C/N		Reference Document	Acceptance Norms	Record Format	D*	Agency M C N		Remarks		
1	2	3	4	5	6		7	8	9	✓	10		11		
		2. Tensile strength & elongation at break of insulation & outer sheath 3. Tensile strength & elongation of PVC at break of insulation & outer sheath (Ageing Test)	CR	Mech	Each type & size of cables as per sampling plan of IS 1554 (Part 1) & IS 7098 (Part-I) One sample per batch of offered lot irrespective of sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test Certificate	✓	P	W	W		
		3a. Tensile strength & elongation of XLPE at break of insulation (Ageing Test) 4. Insulation resistance (Volume resistivity method) 5. High voltage test at room temperature 6. Thermal stability on PVC insulation and outer sheath 7. Hot Set Test (for XLPE insulation only) 8. Oxygen index Test on outer sheath	CR	Mech	--do--		NTPC ADS/ IS 7098 Part I	NTPC ADS/ IS 7098 Part I	--do--	✓	P	V	V		
			CR	Mech	--do--		NTPC ADS/ IS 7098 Part I	NTPC ADS/ IS 7098 Part I	--do--	✓	P	W	W		
			CR	Elect	Each type & size of cables as per sampling plan of IS 1554 (Part 1) & IS 7098-Part I		--do--	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	--do--	✓	P	W	W		
			CR	Elect	Each type & size of cables as per sampling plan of IS 1554 (Part 1) & IS 7098-Part I		--do--	--do--	--do--	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		--do--	--do--	--do--	✓	P	W	W		
			CR	Elect	Each type & size of cables as per sampling plan of IS 1554 (Part 1) & IS 7098-Part I		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	--do--	--do--	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		
			CR	Chem	One sample of each offered lot of all offered sizes		NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	NTPC ADS/ IS 1554 (Part I) & IS 7098 Part I	Test certificate	✓	P	W	W		

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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 WITNESS, V: VERIFICATION AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W".

CAPMAT NO. 02.01.04.10.01.01

1365613/2023/PS-PEM-PGIII

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)				QF. NO. 0000-999- QOE- S-041 REV-01 DATE : Page 8 of 9	REVIEWED BY AMAN PANDEY		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	
1	2	3	4	5	6	--do--	7	8	9	10	11		
		9.Smoke density rating test on outer sheath	CR	Chem		--do--	NTPC ADS & ASTM D2843	NTPC ADS	-do-	✓	P	W	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	Refer Note 3
		11.Flammability test on completed cable	CR	Chem		--do--	NTPC ADS & IEC 60332 Part-3 (Category-B)	NTPC ADS	-do-	✓	P	W	
		12.Surface finish & length measurement.	CR	Visual & Meas	100% (COC from Manufacturer to be submitted for surface finish as per specification's requirement)	Refer Note 4	(1) 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. (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	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/ 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 1 (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	--	--

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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-1 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 QIHA		
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	6	7	8	9	10	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 donot 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

QUALITY ASSURANCE



LT Power Cables

Attributes / Characteristics	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	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	Construcional requirements feature as per NTPC specification	Routine & Acceptance Tests as per relevant standard & NTPC	FRLS Tests
Item / Components / Sub System Assembly																
Aluminum (IS-8130)	Y	Y	Y	Y	Y	Y	Y				Y					
XLPE Compound (IS-7098)	Y		Y			Y					Y					
PVC Insulation Compound (IS: 5831)	Y		Y			Y					Y					
FRLS PVC Compound (IS-5831, ASTM-D2843, IS10810(Part 58), IEC-60754 Part-1)	Y		Y								Y					Y
Extrusion & curing /Manufacturing of Core (PVC / XLPE)		Y			Y		Y					Y				
Core Laying							Y									
Armour wire/strip	Y	Y	Y													
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
Wooden drum(IS-10418) /Steel Drum		Y											Y	Y		

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.

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION
EXPANSION PHASE-I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION-VI, PART-B
BID DOC NO.:CS-9585-001-2

SUB-SECTION-E-48
L.T. POWER CABLE

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	
	5.	Wrapping Test	
	6.	Resistance Test	
	7.	Mass of Zinc coating test	
	8.	Uniformity of Zinc coating	
	9.	Adhesion test	
	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:			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-9585-001-2	SUB-SECTION-E-48 L.T. POWER CABLE
			Page 2 of 4

QUALITY ASSURANCE				
CLAUSE NO.				
	Criteria	Condition	Test Requirements	Remarks
PVC insulation & outer sheath:	Samples as per relevant IS, from each size of cables in the offered lot, shall be tested for tensile strength & elongation (before ageing). Tensile & elongation testing shall preferably be done with a computerized machine. The values will be compared with corresponding values mentioned in the Type Test report accepted by NTPC. These values of Tensile Strength & Elongation (before ageing) should be within +/- 15% of the corresponding values of Type Test report. (Please note that test values should be more than the minimum values indicated in relevant standard).	All sizes which meet the criteria	The size which has maximum negative deviation from type test report values will be put on accelerated ageing test. The samples shall be aged in air oven at temperature of 130°C +/- 2°C for 5 hours and tested for TS & elongation. Acceptance norms shall be as per IS.	In case the size does not meet the requirement in accelerated ageing test then all sizes (which had met the criteria) will be put on ageing test as per IS.
XLPE insulation	Samples as per relevant IS, from each size of cables in the offered lot, will be put on ageing test as per IS.	Sizes which do not meet the criteria	Every size will be put on ageing test as per IS.	----
E) Following tests will be carried out on completed cables as per IS on each size of each type (PVC / XLPE insulated)				
	1)	Insulation resistance test (Volume resistivity method)		
	2)	High voltage test		
F) Following tests shall be carried out on only one size of offered lot (comprising of all sizes & types)				
	1)	Thermal stability test on PVC insulation and outer sheath		
	2)	Oxygen index test on outer sheath		
	3)	Smoke density rating test on outer sheath		
	4)	Acid gas generation test on outer sheath		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-9585-001-2	SUB-SECTION-E-48 L.T. POWER CABLE	Page 3 of 4

QUALITY ASSURANCE			
CLAUSE NO.			
G) Flammability test as per IEC 60332 - Part- 3 (Category- B) on completed cables as per following sampling plan:			
		This test will be carried out using composite sampling i.e. irrespective of size; cables of one particular type (i.e. armoured PVC insulated, unarmoured PVC insulated, armoured XLPE 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	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC NO.:CS-9585-001-2	SUB-SECTION-E-48 L.T. POWER CABLE
		Page 4 of 4	

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TYPICAL DRAWING OF CABLE DRUM PACKING



Ref: PW/PE/CMM-PVC Cables Packages (Rev-02)**Dated:19/02/2019****Note: Applicable for cable tenders released on or after 14/01/2019.****Price Variation Formulae for cables -Annexure-I**

1. Prices shall be variable as per price variation formulae given below (basis IEEMA).
The price variation shall be limited to + 20% of total ex-works price actually supplied (cable size wise) and -ve price variation shall be unlimited. Rates for working out price variation shall be as per rates published by IEEMA for the factors given in Annexure-II

2. Base date for prices:**Initial Price (As per IEEMA) for-Alo, Cuo, CCo, PVCCo & Feo:**Base Date shall be- 1st working day of the previous month to the date of issue of tender enquiry.**Final Price (as per IEEMA) for- Al, Cu, Cc, PVCC & Fe:**1st working day of month, one month prior to the date on which cable is notified as being ready for inspection i.e TPIA inspection call raise date on web portal.

3. Variation factor value for ALF, CuF, CCFAL, CCFCu, XLFAL, XLFCu, FeF & FeW as applicable shall be as per Technical Specification.

4. PVC shall be payable within contractual delivery period (including any extension thereto).



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IEEMA table for Price variation cause for various type of cable

1. Aluminium conductor cable

S.No	Cable Type	AIF (Single core unarmoured & Multi core armoured)	AIF (Single core armoured)	CCFAI	XLFAL (Single core)	XLFAL (Multi core)	FeF	FeW	IEEMA Formula
1.	HT XLPE Power cable	ALP	H1	H2	XL3	XL4	H3	H5	$P = P_o + AIF(AL-Alo) + XLFAL(CC-CCo) + CCFAI(PVCC-PVCCo) + FeF(Fe-Feo)$
2.	LT XLPE Power Cable	ALP	P1	L2	XL1	XL1	P3	P3 (Additional)	$P = P_o + AIF(AL-Alo) + XLFAL(CC-CCo) + CCFAI(PVCC-PVCCo) + FeF(Fe-Feo)$
3.	LT PVC Power Cable	ALP	P1	P2	-	-	P3	P3 (Additional)	$P = P_o + AIF(AL-Alo) + CCFAI(PVCC-PVCCo) + FeF(Fe-Feo)$
4.	LT HRPVC Power Cable	ALP	P1	P2	-	-	P3	P3 (Additional)	$P = P_o + AIF(AL-Alo) + CCFAI(PVCC-PVCCo) + FeF(Fe-Feo)$

2. Copper conductor cable

S no.	Cable type	CuF	AIF (single core armoured)	CCFCu	XLFCU (Single core)	XLFCU (Multi core)	FeF	FeW	IEEMA Formula
1	HT XLPE Power cable	CUP	H4	H2	XL3	XL4	H3	H5	$P = P_o + CuF(Cu-Cuo) + XLFCU(CC-CCo) + CCFCu(PVCC-PVCCo) + FeF(Fe-Feo) + AIF(AL-Alo)$
2	LT XLPE Power Cable	CUP	P4	L2	XL1	XL1	P3	P3 (Additional)	$P = P_o + CuF(Cu-Cuo) + XLFCU(CC-CCo) + CCFCu(PVCC-PVCCo) + FeF(Fe-Feo) + AIF(AL-Alo)$

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S no.	Cable type	CuF	AIF (single core armoured)	CCFCu	XLFCU (Single core)	XLFCU (Multi core)	FeF	FeW	IEEMA Formula
3	LT PVC Power Cable	CUP	P4	P2	--	--	P3	P3 (Addit ional)	$P=Po+CuF(Cu-Cuo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo) + AIF(AL-Alo)$
4	LT HRPVC Power Cable	CUP	P4	P2	--	--	P3	P3 (Addit ional)	$P=Po+CuF(Cu-Cuo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo) + AIF(AL-Alo)$
5	LT XLPE Control Cable	CUC	--	P5	--	XL2	P6	P6 (Addit ional)	$P=Po+CuF(Cu-Cuo) + XLFCU(CC-CCo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo)$
6	LT PVC Control Cable	CUC	--	P5	--	--	P6	P6 (Addit ional)	$P=Po+CuF(Cu-Cuo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo)$
7	LT HRPVC Control Cable	CUC	--	P5	--	--	P6	P6 (Addit ional)	$P=Po+CuF(Cu-Cuo) + CCFCu(PVCC-PVCCo) + FeF(Fe-Feo)$
8	LT XLPE Fire Survival Power Cable	CUP	P4	L2	XL1	XL1	P3	P3 (Addit ional)	$P=Po+CuF(Cu-Cuo) + XLFCU(CC-CCo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo) + AIF(AL-Alo)$
9	LT XLPE Fire Survival Control	CUC	--	P5	--	XL2	P6	P6 (Addit ional)	$P=Po+CuF(Cu-Cuo) + XLFCU(CC-CCo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo)$
10	LT EPR Fire Survival Power Cable	CUP	P4	L2	--	--	P3	P3 (Addit ional)	$P=Po+CuF(Cu-Cuo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo) + AIF(AL-Alo)$
11	LT EPR Fire Survival Control cable	CUC	--	P5	--	--	P6	P6 (Addit ional)	$P=Po+CuF(Cu-Cuo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo)$
12	Screened control Cable (Overall screen)	Cu POS	--	--	--	--	Fe POS	Fe POS	$P=Po+CuF(Cu-Cuo) + FeF(Fe-Feo)$
13	Screened control Cable (Individual)	Cu PIS	--	--	--	--	Fe PIS	Fe PIS	$P=Po+CuF(Cu-Cuo) + FeF(Fe-Feo)$

Annexure-II

IEEMA Table for Price Variation Clause for various types of CablesNotes:-

- (i) Cu POS, Cu PIS, Fe POS & Fe PIS tables shall be as per IEEMA circular No. IEEMA (PVC) /Instrumentation Cable/2014 effective from dtd 01.07.2014.
- (ii) All other tables shall be as per IEEMA circular No. 35//DIV/CAB/05/ dated 24.04.2018.

Terms used in PVC formulae:

P = Price payable as adjusted in accordance with above appropriate formula (In Rs./Km).
 Po= Price quoted/confined (in Rs./km).

1. ALUMINIUM

ALF Variation factor for aluminium.
 Al =Price of aluminium.
 Alo = Price of aluminium.

2 COPPER

CuF =Variation factor for copper.
 Cu = Price of CC copper rods.
 Cuo = Price of CC copper rods.

3.PVCc COMPOUND/POLYMER

PVCc = Price of PVC compound.
 PVCco= Price of PVC compound.
 CCFAL= Variation factor for PVC compound/Polymer for aluminium conductor cable.
 CCFcu =Variation factor for PVC compound/Polymer for copper conductor cable.

4. XLPE COMPOUND

Cc = Price of XLPE compound.
 Cco= Price of XLPE compound.
 XLFAL= Variation factor for XLPE compound for aluminium conductor cable.
 XLFCu =Variation factor for XLPE compound for copper conductor cable.

5.STEEL

Fe= Price of steel strips/steel wire.
 Feo= Price of steel strips/steel wire.
 FeF =Variation factor for steel.
 FeW=Variation factor for round wire steel armouring.

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IEEMA (PVC)/Instrumentation Cable/2014

Effective from: 1st July 2014

Material Price Variation Clause For Instrumentation Cables

The Price quoted/confirmed is based on the input cost of raw materials/components as on the date of quotation, and the same is deemed to be related to the prices of raw materials as specified in the price variation clause given below. In case of any variation in these prices, the price payable shall be subject to adjustment up or down in accordance with the formulae provided in this document.

Terms used in price variation formulae:

P Price payable as adjusted in accordance with above appropriate formula (in Rs/Km)

Po Price quoted/confirmed (in Rs/Km)

COPPER

CuF Variation factor for copper

Cu Price of CC copper rods. This price is as applicable on first working day of the month, one month prior to the date of delivery.

Cu_o Price of CC copper rods. This price is as applicable on first working day of the month, one month prior to the date of tendering.

STEEL

FeF Variation factor for steel

Fe Price of Steel Strips/steel wire. This price is as applicable on the first working day of the month, one month prior to the date of delivery.

Fe_o Price of steel strips/steel wire. This price is as applicable on first working day of the month, one month prior to the date of tendering.

The above prices and indices are as published by IEEMA vide Circular reference IEEMA(PVC)/CABLE/--/ prevailing as on 1st working day of the month i.e. one month prior to the date of tendering.

The date of delivery is the date on which the cable is notified as being ready for inspection/dispatch (in the absence of such notification, the date of manufacturer's dispatch note is to be considered as the date of delivery) or the contracted delivery date (including any agreed extension thereto), whichever is earlier.

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Indian Electrical & Electronics Manufacturers' Association

Recd No. 1365613/2023/PS-PEM-PGIII
1365613/2023/PS-PEM-PGIII



IEEMA (PVC)/Instrumentation Cable/2014

Effective from: 1st July 2014

Notes

- (a) All prices of raw materials are exclusive of modvatable excise/CV duty amount and exclusive of any other central, state or local taxes, octroi, etc.
- (b) All Prices are as on first working day of the month.
- (c) The details of prices are as under:
 1. Price of CC copper rods (in Rs/MT) is ex-works price as quoted by the primary producer.
 2. Price of galvanized steel strip / steel wire (in Rs/MT) is ex-works price as quoted by the manufacturer for Round steel Wire and Flat steel strip (the relevant price of steel strip or steel wire is to be selected depending upon the type of armouring of the cable).

Price variation formula for 'Instrumentaion Cables'

$$P = Po + CuF (Cu - Cuo) + FeF (Fe - Feo)$$

1. For Pair Instrumentation Over all Screen Cables

Tables References:

Cu POS Copper Factor
Fe POS Steel Factor

2. For Pair Instrumentation Individual and Over all Screen Cables

Tables References:

Cu PIS Copper Factor
Fe PIS Steel Factor

3. For Triad Instrumentation Over all Screen Cables

Tables References:

Cu TOS Copper Factor
Fe TOS Steel Factor

4. For Triad Instrumentation Individual & Overall Screen Cables

Tables References:

Cu TIS Copper Factor
Fe TIS Steel Factor


Deputy Director General
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Copper Factors for Instrumentation Cables - CuF

Cu POS

Pair Instrumentation Over all Screen Cables					
No. of Pairs Cable size in sq.mm	0.5 sq.mm	0.75 sq.mm	1.0 sq.mm	1.5 sq.mm	2.5 sq.mm
1	0.0142	0.0185	0.0233	0.0326	0.0500
2	0.0258	0.0345	0.0440	0.0625	0.0978
3	0.0353	0.0484	0.0626	0.0904	0.1433
4	0.0448	0.0623	0.0811	0.1183	0.1888
5	0.0578	0.0800	0.1022	0.1467	0.2356
6	0.0662	0.0926	0.1210	0.1768	0.2829
7	0.0756	0.1067	0.1378	0.2000	0.3245
8	0.0852	0.1204	0.1582	0.2327	0.3741
9	0.0933	0.1334	0.1734	0.2534	0.4134
10	0.1046	0.1485	0.1959	0.2893	0.4665
11	0.1111	0.1600	0.2089	0.3067	0.5023
12	0.1236	0.1764	0.2333	0.3452	0.5580
13	0.1289	0.1867	0.2445	0.3600	0.5912
14	0.1378	0.2000	0.2623	0.3867	0.6356
15	0.1467	0.2134	0.2800	0.4134	0.6801
16	0.1618	0.2322	0.3080	0.4573	0.7409
17	0.1645	0.2400	0.3156	0.4667	0.7690
18	0.1734	0.2534	0.3334	0.4934	0.8134
19	0.1822	0.2667	0.3512	0.5201	0.8579
20	0.1911	0.2800	0.3689	0.5467	0.9023
21	0.2000	0.2934	0.3867	0.5734	0.9468
22	0.2089	0.3067	0.4045	0.6001	0.9912
23	0.2178	0.3200	0.4223	0.6267	1.0357
24	0.2381	0.3437	0.4575	0.6813	1.1068
25	0.2356	0.3467	0.4578	0.6801	1.1246
26	0.2445	0.3600	0.4756	0.7068	1.1690
27	0.2534	0.3734	0.4934	0.7334	1.2135
28	0.2623	0.3867	0.5112	0.7601	1.2579
29	0.2711	0.4001	0.5290	0.7868	1.3024
30	0.2800	0.4134	0.5467	0.8134	1.3468
31	0.2889	0.4267	0.5645	0.8401	1.3913
32	0.2978	0.4401	0.5823	0.8668	1.4357
33	0.3067	0.4534	0.6001	0.8934	1.4802
34	0.3156	0.4667	0.6179	0.9201	1.5246
35	0.3245	0.4801	0.6356	0.9468	1.5691
36	0.3334	0.4934	0.6534	0.9735	1.6135
37	0.3423	0.5067	0.6712	1.0001	1.6580
38	0.3512	0.5201	0.6890	1.0268	1.7024
39	0.3600	0.5334	0.7068	1.0535	1.7469
40	0.3689	0.5467	0.7245	1.0801	1.7913
41	0.3778	0.5601	0.7423	1.1068	1.8358
42	0.3867	0.5734	0.7601	1.1335	1.8802
43	0.3956	0.5867	0.7779	1.1601	1.9247
44	0.4045	0.6001	0.7957	1.1868	1.9691
45	0.4134	0.6134	0.8134	1.2135	2.0136
46	0.4223	0.6267	0.8312	1.2402	2.0580
47	0.4312	0.6401	0.8490	1.2668	2.1025
48	0.4710	0.6759	0.9010	1.3410	2.2009

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Copper Factors for Instrumentation Cables - CuF

Cu PIS

Pair Instrumentation Individual and Over all Screen Cables					
No. of Pairs Cable size in sq.mm	0.5 sq.mm	0.75 sq.mm	1.0 sq.mm	1.5 sq.mm	2.5 sq.mm
1	0.0133	0.0178	0.0222	0.0311	0.0489
2	0.0349	0.0437	0.0531	0.0717	0.1069
3	0.0490	0.0621	0.0763	0.1041	0.1570
4	0.0630	0.0806	0.0994	0.1389	0.2071
5	0.0800	0.1022	0.1245	0.1689	0.2578
6	0.0937	0.1200	0.1484	0.2042	0.3103
7	0.1067	0.1378	0.1689	0.2311	0.3556
8	0.1218	0.1569	0.1948	0.2692	0.4107
9	0.1334	0.1734	0.2134	0.2934	0.4534
10	0.1503	0.1943	0.2417	0.3349	0.5122
11	0.1600	0.2089	0.2578	0.3556	0.5512
12	0.1785	0.2313	0.2882	0.4001	0.6128
13	0.1867	0.2445	0.3023	0.4178	0.6490
14	0.2000	0.2623	0.3245	0.4489	0.6979
15	0.2134	0.2800	0.3467	0.4801	0.7468
16	0.2350	0.3053	0.3812	0.5305	0.8141
17	0.2400	0.3156	0.3912	0.5423	0.8446
18	0.2534	0.3334	0.4134	0.5734	0.8934
19	0.2667	0.3512	0.4356	0.6045	0.9423
20	0.2800	0.3689	0.4578	0.6356	0.9912
21	0.2934	0.3867	0.4801	0.6668	1.0401
22	0.3067	0.4045	0.5023	0.6979	1.0890
23	0.3200	0.4223	0.5245	0.7290	1.1379
24	0.3479	0.4535	0.5673	0.7911	1.2165
25	0.3467	0.4578	0.5690	0.7912	1.2357
26	0.3600	0.4756	0.5912	0.8223	1.2846
27	0.3734	0.4934	0.6134	0.8534	1.3335
28	0.3867	0.5112	0.6356	0.8846	1.3824
29	0.4001	0.5290	0.6579	0.9157	1.4313
30	0.4134	0.5467	0.6801	0.9468	1.4802
31	0.4267	0.5645	0.7023	0.9779	1.5291
32	0.4401	0.5823	0.7245	1.0090	1.5780
33	0.4534	0.6001	0.7468	1.0401	1.6269
34	0.4667	0.6179	0.7690	1.0712	1.6758
35	0.4801	0.6356	0.7912	1.1024	1.7247
36	0.4934	0.6534	0.8134	1.1335	1.7736
37	0.5067	0.6712	0.8357	1.1646	1.8225
38	0.5201	0.6890	0.8579	1.1957	1.8713
39	0.5334	0.7068	0.8801	1.2268	1.9202
40	0.5467	0.7245	0.9023	1.2579	1.9691
41	0.5601	0.7423	0.9246	1.2891	2.0180
42	0.5734	0.7601	0.9468	1.3202	2.0669
43	0.5867	0.7779	0.9690	1.3513	2.1158
44	0.6001	0.7957	0.9912	1.3824	2.1647
45	0.6134	0.8134	1.0135	1.4135	2.2136
46	0.6267	0.8312	1.0357	1.4446	2.2625
47	0.6401	0.8490	1.0579	1.4757	2.3114
48	0.6887	0.8936	1.1186	1.5587	2.4186

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Steel Factors for Instrumentation Cables - FeF					
Fe POS					
Pair Instrumentation Over all Screen Cables					
No. of Pairs Cable size in sq.mm	0.5 sq.mm	0.75 sq.mm	1.0 sq.mm	1.5 sq.mm	2.5 sq.mm
1	0.1490	0.1565	0.1635	0.1735	0.1930
2	0.2190	0.2335	0.2470	0.2665	0.2595
3	0.2360	0.2545	0.2690	0.2900	0.2680
4	0.2390	0.2580	0.2715	0.2945	0.2830
5	0.2630	0.2820	0.2420	0.2805	0.3155
6	0.2840	0.3160	0.2805	0.2995	0.3430
7	0.2840	0.2595	0.2805	0.2995	0.3430
8	0.3235	0.2930	0.3030	0.3315	0.3780
9	0.2805	0.3180	0.3290	0.3590	0.4205
10	0.2970	0.3215	0.3455	0.3755	0.4385
11	0.3005	0.3255	0.3490	0.3805	0.4435
12	0.3055	0.3440	0.3680	0.3880	0.4520
13	0.3265	0.3530	0.3780	0.4105	0.4785
14	0.3265	0.3530	0.3780	0.4105	0.4785
15	0.3490	0.3765	0.4015	0.4365	0.5195
16	0.3490	0.3765	0.4015	0.4365	0.5195
17	0.3590	0.4005	0.4140	0.4635	0.5470
18	0.3590	0.4005	0.4265	0.4635	0.5470
19	0.3590	0.4005	0.4265	0.4635	0.5470
20	0.3830	0.4240	0.4535	0.4920	0.5760
21	0.3830	0.4240	0.4535	0.4920	0.5760
22	0.4065	0.4520	0.4785	0.5310	0.6190
23	0.4065	0.4520	0.4810	0.5310	0.6190
24	0.4305	0.4770	0.5070	0.5595	0.6475
25	0.4305	0.4770	0.5070	0.5595	0.6475
26	0.4305	0.4770	0.5070	0.5595	0.6475
27	0.4355	0.4820	0.5245	0.5660	0.6700
28	0.4570	0.5045	0.5345	0.5895	0.6950
29	0.4570	0.5045	0.5345	0.5895	0.6950
30	0.4570	0.5045	0.5345	0.5895	0.6950
31	0.4795	0.5285	0.5595	0.6150	0.7225
32	0.4820	0.5285	0.5595	0.6150	0.7225
33	0.4820	0.5285	0.5595	0.6150	0.7225
34	0.4920	0.5520	0.5835	0.6410	0.7500
35	0.4920	0.5520	0.5835	0.6410	0.7500
36	0.4920	0.5520	0.5835	0.6410	0.7500
37	0.4920	0.5520	0.5835	0.6410	0.7500
38	0.5145	0.5760	0.6225	0.6550	0.7805
39	0.5145	0.5760	0.6225	0.6550	0.7805
40	0.5145	0.5760	0.6225	0.6550	0.7805
41	0.5395	0.6025	0.6475	0.6975	0.8230
42	0.5395	0.6025	0.6475	0.6975	0.8230
43	0.5395	0.6025	0.6475	0.6975	0.8230
44	0.5635	0.6265	0.6735	0.7250	0.8540
45	0.5635	0.6265	0.6760	0.7250	0.8540
46	0.5635	0.6265	0.6760	0.7250	0.8540
47	0.5635	0.6265	0.6760	0.7250	0.8540
48	0.5635	0.6265	0.6760	0.7375	0.8665

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Steel Factors for Instrumentation Cables - FeF					
Fe PIS					
Pair Instrumentation Individual and Over all Screen Cables					
No. of Pairs Cable size in sq.mm	0.5 sq.mm	0.75 sq.mm	1.0 sq.mm	1.5 sq.mm	2.5 sq.mm
1	0.1880	0.1980	0.2070	0.2220	0.2410
2	0.2315	0.2460	0.2595	0.2815	0.2755
3	0.2505	0.2690	0.2820	0.2495	0.2830
4	0.2645	0.2830	0.2420	0.2805	0.3155
5	0.2895	0.2730	0.2805	0.3005	0.3430
6	0.2755	0.2980	0.3005	0.3280	0.3730
7	0.2755	0.2980	0.3005	0.3280	0.3730
8	0.2980	0.3215	0.3455	0.3740	0.4230
9	0.3230	0.3490	0.3730	0.4040	0.4685
10	0.3405	0.3655	0.3765	0.4215	0.4885
11	0.3430	0.3690	0.3815	0.4265	0.4945
12	0.3490	0.3765	0.4015	0.4470	0.5160
13	0.3715	0.3990	0.4255	0.4720	0.5420
14	0.3715	0.3990	0.4255	0.4720	0.5420
15	0.3965	0.4240	0.4510	0.5020	0.5720
16	0.3955	0.4240	0.4510	0.5020	0.5720
17	0.4190	0.4495	0.4795	0.5295	0.6150
18	0.4190	0.4495	0.4795	0.5295	0.6150
19	0.4190	0.4495	0.4795	0.5295	0.6150
20	0.4445	0.4770	0.5060	0.5570	0.6450
21	0.4445	0.4895	0.5060	0.5695	0.6450
22	0.4695	0.5045	0.5345	0.5870	0.6885
23	0.4695	0.5045	0.5345	0.5870	0.6885
24	0.4970	0.5310	0.5620	0.6285	0.7210
25	0.4970	0.5310	0.5620	0.6285	0.7210
26	0.4970	0.5310	0.5620	0.6285	0.7210
27	0.5035	0.5495	0.5810	0.6360	0.7410
28	0.5135	0.5610	0.6050	0.6610	0.7690
29	0.5135	0.5610	0.6050	0.6610	0.7690
30	0.5260	0.5610	0.6050	0.6610	0.7690
31	0.5495	0.5845	0.6300	0.6885	0.7990
32	0.5495	0.5845	0.6300	0.6885	0.7990
33	0.5495	0.5845	0.6300	0.6885	0.7990
34	0.5735	0.6225	0.6585	0.7285	0.8405
35	0.5735	0.6225	0.6585	0.7285	0.8405
36	0.5735	0.6225	0.6585	0.7285	0.8405
37	0.5735	0.6225	0.6585	0.7285	0.8405
38	0.5990	0.6485	0.6850	0.7575	0.8740
39	0.5990	0.6485	0.6850	0.7575	0.8740
40	0.5990	0.6485	0.6850	0.7575	0.8740
41	0.6250	0.6775	0.7135	0.7880	0.9180
42	0.6250	0.6775	0.7135	0.7880	0.9180
43	0.6250	0.6775	0.7135	0.7880	0.9180
44	0.6485	0.7050	0.7410	0.8165	0.9495
45	0.6485	0.7050	0.7410	0.8165	0.9495
46	0.6485	0.7050	0.7410	0.8165	0.9495
47	0.6485	0.7050	0.7410	0.8165	0.9495
48	0.6485	0.7050	0.7535	0.8290	0.9620

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Cir. No. 35/DIV/ CAB/05/

24th April 2018

To Members of the Cable Division, Utilities, Railways & Listed purchasing organizations

Sub: Correction in PV formulae of LT XLPE Power Cable and addition of factors for HT XLPE Power Cables

We have recently published revised Price Variation Clause for LT&HT XLPE Power Cables and made it effective from 1st November 2017 vide Cir. No.111/DIV/CAB/05 dated 5th December 2017

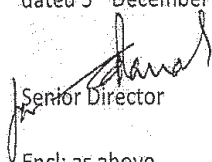
While replying to a query of a buyer it is observed that the polymer factor for LT XLPE Power Cables (both aluminium and copper) was incorrectly represented by Table P2.

We have now corrected the anomaly by correcting the PV formulae of LT XLPE Aluminium and Copper Insulated Cables (Sl. No. D & E) by representing Polymer factor by Table L2.

We have also worked out factors for XLPE, Copper and Steel for 3 core HT XLPE Power Cables for 500 and 630 sq.mm.

We now enclose complete PV clause of Cable by including all the PV formulae of different types of power cable (Sl. No. A to I), polymer factor Table L2 and updated XL4, H2 and H5 Table of factors for your perusal & record.

We request to replace PV clause of Cable already circulated vide Cir. 111/DIV/CAB/05 dated 5th December 2017 with the enclosed PV clause in your records for future use.


 Senior Director

Encl: as above

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Material Price Variation Clause For PVC And XLPE Insulated Cables

The Price quoted/confirmed is based on the input cost of raw materials/components as on the date of quotation, and the same is deemed to be related to the prices of raw materials as specified in the price variation clause given below. In case of any variation in these prices, the price payable shall be subject to adjustment up or down in accordance with the formulae provided in this document.

Terms used in price variation formulae:

P Price payable as adjusted in accordance with above appropriate formula (in Rs/Km)

Po Price quoted/confirmed (in Rs/Km)

ALUMINIUM

AIF Variation factor for aluminium

AI Price of Aluminium. This price is as applicable of first working day of the month, one month prior to the date of delivery.

Alo Price of aluminium. This price is as applicable on first working day of the month, one month prior to the date of tendering.

COPPER

CuF Variation factor for copper

Cu Price of CC copper rods. This price is as applicable on first working day of the month, one month prior to the date of delivery.

Cuo Price of CC copper rods. This price is as applicable on first working day of the month, one month prior to the date of tendering.

PVC COMPOUND

PVCc price of PVC compound. This price is as applicable on first working day of the month, one month prior to the date of delivery.

PVCco Price of PVC compound. This price is as applicable on first working day of the month, one month prior to the date of tendering.

CCFAI Variation factor for PVC compound/Polymer for aluminum conductor cable.

CCFCu Variation factor for PVC compound/Polymer for copper conductor cable.

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 XLPE COMPOUND

Effective from: 1st November 217

Cc price of XLPE compound. This price is as applicable on first working day of the month, one month prior to the date of delivery.

Cco Price of XLPE compound. This price is as applicable on first working day of the month, one month prior to the date of tendering.

XLFAL Variation factor for XLPE compound for aluminum conductor cable.

XLFCU Variation factor for XLPE compound for Copper conductor cable.

STEEL

FeF Variation factor for steel

FeW Variation factor for round wire steel armouring

Fe Price of Steel Strips/steel wire. This price is as applicable on the first working day of the month, one month prior to the date of delivery.

Feo Price of steel strips/steel wire. This price is as applicable on first working day of the month, one month prior to the date of tendering.

The above prices and indices are as published by IEEMA vide Circular reference IEEMA (PVC)/CABLE R(1)/--/- prevailing as on 1st working day of the month i.e. one month prior to the date of tendering.

The date of delivery is the date on which the cable is notified as being ready for inspection/dispatch (in the absence of such notification, the date of manufacturer's dispatch note is to be considered as the date of delivery) or the contracted delivery date (including any agreed extension thereto), whichever is earlier.

Notes

- All prices of raw materials are exclusive of GST amount.
- All prices excluding Aluminium & Copper are as on first working day of the month.
- The details of prices are as under:

- Price of Aluminium is LME average Cash SELLER Settlement price of Primary Aluminium in US\$ per MT as published by London Metal Bulletin (LME) including Premium for Aluminium Ingot in US\$ per MT is converted in Indian Rs./MT.
- Price of PVC Compound (in Rs/MT) is the ex-works price, as quoted by the manufacturer.
- Price of XLPE Compound (in Rs/MT) is the ex-works price, as quoted by the manufacturer
- Price of CC copper rods (in Rs/MT) is ex-works price as quoted by the primary producer.
- Price of galvanized steel strip / steel wire (in Rs/MT) is ex-works price as quoted by the manufacturer for Round steel Wire and Flat steel strip (the relevant price of steel strip or steel wire is to be selected depending upon the type of armouring of the cable).

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Price variation formulae for 'Power Cables'

A. Aluminum conductor PVC insulated 1.1 kV power cables

$$P = Po + AIF (AL - Alo) + CCFAI (PVCc - PVCco) + FeF (Fe - Feo)$$

For unarmoured multicore cables (without steel armour); FeF = 0

Table References:

ALP	Aluminium conductor in single core unarmoured & multicore cables
P1	Aluminium conductor aluminium armour in single core armoured cables
P2	PVC compound
P3	Steel armour

B. Copper conductor PVC insulated 1.1 kV power cables

$$P = Po + CuF (Cu - Cuo) + CCFCu (PVCc - PVCco) + FeF (Fe - Feo) + AIF (Al - Alo)$$

For steel armoured cables; AIF = 0 For aluminium armoured cables; FeF = 0

For unarmoured cables; FeF, AIF = 0

Tables References:

CUP	Copper conductor
P2	PVC compound
P3	Steel armour
P4	Aluminium armour

C. Copper conductor PVC insulated 1.1 kV control cables

$$P = Po + CuF (Cu - Cuo) + CCFCu (PVCc - PVCco) + FeF (Fe - Feo)$$

For unarmoured cables; FeF = 0

Tables References:

CUC	Copper conductor
P5	PVC compound
P6	Steel armour

D. Aluminum conductor XLPE insulated 1.1 kV power cables

$$P = Po + AIF (AL - Alo) + XLFAL (CC - Cco) + CCFAI (PVCc - PVCco) + FeF (Fe - Feo)$$

For unarmoured multicore cables (without steel armour); FeF = 0

Table References:

ALP	Aluminium conductor in single core unarmoured & multicore cables
P1	Aluminium conductor aluminium armour in single core armoured cables
L2	Polymer (CCFAI)
P3	Steel armour
XL1	XLPE Compound (XLFAL)

E. Copper conductor XLPE insulated 1.1 kV power cables

$$P = Po + CuF (Cu - Cuo) + XLFCU (CC - Cco) + CCFCu (PVCc - PVCco) + FeF (Fe - Feo) + AIF (Al - Alo)$$

For steel armoured cables; AIF = 0 For aluminium armoured cables; FeF = 0



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For unarmoured cables; FeF, AIF = 0

Tables References:

CUP	Copper conductor
L2	Polymer (CCFCu)
P3	Steel armour
P4	Aluminium armour
XL1	XLPE Compound (XLFCu)

F. Copper conductor XLPE insulated 1.1 kV control cables

$$P = P_o + CuF (Cu - Cu_o) + XLFCU (CC-Cco) + CCFCu (PVCc-PVCco) + FeF (Fe-Fe_o)$$

For unarmoured cables; FeF = 0

Tables References:

CUC	Copper conductor
P5	PVC compound
P6	Steel armour
XL2	XLPE Compound

G. For Aluminium conductor XLPE insulated 3.3 to 33 kV power cables

$$P = P_o + AIF (Al - Al_o) + XLFAL (CC-Cco) + CCFAI (PVCc - PVCco) + FeF (Fe - Fe_o)$$

For unarmoured multicore cables (without steel armour); FeF = 0

Table References:

ALP	Aluminium conductor in single core unarmoured & multicore cables
H1	Aluminium conductor + aluminium armour in single core armoured cables
H2	Polymer
H3/H5	Steel armour (Flat/Round)
XL3/XL4	XLPE Compound (Single core /Multicore)

H. Copper conductor XLPE Insulated 3.3 to 33 kV power cables

$$P = P_o + CuF (Cu - Cu_o) + XLFCU (CC-Cco) + CCFCu (PVCc - PVCco) + FeF (Fe - Fe_o) + AIF (Al - Al_o)$$

For steel armoured cables; AIF = 0 For aluminium armoured cables; FeF = 0

For unarmoured cables; FeF, AIF = 0

Table References:

CUP	Copper conductor
H2	Polymer
H3/H5	Steel armour (Flat/Round)
H4	Aluminium armour
XL3/XL4	XLPE Compound (Single core /Multicore)

I. Copper conductor XLPE insulated 1.0 and 1.5 kV Solar PV DC cables

$$P = P_o + CuF (Cu - Cu_o)$$

Table CUscd Copper Conductor

[Signature]
 Authorized Signatory

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TABLE ALP

VARIATION FACTOR FOR ALUMINIUM (AIF)
POWER CABLES WITH ALUMINIUM CONDUCTOR
(EXCLUDING SINGLE CORE ARMoured CABLES)

Nominal Cross Sectional Area (in Sq. mm.)	1 core	2 core	3 core	3.5 core	4 core
2.5	0.007	0.014	0.021	-	0.028
4	0.011	0.023	0.034	-	0.046
6	0.017	0.034	0.052	-	0.069
10	0.029	0.053	0.087	-	0.116
16	0.046	0.091	0.137	-	0.183
25/16	0.073	0.146	0.219	0.262	0.292
35/16	0.101	0.202	0.302	0.345	0.404
50/25	0.137	0.273	0.410	0.478	0.547
70/35	0.197	0.395	0.593	0.687	0.791
95/50	0.274	0.548	0.821	0.949	1.095
120/70	0.346	0.691	1.035	1.221	1.382
150/70	0.425	0.853	1.279	1.464	1.706
185/95	0.533	1.070	1.605	1.861	2.140
225/120	0.655	1.310	1.965	2.287	2.620
240/120	0.703	1.400	2.099	2.421	2.799
300/150	0.879	1.757	2.635	3.033	3.514
400/185	1.126	2.249	3.374	3.873	4.498
500	1.418	2.838	4.256	-	5.675
630	1.828	3.663	5.494	-	7.326
800	2.340	4.679	7.018	-	9.357
1000	2.951	5.890	8.934	-	11.779

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TABLE CUP

VARIATION FACTOR FOR COPPER CONDUCTOR (CUF)
POWER CABLES WITH COPPER CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm.)	1 core	2 core	3 core	3.5 core	4 core
2.5	0.023	0.046	0.069	-	0.092
4	0.036	0.076	0.112	-	0.151
6	0.056	0.112	0.171	-	0.227
10	0.095	0.174	0.286	-	0.382
16	0.151	0.299	0.451	-	0.602
25/16	0.240	0.480	0.720	0.862	0.960
35/16	0.332	0.664	0.993	1.135	1.329
50/25	0.451	0.898	1.348	1.572	1.799
70/35	0.648	1.299	1.950	2.260	2.602
95/50	0.901	1.802	2.700	3.121	3.601
120/70	1.138	2.273	3.407	4.016	4.545
150/70	1.398	2.806	4.207	4.815	5.611
185/95	1.753	3.519	5.279	6.121	7.038
225/120	2.154	4.309	6.463	7.522	8.617
240/120	2.312	4.605	6.904	7.963	9.206
300/150	2.891	5.779	8.667	9.976	11.558
400/185	3.703	7.397	11.097	12.738	14.794
500	4.664	9.334	13.998	-	18.665
630	6.012	12.048	18.070	-	24.095
800	7.696	15.389	23.082	-	30.775
1000	9.706	19.372	29.055	-	38.741

TABLE CUdc

VARIATION FACTOR FOR COPPER CONDUCTOR (CUF)
1.0 & 1.5KV Solar PV DC Cables with Copper Conductor

Cable Size in sq.mm.	Copper content in MT/km
2.5	0.023
4	0.038
6	0.058
10	0.090

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TABLE CUC

VARIATION FACTOR FOR COPPER CONDUCTOR (CUF)
CONTROL CABLES WITH COPPER CONDUCTOR

No of Cores	Core size 1.5 sq mm	Core size 2.5 sq mm
2	0.026	0.047
3	0.039	0.070
4	0.052	0.094
5	0.065	0.117
6	0.078	0.141
7	0.091	0.164
8	0.110	0.182
9	0.117	0.205
10	0.130	0.235
12	0.157	0.282
14	0.183	0.329
16	0.209	0.376
18	0.246	0.410
19	0.248	0.446
20	0.260	0.456
24	0.313	0.563
27	0.352	0.634
30	0.391	0.704
37	0.483	0.869
44	0.573	1.033
52	0.678	1.221
61	0.796	1.432

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TABLE P1

VARIAION FACTOR FOR ALUMINIUM (AIF)
ALUMINIUM ARMoured SINGLE CORE PVC INSULATED 1.1 KV CABLES

Nominal cross sectional area (in Sq.mm)	Aluminium factor for Aluminium armoured cable with aluminun conductor
4	0.0685
6	0.0795
10	0.1017
16	0.1303
25	0.1693
35	0.2090
50	0.2597
70	0.3360
95	0.4567
120	0.5443
150	0.6427
185	0.7743
240	0.9737
300	1.2582
400	1.5502
500	1.8958
630	2.3650
800	2.9306
1000	3.7666

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TABLE P2

VARIATION FACTOR FOR PVC COMPOUND (CCFAI/CCFCu)
PVC INSULATED 1.1 KV POWER CABLES WITH COPPER/ALUMINIUM CONDUCTOR

Nominal cross Sectional Area (in Sq. mm)	1 core	2 core		3 core		3.5 core		4 core	
	Unarm	Unarm	arm	Unarm	arm	Unarm	arm	Unarm	arm
2.5	0.079	0.125	0.139	0.141	0.157	-	-	0.161	0.179
4	0.094	0.140	0.156	0.164	0.182	-	-	0.188	0.209
6	0.101	0.154	0.171	0.179	0.199	-	-	0.198	0.220
10	0.114	0.194	0.216	0.214	0.238	-	-	0.249	0.277
16	0.142	0.234	0.246	0.279	0.290	-	-	0.328	0.345
25	0.171	0.288	0.303	0.364	0.383	0.422	0.444	0.443	0.466
35	0.189	0.321	0.338	0.403	0.429	0.489	0.515	0.498	0.524
50	0.211	0.411	0.433	0.508	0.535	0.613	0.645	0.647	0.681
70	0.241	-	-	0.613	0.645	0.707	0.744	-	-
95	0.284	-	-	0.795	0.811	0.908	0.927	-	-
120	0.339	-	-	0.866	0.884	1.024	1.045	-	-
150	0.388	-	-	1.070	1.092	1.289	1.315	-	-
185	0.450	-	-	1.310	1.337	1.499	1.530	-	-
225	0.521	-	-	1.586	1.618	1.840	1.878	-	-
240	0.534	-	-	1.649	1.683	1.990	2.031	-	-
300	0.653	-	-	2.007	2.048	2.361	2.409	-	-
400	0.770	-	-	2.437	2.487	2.616	2.669	-	-
500	0.936	-	-	3.117	3.181	3.687	3.762	-	-
630	1.175	-	-	-	-	-	-	-	-
800	1.433	-	-	-	-	-	-	-	-
1000	1.642	-	-	-	-	-	-	-	-

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TABLE P3

VARIATION FACTOR FOR STEEL (FeF)

PVC INSULATED 1.1 KV POWER CABLES WITH COPPER/ALUMINIUM CONDUCTOR

Nominal Cross sectional Area (in Sq. mm)	2 core	Shape	3 core	Shape	3 ½ core	Shape	4 core	Shape
4	0.305	W	0.335	W	-	-	0.363	W
6	0.348	W	0.363	W	-	-	0.407	W
10	0.392	W	0.407	W	-	-	0.293	F
16	0.235	F	0.293	F	-	-	0.323	F
25	0.293	F	0.352	F	0.382	F	0.382	F
35	0.323	F	0.382	F	0.411	F	0.440	F
50	0.382	F	0.440	F	0.469	F	0.499	F
70	0.411	F	0.499	F	-	F	0.587	F
95	0.499	F	0.587	F	0.616	F	0.645	F
120	0.528	F	0.616	F	0.675	F	0.731	F
150	0.587	F	0.675	F	0.731	F	0.790	F
185	0.645	F	0.761	F	0.820	F	0.879	F
240	0.731	F	0.879	F	0.937	F	0.996	F
300	0.820	F	0.966	F	1.055	F	1.113	F
400	0.937	F	1.083	F	1.172	F	1.231	F
500	1.055	F	1.231	F	1.348	F	1.406	F
630	1.172	F	-	-	-	-	-	-

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IEEMA (PVC)/CABLE(R-1)/2017

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TABLE P3 (Additional)

VARIATION FACTOR FOR ROUND WIRE 'W' STEEL (FeF)
PVC INSULATED 1.1 KV POWER CABLES WITH COPPER/ALUMINIUM CONDUCTOR

Nominal Cross Sectional Area (in sq. mm)	2 Core	3 Core	3.5 Core	4 Core
1.5	0.247	0.259		0.288
2.5	0.273	0.289		0.329
4	0.305	0.335		0.363
6	0.348	0.363		0.407
10	0.392	0.407		0.533
16	0.439	0.523	0.014	0.573
25	0.526	0.625	0.664	0.685
35	0.591	0.685	0.729	0.761
50	0.661	0.790	0.864	1.108
70	0.745	1.122	1.200	1.256
95	1.085	1.286	1.376	1.443
120	1.147	1.386	1.479	1.562
150	1.267	1.526	1.684	2.173
185	1.403	2.090	2.315	2.421
240	1.994	2.397	2.641	2.722
300	2.180	2.642	3.670	3.842
400	2.987	3.728	4.126	4.292
500	3.517	4.225	5.958	6.301
630	4.774	6.018	6.737	7.141

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TABLE P4

VARIATION FACTOR FOR ALUMINIUM (AIF)
PVC INSULATED 1.1 KV POWER CABLES WITH COPPER CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm)	Aluminium Factor for Aluminium armoured cable with copper conductor
4	0.058
6	0.063
10	0.073
16	0.084
25	0.096
35	0.108
50	0.123
70	0.139
95	0.183
120	0.198
150	0.218
185	0.241
240	0.271
300	0.379
400	0.424
500	0.478
630	0.537
800	0.591
1000	0.816

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TABLE P5

VARIATION FACTOR FOR PVC COMPOUND (CCFCu)
PVC INSULAYTED CONTROL CABLES WITH COPPER CONDUCTOR

No of cores	Core size 1.5 sq mm		Core size 2.5 sq mm	
	Unarm	Arm	Unarm	Arm
2	0.118	0.121	0.125	0.139
3	0.121	0.131	0.141	0.157
4	0.137	0.152	0.161	0.179
5	0.157	0.174	0.187	0.206
6	0.179	0.199	0.234	0.260
7	0.179	0.199	0.234	0.260
8	0.193	0.215	0.292	0.325
9	0.216	0.241	0.300	0.335
10	0.236	0.262	0.303	0.337
12	0.249	0.277	0.334	0.371
14	0.311	0.327	0.389	0.409
16	0.344	0.362	0.435	0.458
18	0.352	0.371	0.474	0.500
19	0.375	0.395	0.476	0.501
20	0.391	0.412	0.519	0.546
24	0.457	0.481	0.584	0.615
27	0.491	0.517	0.631	0.664
30	0.529	0.557	0.706	0.743
37	0.615	0.647	0.835	0.879
44	0.739	0.778	1.019	1.026
52	0.845	0.889	1.100	1.158
61	0.952	1.002	1.246	1.312

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TABLE P6

VARIATION FACTOR FOR STEEL (FeF)
PVC INSULATED CONTROL CABLES WITH COPPER CONDUCTOR

No of cores	Core size 1.5 sq mm	Shape of armour	Core size 2.5 sq mm	Shape of armour
2	0.243	W	0.277	W
3	0.257	W	0.289	W
4	0.277	W	0.314	W
5	0.303	W	0.342	W
6	0.329	W	0.379	W
7	0.329	W	0.379	W
8	0.341	W	0.456	W
9	0.383	W	0.275	F
10	0.408	W	0.325	F
12	0.289	F	0.342	F
14	0.306	F	0.360	F
16	0.317	F	0.372	F
18	0.332	F	0.350	F
19	0.343	F	0.397	F
20	0.368	F	0.400	F
24	0.398	F	0.475	F
27	0.414	F	0.478	F
30	0.425	F	0.503	F
37	0.461	F	0.548	F
44	0.507	F	0.601	F
52	0.556	F	0.641	F
61	0.585	F	0.685	F

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TABLE P6 (Additional)

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VARIATION FACTOR FOR ROUND WIRE 'W' STEEL (FeF)
PVC INSULATED CONTROL CABLES WITH COPPER CONDUCTOR

No. of Cores	Core size 1.5 sq mm	Core size 2.5 sq mm
2	0.243	0.273
3	0.257	0.289
4	0.277	0.314
5	0.303	0.342
6	0.329	0.379
7	0.329	0.379
8	0.341	0.456
9	0.383	0.508
10	0.408	0.535
12	0.510	0.572
14	0.546	0.625
16	0.581	0.660
19	0.608	0.696
24	0.714	0.819
25	0.679	0.798
27	0.732	0.837
28	0.696	0.815
30	0.758	0.881
33	0.747	0.883
37	0.820	1.217
44	0.926	1.355
48	1.122	1.308
50	1.122	1.308
52	1.149	1.361
56	1.202	1.388
61	1.299	1.520

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TABLE L2

VARIATION FACTOR FOR POLYMER (CCFAI / CCFCu)
XLPE INSULATED 1.1 KV POWER CABLES WITH COPPER / ALUMINIUM CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm)	1 core	2 core		3 core		3.5 core		4 core	
	Unarm	Unarm	Arm	Unarm	Arm	Unarm	Arm	Unarm	Arm
2.5	0.055	0.163	0.175	0.166	0.177	-	-	0.177	0.188
4	0.075	0.201	0.204	0.205	0.213	-	-	0.218	0.213
6	0.085	0.213	0.234	0.205	0.230	-	-	0.242	0.232
10	0.082	0.252	0.280	0.217	0.251	-	-	0.285	0.298
16	0.089	0.278	0.341	0.289	0.246	-	-	0.300	0.279
25	0.101	0.307	0.278	0.276	0.247	0.295	0.264	0.331	0.290
35	0.109	0.330	0.319	0.305	0.270	0.328	0.292	0.368	0.319
50	0.124	0.482	0.685	0.348	0.311	0.372	0.335	0.422	0.394
70	0.146	0.354	0.335	0.469	0.397	0.489	0.420	0.528	0.464
95	0.163	0.436	0.389	0.504	0.441	0.544	0.471	0.591	0.523
120	0.176	0.475	0.421	0.556	0.498	0.599	0.538	0.722	0.656
150	0.217	0.510	0.490	0.690	0.611	0.717	0.633	0.840	0.762
185	0.236	0.631	0.608	0.836	0.738	0.854	0.756	1.007	0.899
240	0.273	0.750	0.726	1.002	0.842	1.079	0.952	1.238	1.119
300	0.303	0.919	0.887	1.161	1.012	1.170	1.031	1.457	1.414
400	0.372	1.093	1.040	1.376	1.283	1.545	1.379	1.778	1.626
500	0.413	1.342	-	1.568	1.400	1.806	1.456	-	-
630	0.469	1.546	-	-	-	-	-	-	-
800	0.569	-	-	-	-	-	-	-	-
1000	0.667	-	-	-	-	-	-	-	-

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TABLE XL1
 VARIATION FACTOR FOR XLPE COMPOUND (XLFAL/XLFCU)
 XLPE INSULATED 1.1 KV POWER CABLES WITH COPPER/ALUMINIUM CONDUCTOR

Nominal cross Sectional Area (in Sq. mm)	1 core		2 core		3 core		3.5 core		4 core	
	Unarm	Arm	Unarm	Arm	Unarm	arm	Unarm	Arm	Unarm	arm
2.5	0.007	0.010	0.014	0.014	0.021	0.021			0.028	0.028
4	0.009	0.012	0.018	0.018	0.027	0.027			0.036	0.036
6	0.010	0.015	0.022	0.022	0.033	0.033			0.043	0.043
10	0.013	0.018	0.025	0.025	0.039	0.039			0.053	0.053
16	0.016	0.023	0.034	0.034	0.049	0.049			0.065	0.065
25	0.021	0.030	0.048	0.048	0.070	0.070	0.084	0.084	0.093	0.093
35	0.025	0.035	0.059	0.059	0.084	0.084	0.099	0.099	0.112	0.112
50	0.033	0.044	0.075	0.075	0.108	0.108	0.130	0.130	0.144	0.144
70	0.042	0.054	0.095	0.095	0.137	0.137	0.160	0.160	0.179	0.179
95	0.048	0.062	0.110	0.110	0.160	0.160	0.190	0.190	0.211	0.211
120	0.060	0.076	0.138	0.138	0.200	0.200	0.239	0.239	0.266	0.266
150	0.078	0.095	0.180	0.180	0.259	0.259	0.296	0.296	0.344	0.344
185	0.097	0.116	0.224	0.224	0.324	0.324	0.369	0.369	0.430	0.430
240	0.116	0.137	0.266	0.266	0.388	0.388	0.446	0.446	0.518	0.518
300	0.138	0.164	0.325	0.325	0.467	0.467	0.540	0.540	0.620	0.620
400	0.175	0.214	0.357	0.357	0.536	0.536	0.619	0.619	0.714	0.714
500	0.217	0.260	0.440	0.440	0.660	0.660	0.769	0.769	0.880	0.880
630	0.265	0.318	0.542	0.542	0.814	0.814	0.941	0.941	1.085	1.085
800	0.323	0.389								
1000	0.375	0.444								

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TABLE XL2
VARIATION FACTOR FOR XLPE COMPOUND (XLFCU)
XLPE INSULAYTED CONTROL CABLES WITH COPPER CONDUCTOR

No of cores	Core size 1.5 sq mm		Core size 2.5 sq mm	
	Unarm	Arm	Unarm	Arm
2	0.010	0.010	0.012	0.012
3	0.016	0.016	0.018	0.018
4	0.021	0.021	0.025	0.025
5	0.026	0.026	0.031	0.031
6	0.031	0.031	0.037	0.037
7	0.036	0.036	0.043	0.043
8	0.036	0.036	0.043	0.043
9	0.042	0.042	0.049	0.049
10	0.052	0.052	0.061	0.061
12	0.062	0.062	0.074	0.074
14	0.073	0.073	0.086	0.086
16	0.083	0.083	0.098	0.098
18	0.094	0.094	0.110	0.110
19	0.099	0.099	0.116	0.116
20	0.104	0.104	0.123	0.123
24	0.125	0.125	0.147	0.147
27	0.140	0.140	0.165	0.165
30	0.156	0.156	0.184	0.184
37	0.192	0.192	0.227	0.227
44	0.229	0.229	0.270	0.270
52	0.270	0.270	0.319	0.319
61	0.317	0.317	0.374	0.374

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TABLE XL3

VARIATION FACTOR FOR XLPE(XLFAL/XLFCU)

SINGLE CORE ARMoured /UNARMoured XLPE INSULATED 3.3 to 33 KV POWER CABLES WITH
CU / AL CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm.)	XLPE Factor for Armoured/ Unarmoured Cable with AL /CU Conductor					
	3.3 KV	6.6 KV (E)	11 KV (E)/ 6.6 KV (UE)	11 KV (UE)	22 KV (E)	33 KV (E)
25	0.110	0.131	0.170	0.279		
35	0.122	0.137	0.175	0.284	0.317	0.522
50	0.135	0.151	0.191	0.307	0.341	0.563
70	0.155	0.172	0.215	0.342	0.379	0.615
95	0.174	0.193	0.241	0.377	0.417	0.670
120	0.192	0.212	0.262	0.407	0.449	0.713
150	0.209	0.229	0.283	0.437	0.481	0.757
185	0.228	0.250	0.308	0.471	0.518	0.809
240	0.255	0.279	0.343	0.519	0.569	0.883
300	0.280	0.322	0.372	0.560	0.613	0.943
400	0.326	0.392	0.420	0.625	0.683	1.041
500	0.388	0.461	0.469	0.694	0.757	1.142
630	0.467	0.520	0.529	0.777	0.845	1.265
800	0.567	0.593	0.602	0.874	0.949	1.407
1000	0.656	0.665	0.660	0.955	1.036	1.525

Note : XLPE factors include Semicons for Conductor & Insulation screen

TABLE - XL4

VARIATION FACTOR FOR XLPE (CCF1A/ / CCF1Cu)

3 CORE XLPE INSULATED 3.3 to 33 KV POWER CABLES WITH COPPER / ALUMINIUM CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm)	3.3 KV ARM	6.6 KV (E) ARM	6.6 KV (UE) / 11 KV (E) ARM	11 KV (UE) ARM	22 KV (E) ARM	33 KV (E) ARM
25	0.315	0.394	0.511	0.838		
35	0.339	0.427	0.545	0.880	0.982	1.638
50	0.378	0.474	0.600	0.957	1.065	1.751
70	0.435	0.541	0.679	1.067	1.183	1.916
95	0.489	0.604	0.755	1.171	1.295	2.071
120	0.537	0.661	0.822	1.265	1.396	2.210
150	0.585	0.719	0.890	1.359	1.497	2.350
185	0.642	0.784	0.968	1.468	1.614	2.513
240	0.717	0.873	1.074	1.615	1.773	2.732
300	0.781	1.006	1.167	1.744	1.928	2.919
400	0.886	1.227	1.314	1.948	2.130	3.229
500	0.956	1.421	1.446	2.148	2.381	3.538
630	1.129	1.582	1.609	2.382	2.630	3.940

Note : XLPE factors include Semicons for Conductor & Insulation screen

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TABLE H1
VARIATION FACTOR FOR ALUMINIUM (AIF)
ALUMINIUM ARMoured SINGLE CORE XLPE INSULATED 3.3 TO 33 KV CABLES

Nominal Cross Sectional Area (in Sq. mm.)	Aluminium Factor for Aluminium Armoured Cable with Aluminium Conductor					
	3.3 KV	6.6 KV (E)	11 KV (E)/ 6.6 KV (UE)	11 KV (UE)	22 KV (E)	33 KV (E)
35	0.251	0.284	0.301	0.344	0.358	0.473
50	0.312	0.336	0.352	0.397	0.408	0.672
70	0.385	0.409	0.423	0.469	0.501	0.723
95	0.476	0.500	0.518	0.637	0.656	0.856
120	0.561	0.586	0.601	0.726	0.744	0.949
150	0.653	0.678	0.696	0.823	0.842	1.050
185	0.773	0.797	0.893	0.949	0.965	1.183
240	0.997	1.063	1.083	1.139	1.154	1.387
300	1.209	1.271	1.283	1.333	1.307	1.753
400	1.438	1.556	1.565	1.620	1.636	2.046
500	1.873	1.901	1.910	2.110	2.128	2.484
630	2.337	2.361	2.369	2.580	2.595	2.978
800	3.007	3.071	3.080	3.145	3.163	3.588
1000	3.737	3.741	3.749	3.804	3.822	4.565

TABLE H2
VARIATION FACTOR FOR POLYMER (CCFAI / CCFCu)
3 CORE XLPE INSULATED 3.3 to 33 KV POWER CABLES WITH COPPER / ALUMINIUM CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm)	3.3 KV ARM	6.6 KV (E) ARM	6.6 KV (UE) / 11 KV (E) ARM	11 KV (UE) ARM	22 KV (E) ARM	33 KV (E) ARM
35	0.374	0.990	1.142	1.604	1.782	-
50	0.445	1.119	1.260	1.834	2.046	2.864
70	0.547	1.290	1.396	2.011	2.284	3.219
95	0.594	1.440	1.647	2.269	2.428	3.367
120	0.732	1.692	1.877	2.498	2.715	3.646
150	0.812	1.906	2.061	2.767	2.931	3.927
185	0.960	2.086	2.406	3.028	3.180	4.166
240	1.130	2.484	2.744	3.398	3.580	4.589
300	1.219	2.912	3.161	3.840	4.016	5.029
400	1.313	3.530	3.664	4.353	4.666	5.736
500	1.652	3.925	3.971	4.621	4.878	5.913
630	1.949	4.487	4.982	5.225	5.477	6.696

Fillers added in PVC consumption

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TABLE H3
 VARIATION FACTOR FOR STEEL (FeF)
 XLPE INSULATED 3.3 TO 33 KV POWER CABLES WITH COPPER / ALUMINIUM CONDUCTOR

Nominal Cross Sectional Area Sq. mm.	3.3 KV	6.6 KV (E)	11 KV (E) / 6.6 KV (UE)	11 KV (UE)	22 KV (E)	33 KV (E)
25	0.551	0.604	0.656	0.814		
35	0.645	0.645	0.731	0.879	0.937	-
50	0.675	0.703	0.761	0.937	0.966	1.181
70	0.761	0.761	0.849	0.996	1.055	1.289
95	0.820	0.849	0.907	1.083	1.113	1.348
120	0.879	0.907	0.966	1.142	1.172	1.406
150	0.966	0.966	1.055	1.201	1.259	1.494
185	1.025	1.055	1.113	1.259	1.318	1.553
240	1.142	1.142	1.231	1.377	1.406	1.641
300	1.231	1.259	1.318	1.465	1.524	1.758
400	1.348	1.406	1.435	1.582	1.641	1.876

1365613/2023/PS-PEM-PGIII



IEEMA (PVC)/CABLE(R-1)/2017

Effective from: 1st November 217

TABLE H4

VARIATION FACTOR FOR ALUMINIUM (AIF)

XLPE INSULATED SINGLE CORE 3.3 TO 33 KV POWER CABLES WITH COPPER CONDUCTOR

Nominal Cross Sectional Area (in Sq. mm.)	Aluminium Factor for Aluminium Armoured Cable with Copper Conductor					
	3.3 KV	6.6 KV (E)	11 KV (E)/ 6.6 KV (UE)	11 KV (UE)	22 KV (E)	33 KV (E)
35	0.153	0.187	0.204	0.247	0.258	0.372
50	0.179	0.203	0.220	0.262	0.275	0.425
70	0.196	0.219	0.233	0.278	0.311	0.444
95	0.213	0.237	0.254	0.373	0.392	0.470
120	0.228	0.253	0.268	0.393	0.410	0.488
150	0.243	0.269	0.287	0.414	0.432	0.504
185	0.261	0.285	0.381	0.437	0.455	0.526
240	0.324	0.389	0.410	0.465	0.480	0.556
300	0.365	0.428	0.440	0.490	0.510	0.737
400	0.432	0.471	0.480	0.536	0.552	0.783
500	0.489	0.517	0.526	0.726	0.744	0.844
630	0.544	0.568	0.572	0.787	0.801	0.902
800	0.706	0.787	0.797	0.862	0.880	0.982
1000	0.824	0.865	0.867	0.923	0.940	1.324

TABLE - H5

VARIATION FACTOR FOR STEEL (FeW)

XLPE INSULATED 3.3KV TO 33 KV POWER CABLES WITH COPPER / ALUMINIUM CONDUCTOR

Nominal Cross Sectional Area in Sq. mm	3.3/3.3 KV	3.3/6.6 KV	11 KV (E) / 6.6 KV (UE)	11 KV (UE)	22 KV (E)	33 KV (E)
25	1.258	1.457	1.612	2.509	1.503	--
35	1.361	1.569	1.853	2.644	2.797	2.517
50	1.682	1.687	2.321	2.800	2.921	4.569
70	2.033	1.979	2.503	3.219	3.347	4.809
95	2.202	2.507	2.718	4.019	4.200	5.437
120	2.371	2.675	2.882	4.241	4.416	6.713
150	2.870	2.847	3.265	4.447	4.621	6.976
185	3.121	3.309	4.148	4.726	5.289	7.356
240	3.758	4.227	4.442	5.442	6.651	7.718
300	4.099	5.024	5.182	6.894	7.084	8.187
400	5.750	6.572	6.658	7.433	7.657	8.760
500	6.716	6.777	6.861	7.588	7.797	8.830
630	7.492	7.465	7.477	8.209	8.386	9.413

	CORPORATE QUALITY ASSURANCE/ कॉर्पोरेट गुणवत्ता आश्वासन MAIN CONTRACTOR'S PROPOSAL CUM EVALUATION REPORT मुख्य संविदाकार प्रस्ताव सह मुल्यांकन रिपोर्ट		

Ref No: संदर्भ सं.:		Date: तिथि:	
i.	Main Contractor मुख्य संविदाकार		
ii.	Project परियोजना		
iii.	Package Name पैकेज का नाम	Package No पैकेज सं.	
iv.	Proposed Item/Scope of Sub-contracting उप-संविदा(अनुबंध) का प्रस्तावित मद/ दायरा		
v.	Item covered under निम्नलिखित के अंतर्गत शामिल मद	Schedule-1 /अनुसूची- 1	As per contract clause No- अनुबंध के अनुसार खंड सं.- -
		Schedule-2 अनुसूची- -2	
vi.	If item is Schedule-1 and proposed sub-vendor is indigenous, Main Contractor to explain how the contractual provisions will be fulfilled /यदि मद अनुसूची -1 है और प्रस्तावित उप-विक्रेता स्वदेशी है, तो मुख्य संविदाकार को स्पष्ट करना होगा कि संविदा/अनुबंध के प्रावधान कैसे पूरे किए जाएंगे		
vii.	Name and Address of the proposed Sub-vendor's works /प्रस्तावित सब-वेंडर का नाम तथा पता		
viii.	PO placement date/ Start of manufacturing (if self-manufactured) as per L2 network पीओ नियोजन की तिथि / एल- 2 नेटवर्क के अनुसार विनिर्माण (यदि स्व-निर्मित है) की शुरुआत		
ix.	Item Description (Type/Size/Rating/Scope of Sub-Contracting) मद का विवरण (प्रकार / आकार / रेटिंग / उप-अनुबंध का दायरा)	Total quantity of proposed item envisaged in this package (Nos/ Running Meters/ Kgs/ Tons etc) इस पैकेज में परिकल्पित प्रस्तावित मद की कुल मात्रा (संख्या / क्रियाशील मीटर / किलोग्राम / टन आदि)	Quantity proposed to be procured from proposed sub-vendor (Nos/ Running Meters /Kgs /Tons etc) प्रस्तावित उप-विक्रेता (संख्या / क्रियाशील मीटर / किलोग्राम / टन आदि) से खरीदी जाने वाली मात्रा
			Timeline for quantity requirements as per project schedule & whether the proposed Sub-vendor equipped with adequate capacity to supply proposed order quantity in time / परियोजना समय सूची के अनुसार मात्रा आवश्यकताओं के लिए समय-सीमा और क्या प्रस्तावित उप-विक्रेता समय पर प्रस्तावित मांग की मात्रा की आपूर्ति करने में पूरी तरह से सक्षम है

	CORPORATE QUALITY ASSURANCE/ कॉर्पोरेट गुणवत्ता आश्वासन MAIN CONTRACTOR'S PROPOSAL CUM EVALUATION REPORT मुख्य संविदाकार प्रस्ताव सह मुल्यांकन रिपोर्ट

x.	<i>Supply experience of the proposed sub-vendor (including supplies to Main Contractor, if any) for similar item/scope of sub-contracting, for last 3 years (Note:- Only relevant experience details w.r.t. proposed item/scope of subcontracting to be brought out here)</i> पिछले 3 वर्षों के लिए उप-अनुबंध के समान मद / दायरे के लिए प्रस्तावित सब-वेंडर (मुख्य संविदाकार हेतु आपूर्ति, यदि कोई हो, सहित) का आपूर्ति अनुभव (नोट: - उप-अनुबंध के प्रस्तावित मद / दायरे के संबंध में केवल प्रासंगिक अनुभव के विवरण का उल्लेख हो)								
	Project/Package परियोजना/पैकेज	Customer Name ग्राहक का नाम	Supplied Item (Type/Rating/Model /Capacity/Size etc) आपूर्ति मद (प्रकार/रेटिंग /मॉडल /क्षमता/आकार आदि)	PO ref no/date पीओ संदर्भ सं. /तिथि	Supplied Quantity आपूर्ति की मात्रा	Date of Supply आपूर्ति की तिथि			
<i>We confirm that as per our assessment, the proposed sub-vendor has requisite capabilities & supply experience and is suitable for supplying the proposed item/scope of sub-contracting/हम अपने आकलन के अनुसार इस बात की पुष्टि करते हैं कि, प्रस्तावित उप-विक्रेता के पास अपेक्षित क्षमता और आपूर्ति करने का अनुभव है और उप-अनुबंध के दायरे /प्रस्तावित मद की आपूर्ति के लिए उपयुक्त है।</i>									
Name: नाम:		Desig: पद:		Contact No: दूरभाष सं.:		Sign: हस्ताक्षर:		Date: तिथि:	

Company's Seal/Stamp:- कंपनी का मुहर:-

	CORPORATE QUALITY ASSURANCE/ कॉर्पोरेट गुणवत्ता आश्वासन SUB-VENDOR QUESTIONNAIRE/ सब-वेंडर प्रश्नावली
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	संख्या, उनकी योग्यता, मशीन और उपलब्ध उपकरण आदि)	(if applicable) लागू / लागू नहीं, अगर विनिर्माण मुख्य संविदाकार / खरीददार के डिजाइन के अनुसार है) विवरण अनुलग्नक -एफ 2.2 पर संलग्न है। (यदि लागू हो)
7.	Overall organization Chart with Manpower Details (Design/Manufacturing/Quality etc) मैनपावर विवरण के साथ समग्र संगठन का चार्ट(डिजाइन / विनिर्माण / गुणवत्ता आदि)	Details attached at Annexure – F2.3 विवरण अनुलग्नक – F2.3 में संलग्न है।
8.	After sales service set up in India, in case of foreign sub-vendor(Location, Contact Person, Contact details etc.) भारत में बिक्री सेवा की स्थापना के बाद, विदेशी उप-विक्रेता के मामले में(स्थल, संपर्क व्यक्ति, संपर्क विवरण आदि)	Applicable / Not applicable लागू / लागू नहीं Details attached at Annexure – F2.4 विवरण अनुलग्नक -2.4 पर संलग्न है।
9.	Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any फ्लोचार्ट सहित विनिर्माण प्रक्रिया निष्पादन योजना, जिसमें आउटसोर्स प्रक्रिया, यदि कोई हो, सहित कच्चे माल से तैयार उत्पाद तक विनिर्माण के विभिन्न चरणों को दर्शाया गया हो,	Details attached at Annexure – F2.5 विवरण अनुलग्नक - F2.5में संलग्न है।
10.	Sources of Raw Material/Major Bought Out Item कच्चे माल के स्रोत / खरीदे हुए मुख्य मद	Details attached at Annexure – F2.6 विवरण अनुलग्नक - F2.6में संलग्न है।
11.	Quality Control exercised during receipt of raw material/BOI, in-process, Final Testing, packing कच्चे माल / खरीदे हुए मद, प्रक्रियाबद्ध, अंतिम परीक्षण, पैकिंग करते समय गुणवत्ता नियंत्रण	Details attached at Annexure – F2.7 विवरण अनुलग्नक - F2.7 पर संलग्न है
12.	Manufacturing facilities (List of machines, special process facilities, material handling etc.) विनिर्माण सुविधा(मशीनों की सूची, विशेष प्रक्रिया सुविधाएं, सामग्री रख-रखाव आदि)	Details attached at Annexure – F2.8 विवरण अनुलग्नक - F2.8में संलग्न है।
13.	Testing facilities (List of testing equipment) परीक्षण सुविधाएं(परीक्षण उपकरण की सूची)	Details attached at Annexure – F2.9 विवरण अनुलग्नक – F2. 9 में संलग्न है।
14.	If manufacturing process involves fabrication then- यदि निर्माण प्रक्रिया में फेब्रिकेशन की गई है तो- List of qualified Welders पात्र वेल्डर की सूची	Applicable / Not applicable लागू / लागू नहीं Details attached at Annexure – F2.10 विवरण अनुलग्नक - F2.10में संलग्न है।

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i.	Item/Scope of Sub-contracting उप-संविदा(अनुबंध) का मद/ दायरा			
ii.	Address of the registered office पंजीकृत कार्यालय का पता 	Details of Contact Person संपर्क व्यक्ति का विवरण <i>(Name, Designation, Mobile, Email)</i> (नाम, पदनाम, मोबाइल, ईमेल)		
iii.	Name and Address of the proposed Sub-vendor's works where item is being manufactured प्रस्तावित उप-विक्रेता के कार्यों का नाम और पता, जहां मद का निर्माण किया जा रहा है 	Details of Contact Person: संपर्क व्यक्ति का विवरण <i>(Name, Designation, Mobile, Email)</i> (नाम, पदनाम, मोबाइल, ईमेल)		
iv.	Annual Production Capacity for proposed item/scope of sub-contracting उप-संविदा(अनुबंध) के प्रस्तावित मद / दायरे के लिए वार्षिक उत्पादन क्षमता			
v.	Annual production for last 3 years for proposed item/scope of sub-contracting उप-संविदा(अनुबंध) के प्रस्तावित मद / दायरे के लिए पिछले 3 वर्षों का वार्षिक उत्पादन			
vi.	Details of proposed works प्रस्तावित कार्यों का विवरण			
1.	Year of establishment of present works वर्तमान फैक्टरी की स्थापना का वर्ष			
2.	Year of commencement of manufacturing at above works उपरोक्त फैक्टरी में निर्माण कार्य शुरू होने का वर्ष			
3.	Details of change in Works address in past (if any) पूर्व में फैक्टरी स्थल में परिवर्तन का विवरण (यदि कोई हो)			
4.	Total Area कुल क्षेत्र Covered Area शामिल क्षेत्र			
5.	Factory Registration Certificate फैक्टरी पंजीकरण प्रमाण पत्र	Details attached at Annexure – F2.1 विवरण अनुलग्नक- एफ 2.1 पर संलग्न है		
6.	Design/ Research & development set-up डिजाइन / अनुसंधान और विकास सेटअप (No. of manpower, their qualification, machines & tools employed etc.) (श्रमिकों की	Applicable / Not applicable if manufacturing is as per Main Contractor/purchaser design) Details attached at Annexure – F2.2		

	CORPORATE QUALITY ASSURANCE/ कॉर्पोरेट गुणवत्ता आश्वासन SUB-VENDOR QUESTIONNAIRE/ सब-वेंडर प्रश्नावली
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	<i>List of qualified NDT personnel with area of specialization</i> विशेषज्ञता के क्षेत्र सहित पात्र एनडीटी कार्मिकों की सूची	<i>(if applicable)</i> लागू / लागू नहीं			
15.	<i>List of out-sourced manufacturing processes with Sub-Vendors' names & addresses</i> सब-वेंडर द्वारा बाह्य स्रोतों (उनके नाम और पते सहित) से करवाए गए निर्माण प्रक्रियाओं की सूची	<i>Applicable / Not applicable</i> लागू / लागू नहीं <i>Details attached at Annexure. –F2.11</i> विवरण अनुलग्नक - F2.10 में संलग्न है। <i>(if applicable)</i> (यदि लागू हो)			
16.	<i>Supply reference list including recent supplies</i> नवीनतम आपूर्ति सहित आपूर्ति संदर्भ सूची	<i>Details attached at Annexure – F2.12</i> विवरण अनुलग्नक - F2.12 में संलग्न है। <i>(as per format given below)</i> (नीचे दिए गए प्रारूप के अनुसार)			
Project/ package परियोजना /पैकेज	Customer Name ग्राहक का नाम	Supplied Item (Type/Rating/Model /Capacity/Size etc) आपूर्ति की गई वस्तु (प्रकार / रेटिंग / मॉडल / क्षमता / आकार आदि)	PO ref no/date पीओ संदर्भ सं. / तिथि	Supplied Quantity आपूर्ति की मात्रा	Date of Supply आपूर्ति की तारीख
17.	<i>Product satisfactory performance feedback letter/certificates/End User Feedback</i> उत्पाद के संतोषजनक प्रदर्शन संबंधी फीडबैक पत्र / प्रमाण पत्र / अंतिम उपयोगकर्ता फीडबैक	<i>Attached at annexure - F2.13</i> अनुलग्नक F2.13 पर संलग्न है			
18.	<i>Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product (similar or higher rating)</i> प्रस्तावित उत्पाद (एक समान या उच्च रेटिंग वाले) के लिए टाइप टेस्ट रिपोर्ट (टाइप टेस्ट विवरण, रिपोर्ट संख्या, एजेंसी, जांच की तारीख) का सारांश <i>Note:- Reports need not to be submitted</i>	<i>Applicable / Not applicable</i> लागू / लागू नहीं <i>Details attached at Annexure – F2.14</i> विवरण अनुलग्नक - F2.14 में संलग्न है <i>(if applicable)</i> (यदि लागू हो)			
19.	<i>Statutory / mandatory certification for the proposed product</i> प्रस्तावित उत्पाद के लिए वैधानिक / अनिवार्य प्रमाणीकरण	<i>Applicable / Not applicable</i> लागू / लागू नहीं <i>Details attached at Annexure – F2.15</i> <i>(if applicable)</i> (यदि लागू हो)			
20.	<i>Copy of ISO 9001 certificate</i> आईएसओ 9001 प्रमाण पत्र की प्रति <i>(if available)</i> (यदि उपलब्ध हो)	<i>Attached at Annexure – F2.16</i> अनुलग्नक में संलग्न - F2.16 है			
21.	<i>Product technical catalogues for proposed item (if available)</i> प्रस्तावित मद के लिए उत्पाद तकनीकी कैटलॉग (यदि उपलब्ध हो)	<i>Details attached at Annexure – F2.17</i> विवरण अनुलग्नक - F2.17 में संलग्न है			

	CORPORATE QUALITY ASSURANCE/ कॉर्पोरेट गुणवत्ता आश्वासन		
	SUB-VENDOR QUESTIONNAIRE/ सब-वेंडर प्रश्नावली		

Name: नाम:	Desig: पद:	Sign: हस्ता क्षर:	Date: तिथि :
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Company's Seal/Stamp:- कंपनी की मुहर / मोहर: -

INTEGRITY PACT**Between**

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi - 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for _____

_____ (hereinafter referred to as "Contract"). The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint panel of Independent External Monitor(s) (IEMs), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1- Commitments of the Principal

- 1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles: -
 - 1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.
 - 1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.
 - 1.1.3 The Principal will exclude from the process all known prejudiced persons.
- 1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

Section 2 - Commitments of the Bidder(s)/ Contractor(s)

- 2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. The Bidder(s)/ Contractor(s) commits himself to observe the following principles during participation in the tender process and during the contract execution.

- 2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he/ she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.
- 2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.
- 2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant Indian Penal Code (IPC) and Prevention of Corruption Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
- 2.1.4 Foreign Bidder(s)/ Contractor(s) shall disclose the name and address of agents and representatives in India and Indian Bidder(s)/ Contractor(s) to disclose their foreign principals or associates. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.
- 2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.
- 2.3 The Bidder(s)/ Contractor(s) shall not approach the Courts while representing the matters to IEMs and shall await their decision in the matter.

Section 3 - Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/ Contractor(s) from the tender process, terminate the contract, if already awarded, exclude from future business dealings and/ or take action as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 4 - Compensation for Damages

- 4.1 If the Principal has disqualified the Bidder (s) from the tender process before award / order acceptance according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.
- 4.2 If the Principal is entitled to terminate the Contract according to Section 3, or terminates the Contract in application of Section 3 above, the Bidder(s)/ Contractor (s) transgression through a violation of Section 2 above shall be construed breach of contract and the Principal shall be entitled to demand and recover from the Contractor an amount equal to 5% of the contract value or the amount equivalent to Security Deposit/ Performance Bank Guarantee, whichever is higher, as damages, in addition to and without prejudice to its right to demand and recover compensation for any other loss or damages specified elsewhere in the contract.

Section 5 - Previous Transgression

- 5.1 The Bidder declares that no previous transgressions occurred in the last 3 (three) years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.
- 5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason or action can be taken as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

Section 6 - Equal treatment of all Bidder (s)/ Contractor (s) / Sub-contractor (s)

- 6.1 The Principal will enter into Integrity Pacts with identical conditions as this Integrity Pact with all Bidders and Contractors.
- 6.2 In case of Sub-contracting, the Principal Contractor shall take the responsibility of the adoption of Integrity Pact by the Sub-contractor(s) and ensure that all Sub-contractors also sign the Integrity Pact.
- 6.3 The Principal will disqualify from the tender process all Bidders who do not sign this Integrity Pact or violate its provisions.

Section 7 - Criminal Charges against violating Bidders/ Contractors /Subcontractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 -Independent External Monitor(s)

- 8.1 The Principal appoints competent and credible panel of Independent External Monitor (s) (IEMs) for this Integrity Pact. The task of the IEMs is to review independently and objectively, whether and to what extent the parties comply with the obligations under this Integrity Pact.
- 8.2 The IEMs are not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.
- 8.3 The IEMs shall be provided access to all documents/ records pertaining to the Contract, for which a complaint or issue is raised before them as and when warranted. However, the documents/records/information having National Security implications and those documents which have been classified as Secret/Top Secret are not to be disclosed.
- 8.4 The Principal will provide to the IEMs sufficient information about all meetings among the parties related to the Contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the IEMs the option to participate in such meetings.

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- 8.5 The advisory role of IEMs is envisaged as that of a friend, philosopher and guide. The advice of IEMs would not be legally binding and it is restricted to resolving issues raised by a Bidder regarding any aspect of the tender which allegedly restricts competition or bias towards some Bidders. At the same time, it must be understood that IEMs are not consultants to the Management. Their role is independent in nature and the advice once tendered would not be subject to review at the request of the organization.
- 8.6 For ensuring the desired transparency and objectivity in dealing with the complaints arising out of any tendering process or during execution of Contract, the matter should be examined by the full panel of IEMs jointly, who would look into the records, conduct an investigation, and submit their joint recommendations to the Management.
- 8.7 The IEMs would examine all complaints received by them and give their recommendations/ views to the CMD, BHEL at the earliest. They may also send their report directly to the CVO, in case of suspicion of serious irregularities requiring legal/ administrative action. Only in case of very serious issue having a specific, verifiable Vigilance angle, the matter should be reported directly to the Commission. IEMs will tender their advice on the complaints within 30 days.
- 8.8 The CMD, BHEL shall decide the compensation to be paid to the IEMs and its terms and conditions.
- 8.9 IEMs should examine the process integrity, they are not expected to concern themselves with fixing of responsibility of officers. Complaints alleging mala fide on the part of any officer of the Principal should be looked into by the CVO of the Principal.
- 8.10 If the IEMs have reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant Indian Penal Code / Prevention of Corruption Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the IEMs may also transmit this information directly to the Central Vigilance Commissioner, Government of India.
- 8.11 After award of work, the IEMs shall look into any issue relating to execution of Contract, if specifically raised before them. As an illustrative example, if a Contractor who has been awarded the Contract, during the execution of Contract, raises issue of delayed payment etc. before the IEMs, the same shall be examined by the panel of IEMs. Issues like warranty/ guarantee etc. shall be outside the purview of IEMs.
- 8.12 However, the IEMs may suggest systemic improvements to the management of the Principal, if considered necessary, to bring about transparency, equity and fairness in the system of procurement.
- 8.13 The word 'Monitor' would include both singular and plural.

Section 9 - Pact Duration

- 9.1 This Integrity Pact shall be operative from the date this Integrity Pact is signed by both the parties till the final completion of contract for successful Bidder, and for all other Bidders 6 months after the Contract has been awarded. Any violation of the same would entail disqualification of the bidders and exclusion from future business dealings.
- 9.2 If any claim is made/ lodged during currency of this Integrity Pact, the same shall be binding and continue to be valid despite the lapse of this Pact as specified above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 - Other Provisions

- 10.1 This Integrity Pact is subject to Indian Laws and exclusive jurisdiction shall be of the competent Courts as indicated in the Tender or Contract, as the case may be.
- 10.2 Changes and supplements as well as termination notices need to be made in writing.
- 10.3 If the Bidder(s)/ Contractor(s) is a partnership or a consortium or a joint venture, this Integrity Pact shall be signed by all partners of the partnership or joint venture or all consortium members.
- 10.4 Should one or several provisions of this Integrity Pact turn out to be invalid, the remainder of this Integrity Pact remains valid. In this case, the parties will strive to come to an agreement to their original intentions.
- 10.5 Only those bidders / contractors who have entered into this Integrity Pact with the Principal would be competent to participate in the bidding. In other words, entering into this Integrity Pact would be a preliminary qualification.
- 10.6 In the event of any dispute between the Principal and Bidder(s)/ Contractor(s) relating to the Contract, in case, both the parties are agreeable, they may try to settle dispute through Mediation before the panel of IEMs in a time bound manner. In case, the dispute remains unresolved even after mediation by the panel of IEMs, either party may take further action as the terms & conditions of the Contract. The fees/expenses on dispute resolution through mediation shall be shared by both the parties. Further, the mediation proceedings shall be confidential in nature and the parties shall keep confidential all matters relating to the mediation proceedings including any settlement agreement arrived at between the parties as outcome of mediation. Any views expressed, suggestions, admissions or proposals etc. made by either party in the course of mediation shall not be relied upon or introduced as evidence in any further arbitral or judicial proceedings, whether or not such proceedings relate to the dispute that is the subject of mediation proceedings. Neither of the parties shall present IEMs as witness in any Alternative Dispute Resolution or judicial proceedings in respect of the dispute that was subject of mediation.

For and on behalf of Principal
(Office Seal)

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For & On behalf of the Bidder/ Contractor
(Office Seal)

Witness: _____
(Name & Address) _____

Witness: _____
(Name & Address) _____
