1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V

Price Schedule (SCREENED CONTROL CABLES)-MAIN SUPPLY

1.0 MAIN SUPPLY

1.1) Individual & Overall Screened Cable (Type-F)-armoured cable

S.No.	Item code	HSN CODE	Item name	UOM	Ordered Quantity	UNIT EX-WORKS PRICE (DULY PACKED) (INR)	TOTAL EX- WORKS PRICE (DULY PACKED) (INR)
1	507-31082-A	8544	225V TYPE F(IO) 2P-0.5 ARMOURED	MTR	30000		
2	507-31045-A	8544	225V TYPE F(IO) 4P - 0.5 ARMOURED	MTR	20000		
3	507-31049-A	8544	225V TYPE F(IO) 8P - 0.5 ARMOURED	MTR	13000		
4	507-31037-A	8544	225V TYPE F(IO) 12P - 0.5 ARMOURED	MTR	7000		
5	507-31037-A	8544	225V TYPE F(IO) 16P - 0.5 ARMOURED	MTR	9000		

1.2) Overall Screened Cable (Type-G)-Unarmoured cable

S.No.	Item code	HSN CODE	Item name	UOM	Ordered Quantity	UNIT EX-WORKS PRICE (DULY PACKED) (INR)	TOTAL EX- WORKS PRICE (DULY PACKED) (INR)
1	507-31065-A	8544	225V TYPE G(O) 4P - 0.5 ARMOURED	MTR	32000		
2	507-31069-A	8544	225V TYPE G(O) 8P - 0.5 ARMOURED	MTR	52000		
3	507-31053-A	8544	225V TYPE G(O) 12P - 0.5 ARMOURED	MTR	25000		
4	507-31067-A	8544	225V TYPE G(O) 4P - 1.5 ARMOURED	MTR	52000		

NOTES :

1	Quantities indicated above shall be known as Order Quantities. Quantity variation shall be as per NIT.
2	The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ-Cum-Price Schedule. The unit prices shall apply for adjustment of variation in quantity as stipulated above.
3	Manufacturing of the cables shall be taken up by the successful bidder only after approval of technical and quality documentation. Subsequent Quantity shall be cleared for manufacture based on progress of engineering & site requirements.
4	Delivery schedule of Quantites shall be as per NIT.
5	Unit price of cables quoted by bidder shall be inclusive of type test charges. No separate charges shall be payable for type tests.
6	The standard drum length shall be 1000 meters upto and including 8 pairs and 500 meters above 8 pairs. Tolerance on individual drum length shall be ±5%.
7	Overall tolerance on total dispatched quantity of each size shall be (-) 2% and (+) 0% except where the total ordered quantity is one single drum length of 1000m/500m, in which case it shall be -5%/0%. Cables consumed for testing and inspection shall be to bidder's account.
8	In case of the quantities cleared by BHEL for manufacturing are manufactured and offered for inspection by successful bidder in more than one batch, BHEL reserves the right to witness type testing on all batches without any price implications.

1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V

Price Schedule (SCREENED CONTROL CABLES)-MANDATORY SPARES

1.0 MANDATORY SPARES

1.1) Individual & Overall Screened Cable (Type-F)-armoured cable

S.No.	Item code	HSN CODE	Item name	UOM	Ordered Quantity	UNIT EX-WORKS PRICE (DULY PACKED) (INR)	TOTAL EX- WORKS PRICE (DULY PACKED) (INR)
1	507-31082-A	8544	225V TYPE F(IO) 2P-0.5 ARMOURED	MTR	3000		
2	507-31045-A	8544	225V TYPE F(IO) 4P - 0.5 ARMOURED	MTR	3000		
3	507-31049-A	8544	225V TYPE F(IO) 8P - 0.5 ARMOURED	MTR	3000		
4	507-31037-A	8544	225V TYPE F(IO) 12P - 0.5 ARMOURED	MTR	3000		
5	507-31034-A	8544	225V TYPE F(IO) 16P - 0.5 ARMOURED	MTR	3000		

1.2) Overall Screened Cable (Type-G)-Unarmoured cable

S.No.	Item code	HSN CODE	Item name	UOM	Ordered Quantity	UNIT EX-WORKS PRICE (DULY PACKED) (INR)	TOTAL EX- WORKS PRICE (DULY PACKED) (INR)
1	507-31065-A	8544	225V TYPE G(O) 4P - 0.5 ARMOURED	MTR	3000		
2	507-31069-A	8544	225V TYPE G(O) 8P - 0.5 ARMOURED	MTR	3000		
3	507-31053-A	8544	225V TYPE G(O) 12P - 0.5 ARMOURED	MTR	3000		
4	507-31067-A	8544	225V TYPE G(O) 4P - 1.5 ARMOURED	MTR	3000		

NOTES :

1	Quantities indicated above shall be known as Order Quantities. Quantity variation shall be as per NIT.
2	The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ-Cum-Price Schedule. The unit prices shall apply for adjustment of variation in quantity as stipulated above.
3	Manufacturing of the cables shall be taken up by the successful bidder only after approval of technical and quality documentation. Subsequent Quantity shall be cleared for manufacture based on progress of engineering & site requirements.
4	Delivery schedule of Quantites shall be as per NIT.
5	Unit price of cables quoted by bidder shall be inclusive of type test charges. No separate charges shall be payable for type tests.
6	The standard drum length shall be 1000 meters upto and including 8 pairs and 500 meters above 8 pairs. Tolerance on individual drum length shall be ±5%.
7	Overall tolerance on total dispatched quantity of each size shall be (-) 2% and (+) 0% except where the total ordered quantity is one single drum length of 1000m/500m, in which case it shall be -5%/0%. Cables consumed for testing and inspection shall be to bidder's account.
8	In case of the quantities cleared by BHEL for manufacturing are manufactured and offered for inspection by successful bidder in more than one batch, BHEL reserves the right to witness type testing on all batches without any price implications.

Annexure I

Sl. No.	Package Co	Package name	DEPTT	BHEL Drawing No	Drawing Title	Primary/Secondary	Drg Sch for Vendors	Standard Delivery Terms for Supply Portion
1	507-31000-A	SCREENED CONTROL CABLES	ELECT	PE-V0-XXX-507-E143	CROSS SECTION DRGS. - SCREENEDCONTROL CABLES	Primary	R-0 within 14 days from PO & subsequent revisions within 10 days of comments received from BHEL.	Within Four (04) months from date of CAT-1 approval of Primary drawing/documents or BHEL manufacturing clearance whichever is later, subjected to drawing/document submission/re-submission schedule as stipulated, in case of any delay in submission/ resubmission of Primary drawing/documents, then same shall be reduced from the given delivery period. Additional Qty. (if provided separately under Qty. var. clause of contract): Supply within Three (03) months from the date of Quantity clearance by BHEL.
				PE-V0-XXX-507-E916	QUALITY PLAN - SCREENEDCONTROL CABLES	Primary		
				PE-V0-XXX-507-E141	TECHNICAL DATA SHEET - SCREENEDCONTROL CABLES	Primary		
				PE-V0-XXX-507-E144	TYPE TEST CERTIFICATES - SCREENEDCONTROL CABLES	Secondary	Within 1 week after conduction of type test	

Notes

a. The end period specified is for completion of the deliveries. Deliveries to start progressively so as to meet the completion schedule.

b. The delivery conditions specified are for contractual LD purposes, however BHEL may ask for early deliveries without any compensation thereof.

c. Wherever schedule of drawings/documents submission / re-submission is stipulated in the Technical Specifications, same shall be superseded by delivery specified in NIT.

d. Vendor to start manufacturing activities only after obtaining specific manufacturing clearance from BHEL Purchase group.

BHEL	**1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V** **PRE-QUALIFICATION REQUIRMENTS FOR SCREENED CONTROL CABLE**	PE-PQ-445-507-E016 REVISION NO. 00 DATE 06/09/2022 SHEET NO. 1 OF 1

ITEMS : Screened Control Cable **SCOPE :** Supply : YES; Erection & Commissioning : NO	
1.0	Vendor should be a manufacturer of screened/ instrumentation control cables.
2.0	Availability of test reports of tests on FRLS screened control cables to establish in-house Capability to carry out all routine, type acceptance as per relevant IS/ International Standards (except UV radiation & hydrolytic stability Test which can be conducted at Govt. Lab/ Govt. approved Independent lab).
3.0	Capacity of manufacturing 100 km of screened control cables per month.
4.0	Manufactured and supplied at least one (1) km of FRLS cables.
5.0	Manufactured and supplied screened control cables up to 16 pairs.
6.0	Manufactured and supplied at least 250 Km of Screened Control cables in one or more orders and at least 50 Km in one single order.
7.0	Minimum two (2) nos. purchase orders for screened control cables shall be submitted which should not be more than five (5) years old from the date of techno-commercial bid opening for establishing continuity in business.

NOTES (General Points):

1. Consideration of offer shall be subject to customer's approval of bidders, if applicable.
2. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.
3. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities & capacity of the bidder 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 & all the other terms of the tender.

PREPARED BY	CHECKED BY	REVIEWED BY	APPROVED BY
06-09-2022	06/09/22	06/9/2022	6/9/22
DEVENDRA SINGH DY MANAGER	KAVITA GUPTA MANAGER	OMKAR KUMAR D.G.M.	DEBASISA RATH A.G.M. (DH-ELECT)

VOLUME-II

1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V

TECHNICAL SPECIFICATION

FOR

SCREENED CONTROL CABLE

SPECIFICATION NO: ***PE-TS-445-507-E004***

REVISION: **00**

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

	DOCUMENT TITLE **1 X 660 MW WBPDCL** **SAGARDIGHI EXTN UNIT V** TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES	SPECIFICATION NO. PE-TS-445-507-E004	
		VOLUME II	
		SECTION	
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(INCLUDING COVER/ SEPARATOR SHEETS)

	DOCUMENT TITLE **1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V** TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES	SPECIFICATION NO. PE-TS-445-507-E004	
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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 specification shall prevail).

BIDDER'S STAMP & SIGNATURE

	DOCUMENT TITLE **1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V** TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES	SPECIFICATION NO. PE-TS-445-507-E004	
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SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

	DOCUMENT TITLE **1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V** TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES	SPECIFICATION NO. PE-TS-445-507-E004	
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1.0 SCOPE

1.1 Design, Manufacture, Inspection and testing at manufacture's works, proper packing and delivery to site of **Screened Control cables** conforming to this specification.

1.2 General technical requirements of the Screened Control 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 enclosed in NIT. Bidder to take care of the notes mentioned in price schedule.

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

3.0 SPECIFIC TECHNICAL REQUIREMENTS

S. No.	***Reference Clause No. of Section- II***	***Specific Requirement/ Change***
1	3.3	Shall be read as "Type testing requirements, routine/ acceptance testing and special testing requirements shall be as per Annexure – H to QP.
2	3.7 (clause is added)	If a cable drum fails in site testing, then that drum shall be supplied again by vendor free of cost to BHEL.

4.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

Schedule of drawing & documents to be submitted is part of NIT

4.1 Documents required along with the technical offer: -

a) Signed & Stamped copy of Compliance certificate.

b) Signed & stamped copy of unpriced price schedule with "quoted" word indicated against all items.

c) Deviation Schedule" with "NO DEVIATION" and bidder's signature and company stamp.

4.2 Documents required after award of LOI/PO shall be as per NIT (to be submitted by successful bidder).

NOTE: (*)

Quality Plan as enclosed in the technical specification is to be appended with cover sheet bearing document number & description as stated above. The signed & stamped copy for the same shall be submitted to BHEL. There shall be no commercial implication to BHEL on account of QP approval from BHEL/ end customer.

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DATA SHEET-A

SCREENED CONTROL CABLES

S.NO.	PARTICULARS	DETAILS
1	**VOLTAGE GRADE**	225V
2	**TYPE OF CABLES**	TYPE F (INDIVIDUAL & OVERALL SCREENED) & TYPE G (OVERALL SCREENED)
3	**CODES AND STANDARD**	VDE 0815, VDE 0207 (Part-4, Part-5, Part-6), VDE 0816, VDE 0472, IS 1554-I, IEEE-383, SEN 4241475 class F3, IEC 332 Part-1, IEC 332 Part-3 Cat-B, IS 10810 (latest editions and its amendments), IS 3975, IS 5831, IS 8130, IS 10418, IEC 754, ASTMD 2843, ASTMD 2863, BS 5308, BS 60228
3(i)	**CONDUCTOR**	
(a)	CROSS SECTION AREA	0.5 sq.mm, 1.5 sqmm (for DO signal)
(b)	CONDUCTOR MATERIAL	MULTI STRANDED TINNED ANNEALED HIGH CONDUCTIVITY COPPER
(c)	CONDUCTOR GRADE	ELECTROLYTIC GRADE CLASS-2 CONFIRMING TO IS 8130
(d)	NO. & DIA OF STRANDS	7 X 0.3 mm for 0.5 sqmm and 7 X 0.53 mm for 1.5 sqmm
(e)	NO. OF PAIRS	0.5 sq.mm. - 2P, 4P, 8P,12P 1.5 sq.mm. - 2P, 4P, 8P,12P
(f)	REFERENCE STANDARD	VDE0815
(ii)	**INSULATION**	
(a)	MATERIAL	EXTRUDED PVC (COMPOUND YI3) AS PER VDE 0207 PART 4
(b)	THICKNESS IN mm	BETWEEN 0.28 AND 0.35 MM FOR 0.5 SQMM CABLE AND BETWEEN 0.8 AND 0.9 MM FOR 1.5 SQMM CABLE
(c)	VOLUME RESISTIVITY (MIN) IN ohm-cm	i. 1 x 10^13 Ohm-cm at 27 deg.C / room temp. (Min) ii. 1x10^11 at 70 deg.C (Min)
(d)	REFERENCE STANDARD	VDE 0207 PART 4
(e)	OD OF COND. INCLUDING INSULATION	AS PER MANUFACTURER'S CALCULATIONS / STD. PRACTICE
(iii)	**PAIRING & TWISTING**	
(a)	MAX. LAY OF PAIRS (mm)	50
(b)	MIN. LAY OF PAIRS (mm)	20
(c)	CONDUCTOR /PAIR IDENTIFICATION	AS PER ATTACHED ANNEXURE D
4	**SHIELDING**	
(a)	TYPE OF SHIELDING	AL-MYLAR TAPE
(b)	INDIVIDUAL PAIR SHIELDING	TO BE PROVIDED FOR TYPE-F CABLE ONLY
(c)	OVERALL SHIELDING	TO BE PROVIDED FOR BOTH TYPE-F & TYPE-G CABLES
(d)	MINIMUM THICKNESS OF INDIVIDUAL PAIR SHIELDING	28 MICRONS
(e)	MINIMUM THICKNESS OF OVERALL CABLE ASSEMBLY SHIELDING	60 MICRONS
(f)	SHIELDING COVERAGE	100% WITH AT LEAST 25% OVERLAP
5	**DRAIN WIRE (To be provided separately for individual pair shield and overall shield)**	
	MATERIAL	STRANDED ANNEALED TINNED COPPER WIRE
	SIZE (NO. OF STRANDS/ DIA. OF EACH STRAND)	0.5 sq. mm. (7/0.3 mm.)
6	**FILLERS (if applicable)**	
(a)	TYPE	NON METALLIC FLAME AND MOISTURE RETARDANT (AS REQUIRED FOR MAINTAINING CABLE CIRCULARITY)
7	**INNER SHEATH**	
(a)	MATERIAL	EXTRUDED PVC (COMPOUND YM1) AS PER VDE 0207 PART 5
(b)	THICKNESS	AS PER VDE 0207 PART 5
(c)	WHETHER FRLSH	YES
(d)	COLOUR	BLACK
(e)	REFERENCE STANDARD	VDE 0207 PART 5
9	**ARMOUR**	GALVANISED STEEL ROUND WIRE / STRIP AS PER IS-3975 & IS-1554 PART-1

10	**OUTER SHEATH**		
(a)	MATERIAL	EXTRUDED PVC (COMPOUND YM1) AS PER VDE 0207 PART 5	
(b)	THICKNESS	AS PER VDE 0207 PART 5	
(c)	WHETHER FR-LSH	YES	
(d)	COLOUR	SKY BLUE	
(e)	REFERENCE STANDARD	VDE 0207 PART 5	
(f)	MARKING	(i) MANUFACTURER'S NAME AND/OR TRADE MARK, YEAR OF MANUFACTURE, VOLTAGE GRADE, TYPE OF CABLES (CONDUCTOR SIZE AND NO. OF PAIRS), INSULATION MATERIAL, FRLSH etc. - AT EVERY 5M (BY EMBOSSING/ PRINTING) (ii) PROGRESSIVE SEQUENTIAL MARKING OF LENGTH OF CABLE IN METERS- AT EVERY 1M (BY PRINTING)	
11	**TECHNICAL PARAMETERS (C & I) AT 20 DEG C**	0.5 and 1.5 sqmm (IS & OS) Type F	0.5 and 1.5 sqmm (OS) Type G
(a)	MUTUAL CAPACITANCE (MAX.) AT 0.8 KHz, nF / Km	120	100
(b)	CONDUCTOR LOOP RESISTANCE (MAX.), Ohm / Km	73.4 for 0.5 sqmm 24.6 for 1.5 sqmm	73.4 for 0.5 sqmm 24.6 for 1.5 sqmm
(c)	INSULATION RESISTANCE (MIN.), M Ohm / Km	100	100
(d)	CROSS TALK ATTENUATION (MIN.) AT 0.8KHz, dB / Km	60	60
(e)	CHARACTERISTIC IMPEDANCE (MAX.) AT 1KHz, Ohm	320 for 0.5 sqmm 230 for 1.5 sqmm	340 for 0.5 sqmm 240 for 1.5 sqmm
(f)	ATTENUATION (MAX.) AT 1KHz, dB / Km	1.2	1.2
12	**FR-LSH CHARACTERISTICS**		
(b)	SMOKE DENSITY RATING	MAX 60% (AS PER ASTM D 2843): AREA UNDER COVERAGE	
(c)	HALOGEN ACID GAS GENERATION	MAX 20% BY WEIGHT (AS PER IEC 754 PART 1)	
(d)	OXYGEN INDEX	MIN 29 AT ROOM TEMPERATURE (AS PER ASTMD 2863)	
(e)	TEMPERATURE INDEX	MIN 250 DEG.C AT OXYGEN INDEX VALUE OF 21 (AS PER ASTMD 2863)	
13	**FLAMMABILITY TEST**	(1) AS PER IEEE 383 (2) SWEDISH CHIMNEY TEST SEN-SS-424-1475-F3	
14	**TEST VOLTAGE AND DURATION (HIGH VOLTAGE TEST)**		
(a)	CORE TO CORE	1.5 kV FOR 1 MINUTE	
(b)	CORE TO SCREEN	1 kV FOR 1 MINUTE	
(b)	SCREEN TO ARMOUR	1 kV FOR 1 MINUTE	
15	**CABLE DRUM DETAILS**		
(a)	Material Type	WOODEN AS PER IS 10418	
(b)	Standard drum length	1000 M UPTO AND INCLUDING 8 PAIRS 500 M ABOVE 8 PAIRS	
(c)	Tolerance on drum length	±5%	
(g)	Particular information on Drum	THE CABLE DRUMS SHALL CARRY THE FOLLOWING DETAILS IN PRINTED FORM: A) MANUFACTURER'S NAME OR TRADE MAKE B) TYPE OF CABLE & VOLTAGE GRADE C) YEAR OF MANUFACTURE D) TYPE OF INSULATION E) NO. OF CORE AND SIZES OF CABLES F) CABLE CODE G) LENGTH OF CABLE ON DRUM H) NO. OF LENGTH ON DRUM IF MORE THAN ONE I) DIRECTION OF ROTATION BY ARROW J) APPROX GROSS MASS K) IS NUMBER AND ISI MARK	
16	**Tolerance on overall diameter**	±2 mm max. over declared value in technical data sheet	
17	**Tolerance on outer diameter at any cross section for entire length**	not more than 1.0 mm	
18	**Ovality**	not more than 1.0 mm	
19	**Bending radius**	15XOD	

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DATA SHEET-C

S.No.	Particulars	Unit	Description
1	Manufacturer's name	-	
2	Reference design standards	-	
3	Conductor size	sq. mm	
4	Rated Voltage	V	
5	Number of pairs	No.	
6	Cable suitable for both earthed & unearthed system	-	
7	Conductor		
	a) Material	-	
	b) Reference Standard	-	
	c) Grade	-	
	d) No. of strands	No.	
	e) Diameter of strands (nom.)	mm	
	f) Approx. dia of conductor	mm	
	g) Cross Section area	sq. mm	
	h) Maximum conductor resistance per Km at 20°C	ohm	
8	Insulation		
	a) Reference Standard	-	
	b) Material composition	-	
	c) Application	-	
	d) Minimum thickness	mm	
	e) Nom.Thickness	mm	
	f) Max. thickness	mm	
	g) Minimum volume resistivity as per IS 5831	Ohm cm	
	h) Dielectric constant	-	
	i) Maximum conductor temperature withstand capacity	°C	
	j) Core diameter including insulation	mm	
9	Core laying		
	a) Whether cores/pairs are twisted.	-	
	b) Minimum no. of twists per meter.		
	c) Maximum lay of twist	mm	
	d) Identification of cores/pairs	-	
10	Individual Shield		

	a) Material	-	
	b) Thickness of tape	micron	
	c) Coverage/ Overlap	%	
	d) Noise interference better than	dB	
11	Drain wire for individual shield		
	a) Reference standard	-	
	b) Size (No. of strands x dia. of each strand)	sq. mm (no. x mm)	
	c) Material	-	
	d) Resistance of drain wire per km at 20 deg.C	ohm	
12	Overall shield		
	a) Material	-	
	b) Thickness of tape	mm	
	c) Coverage/Overlap	%	
	d) Noise interference better than	dB	
13	Drain wire for overall shield		
	a) Reference standard	-	
	b) Size (No. of strands x dia. of each strand)	sq. mm (no. x mm)	
	c) Material	-	
	d) Resistance per Km (with shield) at 20°C	Ohm/ km	
14	a) Fillers: Material (if applicable)		
	b) Bedding Material		
15	Inner sheath		
	a) Material, type and standard	-	
	b) Whether FRLS	-	
	c) Colour	-	
	d) Method of application	-	
	e) Thickness (min)	mm	
16	Armour		
	a) Material,	-	
	b) Formed wire / round wire		
	c) Minimum Coverage	%	
	d) Method of jointing	-	
	e) Breaking load of joint	-	
	f) Size (approx.) of strip	mm	
	g) Dia of armour	mm	
	h) No. of wires/ strip.	No.	
17	Outer sheath		
	a) Reference standard	-	
	b) Material	-	
	c) Minimum thickness of sheath	mm	

	d) Calculated dia under outersheath	mm	
	e) Oxygen index (as per ASTMD 2863)	-	
	f) Temperature index (in deg. C as per ASTMD 2863)	deg. C	
	g) Maximum acid gas generation as per IEC754-1	%	
	h) Maximum smoke density rating as per ASTMD 2843	%	
	i) Colour of outer sheath	-	
18	Dia over laid-up core	mm	
19	Dia under armour	mm	
20	Dia above armour	mm	
21	Overall diameter of cable	mm	
22	Tolerance on overall diameter	mm	
23	Weight of		
	Copper (conductor & drain wire)	Kg/ km	
	PVC (insulation, sheath & fillers)	Kg/ km	
	Armour	Kg/ km	
	Cable (approx.)	Kg/ km	
24	Cable parameters at 20°C(+/-3 deg. C)		
	a) Conductor resistance (max)	Ohm/ km	
	b) Insulation resistance (min)	M-Ohm/ km	
	c) Mutual capacitance at 0.8KHz (max)	nF/ km	
	d) Cross talk at 0.8KHz (min)	dB	
	e) Attenuation at 1 KHz (max)	dB/ km	
	f) Characteristic impedance at 1 KHz (max)	Ohm	
25	Continuous operating temp. (deg.C)	deg. C	
26	(a) Relevant IS standard including Part & category for Flame retardance of complete cable	-	
	(b) Relevant IEC standard including Part & category for Flammability of complete cable		
27	Whether complete cable passes Swedish Chimney test as per SEN 4241475 (F3)	-	
28	Identification		
	a) Length of cable marked at every mtr.	-	
	b) FRLS marked at every 5 mtrs	-	
	c) Each core of the pair numbered	-	
	d) Conductor identification details for pairs	-	
	e) Details of cable markings	-	
29	Test voltage		
	a) High voltage test/ Dielectric Strength		
	i) Voltage (KV), Core - Core	kV	
	ii) Duration	min	
	b) High Voltage test		
	i) Voltage (KV), Core - Screen	V	

	ii) Duration	min	
	c) Resistance to direct current test (applicable for 225 V cable as per VDE)	-	
	Voltage	V	
	Duration	hrs/days	
30	Min bending radius	No. x OD	
31	Ovality at any cross section	mm	
32	Variation of dia through out cable length	mm	
33	Cable cross-sectional drawings for each type of cable furnished		
34	i) Length of single coil in a drum	M	
	ii) Marking on drum	-	
	iii) Seasoned wood drum provided	-	
	iv) Both ends of cable to be sealed with PVC/ Rubber caps to prevent water/ moisture ingress	-	
	v) Gross weight (approx.)	kg.	
	vi) Net weight (approx.)	kg	
35	Type test procedures as per BHEL Technical Spec. and other relevant standards enclosed.	-	
36	Anti termite & rodent test	-	

SECTION-'II'

GENERAL TECHNICAL SPECIFICATION

	DOCUMENT TITLE **1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V** TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES	SPECIFICATION NO. PE-TS-445-507-E004	
		VOLUME II	
		SECTION II	
		REVISION 0	DATE: 09.08.2022
		SHEET 1 OF 1	

1.0 TECHNICAL REQUIREMENTS

1.1 Technical requirements for SCREENED CONTROL CABLES shall be as indicated in this section, in addition to those specified in 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 and testing of Screened control 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-E004) 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 –C 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.

3.6 Type Test Reports for Tests conducted shall be submitted for BHEL's/ Customer's review/approval.

4.0 **Packing**

4.1 Cables shall be supplied in non-returnable drums. Material of cable drum shall be as specified in Datasheet-A.

4.2 In case of wooden drums, all wooden parts shall be manufactured from seasoned wood treated with copper napthenates/ zinc napthenates (refer IS: 401). 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.

ANNEXURE-A

CORE IDENTIFICATION/ PAIR IDENTIFICATION

ANNEXURE: D

The cable cores shall be colour coded as mentioned below:

Pair	Core	Colour
1 st	1 st	Blue
1 st	2 nd	Red
2 nd	1 st	Grey
2 nd	2 nd	yellow
3 rd	1 st	Green
3 rd	2 nd	Brown
4 th	1 st	White
4 th	2 nd	Black

Each four pair is laidup to from one unit and wound with Mylar Tape. The cores of each unit shall then be identified by numbering for cables of more than 4-pair.

Eg. All eight cores of the first unit shall have " 1/one" printed on each core in Black/ White colour

Unit no.	Colour of Number Printing	Number printed on core
1	BLACK on WHITE core. WHITE on all other cores	1/One
2		2/Two
3		3/Three
4		4/Four
5		5/Five
6	BLACK on WHITE core. WHITE on all other cores	6/Six
7		7/Seven
8		8/Eight
9	BLACK on WHITE core. WHITE on all other cores	9/Nine
10		10/Ten
11		11/Eleven
12		12/Twelve

The dimension L (distance between the markings) shall be limited to 50 mm. The number marking shall be neat. eg. A grey wire having " 7/Seven" number printed on the core is the first (1st) core of the second (2nd) pair of the Seventh unit.

For Black & White cores Printing:- Black on White Core

White on all Other Cores

TYPICAL DRAWING OF CABLE DRUM PACKING

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QUALITY PLAN

1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V
QUALITY PLAN FOR "SCREENED CONTROL CABLE"
TECHNICAL SPECIFICATION NO. PE-TS-445-507-E004

Sl No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M	Quantum of check C,N	Reference Document	Acceptance Norms	Format of record		Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	D*	10			11
I.	RAW MATERIAL													
A	CONDUCTOR													
A1	COPPER ROD For Conductor/ Drain wire	a) Dimension	Maj.	Measu.	1 sample/lot	–	IS:613/IS:12444	IS:613/IS:12444	IMR/ TC	√	V	-	-	
		b) Conductivity/ Resistivity	Cri.	Elec.	1 sample/lot	1 sample/lot	IS:613/IS:12444	IS:613/IS:12444	IMR/ TC	√	V	V	-	
A2	Conductor for compensating cable	a) Size	Min	Dimen	1 Sample / lot	–	Approved Datasheet	Approved Datasheet	IMR/ TC	√	P	-	-	
		b) Resistance check	Maj	Elec	1 Sample / lot	–	Approved Datasheet	Approved Datasheet	IMR/ TC	√	P	-	-	
		c) Thermo emf	Cri	Elec	1 Sample / lot	–	ANSI MC 96.1	ANSI MC 96.1	IMR/ TC	√	P	-	-	
		d) Specific resistance, Temp. cofficient.	Maj	Elec/Mech	1 Sample / lot	1 Sample / lot	MFR CATALOUGE	MFR CATALOUGE	IMR/ TC	√	V	V	V	
		e) Conductor Grade	Maj	Chem	1 Sample / lot	1 Sample / lot	Approved Datasheet	Approved Datasheet	IMR/ TC	√	V	V	V	
B	PVC COMPOUND													
B1	PVC Compound (Insulation & Sheath) Type of compound as per Spec.	a) Thermal stability (for Insulation)	Maj.	Therm.	1 sample/lot	1 sample/lot	VDE 207 Part -4/5	VDE 207 Part -4/5	IMR/ TC	√	P	V	-	
		b) TS & % Elongation Before and After aging and variation.	Maj.	Mech.	1 sample/lot	1 sample/lot	VDE 207 Part -4/5	VDE 207 Part -4/5	IMR/ TC	√	P	V	-	
		c) Loss of Mass (Sheath)	Maj.	Therm.	1 sample/lot	1 sample/lot	VDE 207 Part -4/5	VDE 207 Part -4/5	IMR/ TC	√	P	V	-	
B2	FR Properties for Filler Compound	a) Oxygen index	Cri.	Chem	1 sample/lot	1 sample/lot	ASTMD2863/ Approved Datasheet	ASTMD2863/ Approved Datasheet	IMR/ TC	√	P	V	-	
		b) Temperature index deg. C	Cri.	Chem	1 sample/lot	1 sample/lot	ASTMD2863/ Approved Datasheet	ASTMD2863/ Approved Datasheet	IMR/ TC	√	P	V	-	
B3	FRLS Properties for Sheath	a) Oxygen index	Cri.	Chem	1 sample/lot	1 sample/lot	ASTMD2863/ Approved Datasheet	ASTMD2863/ Approved Datasheet	IMR/ TC	√	P	V	-	
		b) Temperature index	Cri.	Chem	1 sample/lot	1 sample/lot	Approved Datasheet	Approved Datasheet	IMR/ TC	√	P	V	-	
		c) Smoke density rating	Cri.	Chem	1 sample/lot	1 sample/lot	Approved Datasheet	Approved Datasheet	IMR/ TC	√	P	V	-	
		d) HCL Emission	Cri.	Chem	1 sample/lot	1 sample/lot	IEC754-1/ Approved Datasheet	IEC754-1/ Approved Datasheet	IMR/ TC	√	P	V	-	
C	Tapes / Binders (Aluminium Mylar)	a) Thickness	Maj.	Mesu.	1 Sample/ Lot	1 Sample/ Lot	Approved Datasheet	Approved Datasheet	IMR/ TC	√	P	V	-	
		b) Size	Maj.	Mesu.	1 Sample/ Lot	1 Sample/ Lot	Approved Datasheet	Approved Datasheet	IMR/ TC	√	P	V	-	
D	Armour (If applicable)	a) Dimension	Maj.	Mesu.	1 Sample/ Lot	1 Sample/ Lot	Approved Datasheet	Approved Datasheet	IMR/ TC	√	P	V	-	
		b) TS & %Elongation	Maj.	Mech	1 Sample/ Lot	1 Sample/ Lot	IS 3975	IS 3975	IMR/ TC	√	P	V	-	
		c) Zn Coating	Maj.	Chem	1 Sample/ Lot	1 Sample/ Lot	IS 3975	IS 3975	IMR/ TC	√	P	V	-	
		d) Resistivity	Maj.	Elect	1 Sample/ Lot	1 Sample/ Lot	IS 3975	IS 3975	IMR/ TC	√	P	V	-	

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E	Wooden Drums	a) Dimension	Minor	Measurement	Sample	–	As per Mfr std	NTPC Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	V	COC from drum manufacturer
		b) Anti termite treatment	Minor	Chemi	As per Mfr std	–	As per Mfr std	As per Mfr std	COC	√	P	V	V	
		c) Marking	Minor	visual	As per Mfr std	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet			P	V	V	
F	Steel Drum (If applicable)	a) Dimension	Minor	measurement	Sample	–	As per Mfr std	As per Mfr std	IMR/ TC		P	-	-	
		b) Surface Finish	Minor	visual	–	–	As per Mfr std	As per Mfr std	IMR/ TC		P	-	-	
		c) Marking	Minor	visual	As per Mfr std	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet			P	V	V	
II	INPROCESS INSPECTION													
A	Wire Drawing & Anealing	a)Size	Maj.	Dimn.	1 Sample at Start and 1 Sample at End	–	Approved Datasheet	Approved Datasheet	IMR/ TC		P	-	-	
		b) Surface finish	Maj.	Visu.	100%	–	Surface shall be smooth	Surface shall be smooth	IMR/ TC		P	-	-	
		c) % of Elongation	Maj.	Mech.	1 Sample/ Lot	–	IS 10810	IS 10810	IMR/ TC		P	-	-	
B	Tinning (Only for Drain wire)	a) Size	Maj.	Dimn.	1 Sample/ Lot	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
		b) Percentage of Elongation	Maj.	Mech.	1 Sample/ Lot	1 Sample/ Lot	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	V	V	
C	Insulation	a) Surface finish	Maj.	Visu.	100%	–	Surface shall be smooth & free from scratches	Surface shall be smooth & free from scratches	IMR/ TC		P	-	-	
		b) Core Diameter	Maj.	Measu.	1 Sample/ Lot	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
		c) Radial Thickness(Min & Max.)	Maj.	Measu.	1 Sample/ Lot	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	No Repairs are allowed on the Insulated core
		d) Spark Test	Maj.	Elec.	100%	100%	IS 10810(With 3KV ac)	No Spark failure is allowed	IMR/ TC		P	V	V	
		e) Volume Resistivity/ Insulation Resistance	Maj.	Elec.	1 Sample/ Lot	1 Sample/ Lot	VDE -0207/ Approved Datasheet	VDE -0207/ Approved Datasheet	IMR/ TC		P	V	V	
		f) Colour, Marking/ Identification	Maj.	Visual	100%	100%	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	V	-	
		g) TS & %Elongation	Maj.	Mech.	1 Sample/ Lot	–	IS 10810 Approved Datasheet	IS 10810 Approved Datasheet	IMR/ TC		P	-	-	
D	Twisting	a) Lay length and Direction	Maj.	Measu. & Visual	1 Sample at Start and 1 Sample at	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
		b) Size/ Dimension	Maj.	Measu.	1 Sample/ Lot	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
		c) Pair Colour	Maj.	Visual	100%	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	

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1	2	3	4	5	6		7	8	9		10			11
E	Laying of Pairs/ Taping/ Shielding (Wherever Applicable)	a) Construction	Maj.	Visu.	100%	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
		b) Dimension	Maj.	Measu.	1 Sample/ Lot	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
		c) Coverage/ Overlap	Maj.	Measu.	1 Sample/ Lot	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
		d) Continuity	Maj.	Dimn.	1 Sample/ Lot	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
		e) Bunching(for >4P)	Maj.	Measu.	1 Sample/ Lot	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P			
F	Sheathing (Inner - If applicable)	a) Surface Finish	Maj.	Visual	100%	–	Smooth, free from visual defects #	Smooth, free from visual defects#	IMR/ TC			-	-	# Porosity, Burnt particles, Pimples (Repairs are not allowed)
		b) Colour	Maj.	Visual	100%	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
		c) Diameter / Thickness	Maj.	Measu.	1 Sample/ Lot	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
G	Sheathing (Outer)	a) Surface Finish	Maj.	Visual	100%	–	Smooth, free from visual defects#	Smooth, free from visual defects#	IMR/ TC		P	-	-	# Porosity, Burnt particles, Pimples (No Repairs are allowed)
		b) Colour/ Marking/ Embossing	Maj.	Visual	100%	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
		c) Overall Diameter, Thickness	Maj.	Measu.	1 Sample/ Lot	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
		d) TS & %Elongation	Maj.	Mech.	1 Sample/ Lot	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
H	Armouring (If applicable)	a) Surface finish	Maj.	Visual	100%	–	Smooth, free from visual defects like rusting etc.	Smooth, free from visual defects like rusting etc.	IMR/ TC		P	-	-	
		b) Direction of Lay & Coverage	Maj.	Visual	100%	–	Smooth, free from visual defects like rusting etc.	Smooth, free from visual defects like rusting etc.	IMR/ TC		P	-	-	Min coverage shall be 90 %. Gap should not be more than 1 wire/ Strip dimension.
		c) Size of Wire/ Strip	Maj.	Measu.	1 Sample/ Lot	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
		d) Diameter over Armouring	Maj.	Measu.	1 Sample/ Lot	–	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	-	-	
III. FINAL INSPECTION														
A.	TYPE TEST													
B.	ROUTINE TEST	a) Cond.resistance (Cable & Drain wire)	Cri.	Elec.	100%	100%	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR	√	P	V	V	
		b) HV Test	Cri.	Elec.	100%	100%	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR	√	P	V	V	
		c) IR Test (on drum length)	Cri.	Elec.	100%	100%	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR	√	P	V	V	
		d) Drain wire contunity	Cri.	Elec.	100%	100%	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR	√	P	V	V	

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1	2	3	4	5	6		7	8	9		10			11
IV	ACCEPTANCE TEST													
A	Constructional Details & Dimensions of complete cable	a) Constructional Details(CONDUCTOR,DRAIN WIRE,SHEILDING ETC.)	Maj.	Visual	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		b) Shield Al-mylar thickness	Maj.	Measu.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		c) Insulation thickness	Maj.	Measu.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		d) Inner/ Outer sheath thickness (as applicable)	Maj.	Measu.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	before and after ageing for insulation.
		e) Diameter over outer sheath	Maj.	Measu.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		f) Outer sheath - Colour, Marking/ Embossing & End sealing.	Maj.	Visual	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		g) Length checking.	Maj.	Measu.	1 No. of each size & type per Lot	1 No. of each size & type per Lot	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		h) Core - Band marking/ Numbering, Colour.	Maj.	Visual	1 No. of each size & type per Lot	1 No. of each size & type per Lot	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		i) Overall Coverage/overlap of shield & Continuity of drain wire.	Maj.	Visual	1 No. of each size & type per Lot	1 No. of each size & type per Lot	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	Continuity shall be checked as per Manufacturer practice.
		j) Visual & Surface Finish	Maj.	Visual	1 No. of each size & type per Lot	1 No. of each size & type per Lot	Smooth, free from visual defects #	Smooth, free from visual defects #	FIR		P	W	W	# Like Porosity, Burnt particles, Pimples
B	Insulation	a) Volume Resistivity (At room and Elevated Temperature)	Maj.	Elec.	1 No./ Complete lot offered $	1 No./ Complete lot offered $	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		b) IR Test	Cri.	Elec.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		c) TS & %Elongation test of Insualtion (Before & After aging)	Maj.	Mech	1 No./ Complete lot offered $	1 No./ Complete lot offered $	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		d) Thermal Stability	Maj.	Chem.	1 No. of each size & type per Lot	1 No. of each size & type per Lot	VDE 207 Part -4/5	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
C	Sheath	a) TS & %Elongation test of Sheath (Before & After aging)	Maj.	Mech	1 No./ Complete lot offered $	1 No./ Complete lot offered $	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		b) Thermal Stability	Maj.	Chem.	1 No. of each size & type per Lot	1 No. of each size & type per Lot	VDE 207 Part -4/5	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		c) FRLS Test for outer sheath for OI(Oxygen Index), TI(Temperature Index), SDR(Smoke Density Rating) & HCL Emission.	Maj.	Chem	1 No./ Complete lot offered $	1 No./ Complete lot offered $	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	

1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V
QUALITY PLAN FOR "SCREENED CONTROL CABLE"
TECHNICAL SPECIFICATION NO. PE-TS-445-507-E004

Sl No	Component & Operations	Characteristics	Class	Type of check	Quantum of check M	Quantum of check C,N	Reference Document	Acceptance Norms	Format of record		Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	D*	10			11
D	Armouring (If applicable)	a) Surface finish	Crl	Visual	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Smooth, free from visual defects like rusting etc.	Smooth, free from visual defects like rusting etc.	IMR/ TC		P	W	W	
		b) Direction of Lay & Coverage	Crl	Visual	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Smooth, free from visual defects like rusting etc.	Smooth, free from visual defects like rusting etc.	IMR/ TC		P	W	W	Min coverage shall be 90 %. Gap should not be more than 1 wire/ Strip dimension.
		c) Size of Wire/ Strip	Crl	Measu.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	W	W	
		d) Diameter over Armouring	Crl	Measu.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	W	W	
		e)Resistance Test	Crl	Elec.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	W	W	
		f) Wrapping Test	Crl	Mech	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	W	W	
		g) Tensile Test	Crl	Mech	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	NTPC Tech.Specfication /Approved Datasheet	IMR/ TC		P	W	W	
		h) Elongation Test	Crl	Mech	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	IMR/ TC		P	W	W	
E	Tests on complete cable	a) Electrical Parameters (Mutual capacitance, Cross talk, Attenuation, Charactristic Impedence as applicable)	Maj.	Elec.	1 No. of each size & type per Lot	1 No. of each size & type per Lot	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		b) Swidesh chimney test (overall cable)	Maj.	Chem	1 No./ Complete lot offered $	1 No./ Complete lot offered $	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		c) Armouring Dimension & Zn coating. (If applicable)	Maj.	Measu.	1 No./ Complete lot offered $	1 No./ Complete lot offered $	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		d) Cond resistance (Cable & Drain wire)	Cri.	Elec.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		e) Flammability test	Cri.	Elec.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		f) HV Test	Cri.	Elec.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		g) IR test	Cri.	Elec.	Samples as per IS 1554/8784	Samples as per IS 1554/8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		h) Thermal EMF test (For compensating cable only)	Maj.	Elec.	Sample as per IS 8784	Sample as per IS 8784	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
		i) Persulphate Test (For Drain wire only)	Maj.	Chem.	1 No. of each size & type per Lot	1 No. of each size & type per Lot	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet	FIR		P	W	W	
F	Packaing and Dispatch	a) Stencileing, sealing, completeness & Verification with offered list	Maj.	Visual.	100%	1 No. of each size & type per Lot	Tech.Specfication /Approved Datasheet	Tech.Specfication /Approved Datasheet			P	-	W	
		b) Identification	Maj	Visual	100%	100%	Sealing shall be visible	Sealing shall be visible			P	V	V	

LEGEND: * RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
** M: MANUFACTURER/ SUB-SUPPLIER, C: SUPPLIER/ NOMINATED INSPECTION AGENCY, N/E: Cust. /EMPLOYER, P: PERFORM, W: WITNESS AND V: VERIFICATION
APPROPRIATE CHP: NTPC SHALL IDENTIFY IN COLUMN "N" AS "W" $-IRRESPECTIVE OF SIZE AND TYPE

ADS - APPROVED DATA SHEET, SPEC. - CONTRACT SPECIFICATION, TC - TEST CERTIFICATE, COC - CERTIFICATE OF COMPLIANCE
IMR - INWARD MATERIAL REGISTER, FIR.- FINAL INSPECTION REPORT

ANN-H

TYPE/ACCEPTANCE/ROUTINE TEST REQUIREMENTS FOR SCREENED CONTROL CABLE

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS (AS PER VDE)

A. Type Test Conduction:

1. Tests for which "T" is indicated in the 'Test Conduction Required As' column below shall be conducted as Type Test.

2. Sampling:
   a) Type tests (except for Sl. no. b & c below) to be conducted on one size (2P, 4P etc.) of each type (F or G type)/ lot.
   b) Electrical & C&I test to be conducted on each size of each type of cables /lot.
   c) FRLS & Flammability tests to be conducted only on one sample/ lot, irrespective of size/type.

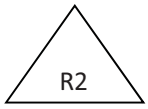
B. Acceptance Test Conduction:

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

2. Sampling:
   a) Acceptance tests (except for Sl. no. b & c below) for every lot shall be as per Appendix-B (Clause 15.2.2) of IS: 1554 Part-I.
   b) Electrical & C&I test to be conducted on each size of each type of cables /lot.
   c) FRLS & Flammability tests to be conducted only on one sample/ lot, irrespective of size/type.

C. Routine Test Conduction:

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

2. Sampling:
   Routine testing shall be conducted on 100% drum. 

D. Test listed in S. No. 11 shall be conducted only on one sample/Lot

ADS: Approved datasheet.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
1.0	**Tests for Conductor**				
I.	Annealing test	For copper conductor only	**T, A**	IS 10810 Pt 1	*Internal in process Test Report to be furnished for both type & acceptance tests*
II.	Tin coating test (for tinned copper)	For copper conductor only	**T, A**	IS 10810 Pt 4	
III.	Resistance test	For Al/Cu	**T, A, R**	VDE 0815	
IV.	Diameter test	For conductor	**T, A**	ADS	
2.0	**Tests for Armour Wires/Strips**				
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	**T,A**	IS 10810 Pt 36	

ANN-H

TYPE/ACCEPTANCE/ROUTINE TEST REQUIREMENTS FOR SCREENED CONTROL CABLE

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
II.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	T, A	IS 10810 Pt 37	
III.	Elongation at break test	Applicable for GS wire/Strip only	T, A	IS 10810 Pt 37	
IV.	Torsion test	For GS round wire only	T, A	IS 10810 Pt 38	
V.	Winding test	For GS strip only	T, A	IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Aluminium wire & GS wire	A, T	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	A, T	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	A, T	IS 10810 Pt 41	
3.0	**Physical Tests for PVC Insulation & PVC sheath**				
I.	Test for thickness & Eccentricity	Applicable for PVC insulation, PVC inner sheath & PVC outer sheath	T, A	VDE 0472	
II.	Tensile strength and elongation test at break	Applicable for PVC insulation, PVC inner sheath & PVC outer sheath			
(a)	Before ageing		T, A	VDE 0472	
(b)	After ageing		T, A	VDE 0472	
III.	Ageing in air oven	Applicable for PVC insulation & PVC outer sheath	T	VDE 0472	
IV.	Loss of mass in air oven test	For PVC insulation, PVC inner & PVC outer sheath	T	VDE 0472	
V.	Hot deformation test	For PVC insulation, PVC inner & PVC outer sheath	T	VDE 0472	
VI.	Heat shock test	For PVC insulation, PVC inner & PVC outer sheath	T	VDE 0472	
VII.	Shrinkage test	For PVC insulation, PVC inner & PVC outer sheath.	T	VDE 0472	
VIII.	Thermal stability test	For PVC insulation, PVC inner & PVC outer sheath	T	VDE 207	R2
IX.	Bleeding & Blooming Test	For PVC insulation & outer sheath.	T	IS 10810 Pt 19	
X.	Cold Bend & Cold Impact test	For PVC inner & outer sheath.	T	VDE 0472	
XI.	Core marking, end sealing	For PVC insulation, PVC inner & PVC outer sheath	A	VDE-207	
4.0	**Tests for Al-Mylar Shield**				
I.	Continuity test	For Al-Mylar shield	T, A	Plant Standard	
II.	Shield thickness	For Al-Mylar shield	A	ADS	
III	Overlap test	For Al-Mylar shield	A	ADS	
IV	Constructional details, dimensions	For Al-Mylar shield	A	ADS	

ANN-H

TYPE/ACCEPTANCE/ROUTINE TEST REQUIREMENTS FOR SCREENED CONTROL CABLE

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
V	Visual, surface finish+	For Al-Mylar shield	A	Plant Standard	
VI	Overall coverage	For Al-Mylar shield	A	Plant Standard	
VII	Noise interference test.	For Al-Mylar shield	T,A	ADS	
5.0	**Tests for Drain Wire**				
I.	Annealing test	For copper conductor only	T, A	IS 10810 Pt 1	*Internal in process Test Report to be furnished for both type & acceptance tests*
II.	Tin coating test (for tinned copper)	For copper conductor only	T, A	IS 10810 Pt 4	
III.	Resistance test	For Al/Cu	T, A, R	VDE 0815	
IV.	Diameter test	For conductor	T, A	ADS	
V.	Continuity test	For drain wire R2	T, A, R	Plant Standard	
6.0	**FRLS Tests**				
I.	Oxygen index test	For PVC outer sheath, inner sheath & Filler	T, A	IS 10810 Pt 58 / ASTMD 2863	R2
II.	Smoke density test	For PVC outer sheath, inner sheath only	T, A	ASTMD 2843	
III.	Halogen Acid gas generation test	For PVC outer sheath, inner sheath & Filler	T, A	IS 10810 Pt 59 / IEC-754-1	
IV.	Temperature Index Test	For PVC outer sheath, inner sheath	T, A	IS 10810 Pt 64 / ASTMD 2863	
7.0	**Flammability Tests**				
I.	Flammability test for bunched cables	For complete cable	T,A	IS 10810 Pt 62/ IEC-60332 (Part-3-23, CAT A/ CAT B.	
II.	Flammability test for single cable	For complete cable	T,A	IS: 10810 Pt 61 / IEC:60332 Part-1	
III.	Swedish chimney test	For complete cable	T,A	SEN SS 424 1475 (Class F3)	
IV.	Flammability test	For complete cable	T,A	IEEE: 383	
8.0	**Electrical Tests**				
I.	High Voltage Test	For complete cable	T, A, R	VDE 0815	
II.	Insulation Resistance Test	For complete cable	T, A, R	IS 10810 Pt 43	
III.	Conductor resistance	For complete cable	A,R	VDE 0815	
IV.	Spark test	Insulation	R	VDE 0207	

ANN-H

TYPE/ACCEPTANCE/ROUTINE TEST REQUIREMENTS FOR SCREENED CONTROL CABLE

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
9.0	**C&I Tests**				
I.	Cross talk	For complete cable	**T, A**	ADS	
II.	Attenuation	For complete cable	**T, A**	ADS	
III.	Characteristic Impedance	For complete cable	**T, A**	ADS	
IV.	Mutual capacitance	For complete cable	**T, A**	ADS	
V.	Noise interference	For complete cable	**T, A**	ADS	
10	**Complete Cable**				
I.	Visual , surface Finish	Overall Cable	**A**	Plant Standard	
II.	Volume resistivity at room and elevated temperature	Overall Cable (Insulation)	**A**	IS 5831/ IS 10810 Pt43/ ADS	
III.	Construction details, dimensions	Overall Cable	**T, A**	ADS	
11	**Anti-Rodent and Termite repulsion test**	For PVC Outer Sheath Only	**A**	Refer note below	

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

ANNEXURE I
1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V

GeM BID NO. -……..……., Dt:- --

Letter head of Company

Ref……. Date…….

To,
Bharat Heavy Electricals Limited
PEM, PPEI Building, Plot No 25,
Sector -16A, Noida (U.P)-201301

Subject: - Certification regarding local content

Dear Sir,

We hereby certify that items offered by us of Chemical Dosing System for **1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V** meets the requirement of minimum local content in line with clause no. -- of NIT and the Public Procurement (Preference to Make in India), Order 2017 dated-15.06.2017, 28.05.2018, 29.05.2019, 04.06.2020 & 16.09.2020. The Percentage (%) of Local content is ……%.

We further confirm that details of location at which the local value addition is made will be our registered works at ……(address of the works)

Yours very truly

……. (authorized signatory of company)

…… (firm name)

authorized signatory
of company

1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V

GeM BID NO. -……..., Dt:-

ANNEXURE -II (INSTRUCTIONS TO PACKING LIST)

For faster verification of bills, successful bidder to submit detailed Bill of Material (BOM) at the time of drawings/ documents submission after placement of PO. Each item of the BOM to be uniquely identified with item code no. or item Sl. No. Supplier to ensure that all items which will find separate mention in the packing list are covered in this detailed BOM.

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

Packing List must indicate:

a) Packing size
b) Gross weight and net weight of each package
c) Contents of the package with cross reference to BOM item code no. / Sl. No.
d) Quantity of each items separately.

The packing list must cover all the BOM items.

Supplier to give following undertaking in the packing list:

The Packing list provided herewith is as per BOM approved under PO No. -----

ANNEXURE III

1 X 660 MW WBPDCL SAGARDIGHI EXTN UNIT V

GeM BID NO. -……..……., Dt:-

Letter head of Company

Ref……. Date…….

To,
Bharat Heavy Electricals Limited
PEM, PPEI Building, Plot No 25,
Sector -16A, Noida (U.P)-201301

Subject: - Certification regarding Land Border

Dear Sir,

I have read the clause regarding restrictions of procurement from a bidder of a country which shares a land border with India. I hereby certify that M/s …… (Organization name) is not from such a country and is eligible to be considered.

Note :- Bidder is requested to furnish the above undertaking on company letterhead from the highest competent authority at your end (i.e Owner, partner, CMD, Director, company secretariat etc.).

Yours very truly

……. (authorized signatory of company)

…… (firm name)

authorized signatory
of company

Annexure-1

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)/ Cotractor (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.

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 Prinicpal 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 & On behalf of the Principal
(Office Seal)

Ashutosh Sharma
Digitally signed by Ashutosh Sharma
Date: 2022.07.07 17:03:04 +05'30'

Place _____
Date _____

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

Witness:

अर्जुन श्रीवास्तव / Arjun Srivastava
उप प्रबंधक (पी.जी.-I) / Dy. Manager (P.G.-I)
भारत हेवी इलेक्ट्रिकल्स लिमिटेड / Bharat Heavy Electricals Ltd.
पावर सेक्टर–परियोजना अभियांत्रिकी प्रबंधन
Power Sector-Project Engineering Management
पीपीईआई भवन, एच.आर.डी.आई एण्ड ईएसआई कॉम्प्लेक्स
PPEI Bldg. H.R.D.I. & ESI Complex,
प्लाट नं. 25, सेक्टर 16 ए, नोएडा –201301
Plot No. 25, Sec. 16 A, Noida - 201301

Witness:_____
(Name & Address) _____
_____

ANNEXURE R :- RISK & COST PURCHASE

DEFAULT/ BREACH OF CONTRACT, INSOLVENCY AND RISK PURCHASE

In case of delays (beyond the maximum late delivery period as per LD clause) in supplies, or if there be defective supplies or non-fulfilment of any other terms and conditions of the Contract as enumerated subsequently in this clause, then, without prejudice to its right to recover any expenses, losses or damages to which the Buyer may be put to incur or sustain by reason of the Seller/Contractor's default or breach of Order/Contract or to suspend business dealings with the Seller/Contractor in terms of the Buyers' Guidelines for Suspension of Business Dealings as applicable from time to time, the Buyer shall also be entitled to cancel the Order/ Contract either in whole or portion thereof without compensation to Seller. On the occurrence of any of the acts/omissions mentioned below, the Buyer may if it so desires, procure upon such terms and in such manner as deemed appropriate, plant/ equipment/ stores not so delivered or others of similar description where plant/ equipment/ stores exactly complying with particulars are not, in the opinion of the Buyer (which shall be final), readily procurable, at the risk and cost of the Seller.

The Seller shall be liable to the Buyer for any excess costs incurred thereof and the Seller shall continue the performance of the Order/Contract to the extent not cancelled under the provisions of this clause. The Seller shall on no account be entitled to any gain on such repurchases. If the Bidder does not agree to this Risk Purchase clause, BHEL reserves the right to reject the bid/offer of the Bidder.

The order/contract may be cancelled in whole or part thereof and Risk & Cost Clause in line with terms and conditions of PO/Contract may be invoked by the Buyer in any of the following cases:

i. If the Seller/Contractor fails to deliver the goods or materials or any installment thereof within the period(s) fixed for such delivery or the Seller's poor progress of the supply/services vis-à-vis delivery/execution timeline as stipulated in the contract, backlog attributable to the Seller including unexecuted portion of supply does not appear to be executable within balance period available;
ii. delivers goods or materials not of the contracted quality and failing to adhere to the contract specifications/execution methodology;
iii. withdrawal from or repudiation/abandonment of the supply/services by the Seller before completion as per contract or if the Seller refuses or is unable to supply goods or materials covered by the order/Contract either in whole or in part or otherwise fails to perform the Order/Contract.

iv. Non supply by the Seller within scheduled completion/delivery period as per contract or as extended from time to time for reasons attributable to the Seller;

v. Termination of Contract on account of any other reason(s) attributable to the Seller.

vi. Assignment, transfer, sub-letting of Contract without BHEL's written permission resulting in termination of Contract or part thereof by BHEL.

vii. If the Seller be an individual or a Sole Proprietorship, in the event of death or insanity of the Seller.

viii. If the Seller/Contractor being an individual or if a partnership firm thereof, shall at any time be adjudged insolvent or shall have a receiving order for administration of his estate made against him or shall take any proceeding for composition under any Insolvency Act for the time being in force or make any assignment of the order/Contract or enter into any arrangement or composition with his creditors or suspend payment or if the firm dissolved under the Partnership Act;

ix. If the Seller/Contractor being a Company is wound up voluntarily or by order of a Court or a Receiver, Liquidator or Manager on behalf of the debenture holders and creditors is appointed or circumstances have arisen which entitles the Court of debenture holder and creditors to appoint a receiver, liquidator or manager

x. Non- Compliance to any contractual condition or any other default attributable to the Seller.

Such defaulting vendor/Seller shall not be eligible to participate in re-tendering conducted on account of risk purchase made due to fault of such vendor/Seller.

BHEL's right to go for Risk and Cost, Calculation of Risk and Cost amount & LD, recovery options to BHEL are given in detail in Annexure-V hereto.

ANNEXURE-V

(RISK AND COST CLAUSE)

1. BHEL reserves the right to terminate the contract or withdraw portion of work and get it done through other agency, at the risk and cost of the contractor *after due notice of a period of 14 days' by BHEL* in any of the following cases:

   i) If the Seller/Contractor fails to deliver the goods or materials or any instalment thereof within the period(s) fixed for such delivery or the Seller's poor progress of the supply/ services vis-a-vis delivery/execution timeline as stipulated in the Contract, backlog attributable to seller including unexecuted portion of supply does not appear to be executable within balance available period;
   ii) Delivers goods or materials not of the contracted quality and failing to adhere to the contract specifications;
   iii) Withdrawal from or repudiation/ abandonment of the supply/ services by Seller before completion as per contract or if the Seller refuses or is unable to supply goods or materials covered by the Order/Contract either in whole or in part or otherwise fails to perform the Order/Contract;
   iv) Non-supply by the Seller within scheduled completion/delivery period as per Contract or as extended from time to time, for the reasons attributable to the Seller;
   v) Termination of Contract on account of any other reason (s) attributable to Seller.
   vi) Assignment, transfer, subletting of Contract without BHEL's written permission resulting in termination of Contract or part thereof by BHEL.
   vii) If the Seller be an individual or a sole proprietorship Firm, in the event of the death or insanity of the Seller;
   viii) If the Seller/Contractor being an individual or if a firm on a partnership thereof, shall at any time, be adjudged insolvent or shall have a receiving order for administration of his estate made against him or shall take any proceeding for composition under any Insolvency Act for the time being in force or make any assignment of the Order/Contract or enter into any arrangement or composition with his creditors or suspend payment or if the firm dissolved under the Partnership Act;
   ix) If the Seller/Contractor being a company is wound up voluntarily or by order of a Court or a Receiver, Liquidator or Manager on behalf of the debenture holders and creditors is appointed or circumstances shall have arisen which entitles the Court of debenture holder and creditors to appoint a receiver, liquidator or manager;
   x) Non-compliance to any contractual condition or any other default attributable to Seller.

1.1 **Risk & Cost Amount against Balance Work:**

Risk & Cost amount against balance work shall be calculated as follows:

Risk & Cost Amount= [(A-B) + (A x H/100)]

Where,
A= Value of Balance scope of Work (*) as per rates of new contract
B= Value of Balance scope of Work (*) as per rates of old contract being paid to the contractor at the time of termination of contract i.e. inclusive of PVC & ORC, if any.
H = Overhead Factor to be taken as 5

In case (A-B) is less than 0 (zero), value of (A-B) shall be taken as 0 (zero).

1.2 *** Balance scope of work (in case of termination of contract):**

Difference of Contract Quantities and Executed Quantities as on the date of issue of Letter for 'Termination of Contract', shall be taken as balance scope of Work for calculating risk & cost amount.

Contract quantities are the quantities as per original contract. If, Contract has been amended, quantities as per amended Contract shall be considered as Contract Quantities.

Items for which total quantities to be executed have exceeded the Contract Quantities based on drawings issued to contractor from time to time till issue of Termination letter, then for these items total Quantities as per issued drawings would be deemed to be contract quantities.

Substitute/ extra items whose rates have already been approved would form part of contract quantities for this purpose.

Substitute/ extra items which have been executed but rates have not been approved, would also form part of contract quantities for this purpose and rates of such items shall be determined in line with contractual provisions.

However, increase in quantities on account of additional scope in new tender shall not be considered for this purpose.

NOTE: In case portion of work is being withdrawn at risk & cost of contractor instead of termination of contract, contract quantities pertaining to portion of work withdrawn shall be considered as 'Balance scope of work' for calculating Risk & Cost amount.

1.3 **LD against delay in executed work in case of Termination of Contract:**

LD against delay in executed work shall be calculated in line with LD clause no. 16 of GCC, for the delay attributable to contractor. For limiting the maximum value of LD, contract value shall be taken as Executed Value of work till termination of contract.

Method for calculation of LD against delay in executed work in case of termination of contract" is given below.

i. Let the time period from scheduled date of start of work till termination of contract excluding the period of Hold (if any) not attributable to contractor = T1
ii. Let the value of executed work till the time of termination of contract = X
iii. Let the Total Executable Value of work for which inputs/fronts were made available to contractor and were planned for execution till termination of contract = Y
iv. Delay in executed work attributable to contractor i.e. T2 = [1-(X/Y)] x T1
v. LD shall be calculated in line with LD clause (clause 16) of the Contract for the delay attributable to contractor taking "X" as Contract Value and "T2" as period of delay attributable to contractor.

2. Recoveries arising out of Risk & Cost and LD or any other recoveries due from Contractor

Without prejudice to the other means of recovery of such dues from the Seller recoveries from the Seller on whom risk & cost has been invoked shall be made from the following:

a) Dues available in the form of Bills payable to seller, SD, BGs against the same contract.
b) Dues payable to seller against other contracts in the same Region/Unit/ Division of BHEL.
c) Dues payable to seller against other contracts in the different Region/Unit/ division of BHEL.

In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against contractor.

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).

IEEMA table for Price variation cause for various type of cable

1. Aluminium conductor cable

S.No	Cable Type	AlF (Single core unarmoured & Multi core armoured)	AlF (Single core armoured)	CCFAl	XLFAL (Single core)	XLFAL (Multi core)	FeF	FeW	IEEMA Formula
1.	HT XLPE Power cable	ALP	H1	H2	XL3	XL4	H3	H5	P=Po+AIF(AL-Alo) + XLFAL(CC-CCo) +CCFAl(PVCC-PVCCo) + FeF(Fe-Feo)
2.	LT XLPE Power Cable	ALP	P1	L2	XL1	XL1	P3	P3 (Additional)	P=Po+AIF(AL-Alo) + XLFAL(CC-CCo) +CCFAl(PVCC-PVCCo) + FeF(Fe-Feo)
3.	LT PVC Power Cable	ALP	P1	P2	-	-	P3	P3 (Additional)	P=Po+AIF(AL-Alo) + CCFAl(PVCC-PVCCo) + FeF(Fe-Feo)
4.	LT HRPVC Power Cable	ALP	P1	P2	-	-	P3	P3 (Additional)	P=Po+AIF(AL-Alo) + CCFAl(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
I	HT XLPE Power cable	CUP	H4	H2	XL3	XL4	H3	H5	P=Po+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=Po+CuF(Cu-Cuo) + XLFCU(CC-CCo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo) + AIF(AL-Alo)

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 (Additional)	P=Po+CuF(Cu-Cuo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo) + AIF(AL-Alo)
4	LT HRPVC Power Cable	CUP	P4	P2	--	--	P3	P3 (Additional)	P=Po+CuF(Cu-Cuo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo) + AIF(AL-Alo)
5	LT XLPE Control Cable	CUC	--	P5	--	XL2	P6	P6 (Additional)	P=Po+CuF(Cu-Cuo) + XLFCU(CC-CCo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo)
6	LT PVC Control Cable	CUC	--	P5	--	--	P6	P6 (Additional)	P=Po+CuF(Cu-Cuo) + CCFCu (PVCC-PVCCo) + FeF(Fe-Feo)
7	LT HRPVC Control Cable	CUC	--	P5	--	--	P6	P6 (Additional)	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 (Additional)	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 (Additional)	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 (Additional)	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 (Additional)	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 Cables

Notes:-

(i) Cu POS, Cu PIS, Fe POS & Fe PIS tables shall be as per IEEMA circular No. IIEMA (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.

ieema
your link to electricity

501, Kakad Chambers
132, Dr. Annie Besant Road, Worli
Mumbai 400018
India

P: +91 22 2493 0532
F: +91 22 2493 2705
E: mumbai@ieema.org
www.ieema.org

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.

New Delhi
Rishyamook Building, First Floor
85 A, Panchkuian Road
New Delhi 110001, India
P: +91 11 2336 3013/14
F: +91 11 2336 3015
E: delhi@ieema.org

Bangalore
204, Swiss Complex
33, Race Course Road
Bangalore 560001, India
P: +91 80 2220 1316/18
F: +91 80 2220 1317
E: bangalore@ieema.org

Kolkata
503 A, Oswal Chambers
2, Church Lane
Kolkata 700001, India
P: +91 33 6510 7855
F: +91 33 2213 1326
E: kolkata@ieema.org

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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

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

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

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

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	0.3955	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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Indian Electrical & Electronics Manufacturer's Association
501, Kakad Chambers
132, Dr. A. B. Road, Worli,
Mumbai - 400 018.
INDIA.
P +91 22 2493 0532
F +91 22 2493 2705
E mumbai@ieema.org
W www.ieema.org

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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Indian Electrical & Electronics Manufacturer's Association
501, Kakad Chambers
132, Dr. A. B. Road, Worli,
Mumbai - 400 018.
INDIA.
P +91 22 2493 0532
F +91 22 2493 2705
E mumbai@ieema.org
W www.ieema.org

IEEMA (PVC)/CABLE(R-1)/2017 **Effective from: 1st November 217**

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

AlF Variation factor for aluminium

Al Price of Aluminiujm. 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.

CCFAl 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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501, Kakad Chambers
132, Dr. A. B. Road, Worli,
Mumbai - 400 018.
INDIA.
P +91 22 2493 0532
F +91 22 2493 2705
E mumbai@ieema.org
W www.ieema.org

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XLPE COMPOUND

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

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

1. 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.
2. Price of PVC Compound (in Rs/MT) is the ex-works price, as quoted by the manufacturer.
3. Price of XLPE Compound (in Rs/MT) is the ex-works price, as quoted by the manufacturer
4. Price of CC copper rods (in Rs/MT) is ex-works price as quoted by the primary producer.
5. 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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501, Kakad Chambers
132, Dr. A. B. Road, Worli,
Mumbai - 400 018.
INDIA.
P +91 22 2493 0532
F +91 22 2493 2705
E mumbai@ieema.org
w www.ieema.org

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Price variation formulae for 'Power Cables'

A. Aluminum conductor PVC insulated 1.1 kV power cables

$P = Po + AlF\ (AL - Alo) + CCFAl\ (PVCc - PVCco) + FeF\ (Fe - Feo)$

For unarmourd 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

$P = Po + CuF\ (Cu - Cuo) + CCFCu\ (PVCc - PVCco) + Fef\ (Fe - Feo) + AlF\ (Al - Alo)$

For steel armoured cables; AlF = 0 For aluminium armoured cables; FeF = 0
For unarmoured cables; FeF, AlF = 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

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

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

$P = Po + AlF\ (AL - Alo) + XLFAL(CC\text{-}Cco) + CCFAl\ (PVCc - PVCco) + FeF\ (Fe - Feo)$

For unarmourd 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 (CCFAl)
P3	Steel armour
XL1	XLPE Compound (XLFAL)

E. Copper conductor XLPE insulated 1.1 kV power cables

$P = Po + CuF\ (Cu - Cuo) + XLFCU\ (CC\text{-}Cco) + CCFCu\ (PVCc - PVCco) + Fef\ (Fe - Feo) + AlF\ (Al - Alo)$

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

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501, Kakad Chambers
132, Dr. A. B. Road, Worli,
Mumbai - 400 018.
INDIA.
P +91 22 2493 0532
F +91 22 2493 2705
E mumbai@ieema.org
W www.ieema.org

For unarmoured cables; FeF, AlF = 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 = Po + CuF (Cu – Cuo) + XLFCU (CC-Cco)+ CCFCu (PVCc-PVCco) + FeF (Fe-Feo)

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 = Po + AlF (Al – Alo) + XLFAL(CC-Cco)+CCFAl (PVCc – PVCco) + FeF (Fe – Feo)

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

Table Refernces:

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

For steel armoured cables; AlF = 0 For aluminium armoured cables; FeF = 0
For unarmoured cables; FeF, AlF = 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 = Po + CuF (Cu – Cuo)
Table CUsdc Copper Conductor

Authorized Signatory

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	1.036	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	8.834	-	11.779

IEEMA (PVC)/CABLE(R-1)/2017 Effective from: 1st November 217

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 CUsdc

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

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

IEEMA (PVC)/CABLE(R-1)/2017 Effective from: 1st November 217

TABLE P1

VARIATION 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 aluminium 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

IEEMA (PVC)/CABLE(R-1)/2017 Effective from: 1st November 217

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	-	-	-	-	-	-	-	-

IEEMA (PVC)/CABLE(R-1)/2017 Effective from: 1st November 217

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	-	-	-	-	-	-

IEEMA (PVC)/CABLE(R-1)/2017 Effective from: 1st November 217

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	4.226	5.958	6.301
630	4.774	6.018	6.737	7.141

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

IEEMA (PVC)/CABLE(R-1)/2017 Effective from: 1st November 217

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

IEEMA (PVC)/CABLE(R-1)/2017 Effective from: 1st November 217

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

IEEMA (PVC)/CABLE(R-1)/2017 Effective from: 1st November 217

TABLE P6 (Additional)

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

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	-	-	-	-	-	-	-	-

IEEMA (PVC)/CABLE(R-1)/2017 Effective from: 1st November 217

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								

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

IEEMA (PVC)/CABLE(R-1)/2017 Effective from: 1st November 217

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 (CCF1Al / 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 (CCFAl / 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

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

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