2 x 660MW UDANGUDI STPP

BOQ-CUM-PRICE SCHEDULE FOR SCREENED CONTROL CABLES

S. No.	ITEM CODE	DESCRIPTION	UNIT	ORDER QTY.	DRUM LENGTH	UNIT PRICE DULY PACKED (EX-WORKS) Rs.	TOTAL PRICE (EX-WORKS) Rs.	Freight % age	GST %age	TOTAL F.O.R. SITE PRICE Rs.
1.0	507-31116-A	1.1kV TYPE F(IO) 2P - 0.5 ARMOURED	MTR	42000	1000					
2.0	507-31009-A	1.1KV TYPE F(IO) 4P - 0.5 ARMOURED	MTR	48000	1000					
3.0	507-31133-A	1.1kV TYPE F(IO) 6P-0.5 ARMOURED	MTR	9000	1000					
4.0	507-31013-A	1.1KV TYPE F(IO) 8P - 0.5 ARMOURED	MTR	19000	1000					
5.0	507-31001-A	1.1KV TYPE F(IO) 12P - 0.5 ARMOURED	MTR	12000	1000					
6.0	507-31132-A	1.1kV TYPE F(IO) 16P-0.5 ARMOURED	MTR	10000	500					
7.0	507-31121-A	1.1kV TYPE F(IO) 24P-0.5 ARMOURED	MTR	10000	500					
8.0	507-31025-A	1.1KV TYPE G(O) 2P - 0.5 ARMOURED	MTR	35000	1000					
9.0	507-31029-A	1.1KV TYPE G(O) 4P - 0.5 ARMOURED	MTR	58000	1000					
10.0	507-31033-A	1.1KV TYPE G(O) 8P - 0.5 ARMOURED	MTR	100000	1000					
11.0	507-31017-A	1.1KV TYPE G(O) 12P - 0.5 ARMOURED	MTR	43000	1000					

NOTES:

1. Quantities indicated above shall be known as Order Quantities. Quantity variation shall be as per NIT.
2. Ordered quantities indicated above shall be cleared for manufacturing along with PO. However, manufacturing of the cables shall be taken up by the successful bidder only after approval of technical and quality documentation.
3. The standard drum length shall be 500/1000 metres as indicated above. Tolerance on individual drum length shall be +/- 5%.
4. 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 500/1000m, in which case it shall be -5% to 0%. Cables consumed for testing and inspection shall be to bidder's account.
5. For each individual cable size, one short length of not less than 200m may be accepted only in the final drum length to complete the supply (except where the total ordered quantity is one single drum length of 500/1000m). The overall tolerance limits stipulated above shall continue to apply (in case short lengths are accepted).
6. In case of the quantities cleared by BHEL for manufacturing (in a lot) are manufactured and offered for inspection by successful bidder in more than one batch, BHEL reserves the right to witness type testing on all batches without any price implication.
7. The charges of UV Radiation test & Hydrolytic Stability test shall be reimbursed extra at actual against original money receipt of Govt. Lab. (CPRI/ ERDA etc.).
8. Bidder shall indicate unit price of cables inclusive of type test charges. No separate charges shall be payable for type tests except listed at Note No. 7 above.

	2 X 660MW UDANGUDI STPP	PE-PQ-435-507-E016
		REVISION NO. 00 DATE 24/02/2023
	PRE-QUALIFICATION REQUIRMENTS FOR SCREENED CONTROL CABLE	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 200 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 20 pairs.
6.0	Manufactured and supplied at least 1000 Km of Screened Control cables in one or more orders and at least 200 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
MEGHA MANAGER	AYAN SAHA SR. MANAGER	SANDEEP LODH SR. D.G.M.	DEBASISA RATH A.G.M. (DH-ELECT)

VOLUME-II

2 X 660 MW UDANGUDI SUPERCRITICAL THERMAL POWER PROJECT STAGE-I

TECHNICAL SPECIFICATION

FOR

SCREENED CONTROL CABLE

SPECIFICATION NO: ***PE-TS-435-507-E004A***

REVISION: **00**

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

	DOCUMENT TITLE **2 X 660MW UDANGUDI STPP** TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES	SPECIFICATION NO. PE-TS-435-507-E004A	
		VOLUME II	
		SECTION	
		REVISION 0	DATE: 24.02.2023
		SHEET 1 OF 1	

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	SPECIFIC TECHNICAL REQUIREMENTS	03
	DATA SHEET-A	04
	ANNEXURE A (COLOUR CODE)	01
	DATA SHEET-C	04
3.	SECTION – II	
	STANDARD TECHNICAL SPECIFICATION	02
	QUALITY PLAN (ALONGWITH ANNEXURE I TO QP)	15
	TOTAL NO. OF SHEETS=	32
	(INCLUDING COVER/ SEPARATOR SHEETS)	

	DOCUMENT TITLE **2 X 660MW UDANGUDI STPP** TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES	SPECIFICATION NO. PE-TS-435-507-E004A
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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

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

	DOCUMENT TITLE **2 X 660MW UDANGUDI STPP** TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES	SPECIFICATION NO. PE-TS-435-507-E004A	
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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 – I 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: (*)

Standard 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 without making any changes in the contents of the document.

	DOCUMENT TITLE **2 X 660MW UDANGUDI STPP** TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES	SPECIFICATION NO. PE-TS-435-507-E004A	
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DATA SHEET-A

1.0	Type of Cable	Flame Retardant Low Smoke Halogen (FR-LSH/ FRLS)
2.0	Standard applicable in general (Latest amendment to be referred if any)	IS:1554 (Part-1), IS:8130, IS:5831, , IS:3975, IS:694, SEN-SS-424-1475, Class F3, IEEE-383, IS:10810 Part 62, Cat-B, ASTMD:2843, ASTMD:2863, ASTM D 3137:81, IEC-60754-1, IEC:60332 Part-1, IEC:60332 Part-3-23, Cat-B.
3.0	Voltage Grade	1.1kV
4.0	Number of cores, cross sectional area of conductors and quantities	As per BOQ-Cum-Price Schedule
5.0	CONDUCTOR	
(a)	Material	Copper
	Grade and Class	Stranded, annealed high conductivity, Class 2
		Non-Compacted, Electrolytic
		Tinned
(b)	Standard Applicable	IS: 8130
(c)	Shape	Circular
(d)	Min. number of strands, Dia. Of each strand, and cross sectional area.	7, 0.3 mm (nom.), 0.5 sq.mm
6.0	INSULATION	
(a)	Material	Extruded HRPVC Type-C
(b)	Standard Applicable	IS: 5831
(c)	Continuous withstand temperature	85°C
(d)	Short-circuit withstand temperature	160°C
(e)	Method of application	By extrusion; sleeve extrusion not permitted.
(f)	Nominal Thickness of insulation	0.6 mm nominal (for 0.5 sq.mm) as per IS-694
(g)	Volume resistivity (Min.)	$1x10^{13}$ ohm-cm at 27 deg. C & $1x10^{10}$ ohm-cm at 85 deg. C.
(h)	Resistant to oil, acid & alkali	*YES*
7.0	LAYING OF CORES	
(a)	Min. number of twist per metre for paired cables.	20 (For 0.5 Sq.mm)
(b)	Maximum lay of individual twisted pair	50 mm (For 0.5 Sq.mm)
(c)	Diameter of core	In accordance with clause 6 (f)
8.0	IDENTIFICATION OF CORES	As per BS 5308-2, refer Annexure-BI.
9.0	INDIVIDUALLY SCREENED	
(a)	Material	Aluminium-Mylar tape
(b)	Coverage	100%
(c)	Overlap	Minimum 30%
(d)	Min. thickness (Micron)	28 micron
10.0	OVERALL SCREENED	
(a)	Material	Aluminium-Mylar tape

(b)	Coverage	100%
(c)	Overlap	Minimum 30%
(d)	Min. thickness (Micron)	55 micron
11.0	DRAIN WIRE	
	To be provided separately for individual pair shield and overall shield.	
(a)	Material	Multi stranded Annealed tinned copper drain wire.
(b)	Size (Cross section area/ No. of strands/ Dia. of each strand)	0.5 sq. mm./ 7/ 0.3 mm.
12.0	BEDDING / BINDER/ TAPE	
(a)	Material	Mylar tape.
13.0	INNER SHEATH	
(a)	Material	Extruded PVC Type ST-2
(b)	Standard Applicable	IS: 5831
(c)	Colour	*Black.*
(d)	Whether FR-LSH/ FRLS Applicable	*YES*
(e)	Thickness of inner sheath	As per Table-4 of IS: 1554 (Part-1)
(f)	Fillers	Acceptable
(g)	Material of fillers (if permitted)	Same as inner sheath (with moisture resistant properties)
(h)	Method of application for multi-core cables:	
(i)	With fillers	*Pressure/Vacuum extruded*
(ii)	Without fillers	*Pressure extruded*
14.0	RIP CORD	A non-metallic cord
15.0	*ARMOUR*	
(a)	*Applicable*	*YES*
(b)	Material:	*Galvanised Steel Round Wire/ Strip wire.* Conforming to (i) Type 'a'/ 'b' as per Table-5 of IS 1554-I and (ii) IS 3975 as per project requirements.
(c)	Standard Applicable	IS: 1554 (Part-1) Table-5 and IS:3975
(d)	Minimum Coverage	90%
(e)	Gap between armour wires	Shall not exceed one armour wire space (No cross-over/ over-riding)
(f)	Breaking load of joint	95 % of normal armour
(g)	Method of jointing	Welding
16.0	OUTERSHEATH	
(a)	Material	Extruded PVC Type ST2
(b)	Standard Applicable	IS: 1554 (Part-1) & IS: 5831
(c)	Colour	*'Light blue'* for Individual & overall screened cable (F type). *'Black'* for Overall screened cable (G type).
(d)	Whether FR-LSH/ FRLS	Yes
(e)	Method of application	Extruded
(f)	Thickness of outer sheath	As per IS: 1554 Part-1 (i.e. Min thickness shall be 1.24 mm)
(g)	Other properties	Resistant to water, termite & rodent attack

(h)	Marking	*Cable size (cross section area and no. of pairs), voltage grade, Type of Insulation e.g. HRPVC, FRLS, Manufacturer's name and/ or trade name, Type of Inner sheath, Type of Outer sheath and year of manufacture @ 5m (by embossing)* *'BHEL-PEM' and 'CUSTOMER' Name @5m (by embossing)* *Progressive sequential length marking @ 1m. (by printing)* *Further customer specific marking requirement (if any) shall be informed later.*
17.0	FR-LSH CHARACTERISTICS	
(a)	Oxygen index	Min 29 (As per ASTMD 2863)
(b)	Temperature index	Min. 250°C at oxygen index value of 21 (As per ASTMD 2863)
(c)	Acid gas generation	Max. 20% by weight (As per IEC-60754-1)
(d)	Smoke density rating	Max. 60% (As per ASTM D 2843): Area under coverage.
(e)	Flammability Test	
(i)	Flammability test for single cable	*YES, As per: IEC-60332 Part-1*
(ii)	Flammability test for bunched cables	*YES, As per: IEC-60332 Part-3-23, CAT-B*
(iii)	Flammability test as per IEEE: 60383	*YES*
(iv)	Swedish Chimney test SEN-SS-424-1475-F3	*YES*
18.0A	*Anti-rodent and Termite repulsion Test*	*YES*
18.0B	*Anti-fungal Test*	*NO. However, self-certification by vendor for anti-fungal property is required*
19.0	Special Tests	
(a)	Hydrolytic Stability Test	*YES*
(b)	Ultraviolet Radiation Test	*YES*
20.0	TOLERANCE ON OVERALL DIAMETER	± 2mm max. over the declared value in Technical datasheet.
21.0	VARIATION IN DIA & OVALITY AT ANY CROSS SECTION	Maximum 1 mm
22.0	CABLE DRUM DETAILS	
(a)	Material Type	Wooden, as per IS 10418
(b)	Standard drum length	1000 metres: upto and including 12 Pairs. 500 metres: above 12 pairs.
(c)	Tolerance on drum length	± 5%
(d)	Painting	Entire surface to be painted
(e)	Construction Details	For wooden drums, all wooden parts shall be manufactured from seasoned wood treated with copper napthenates / zinc napthenates (refer IS: 401) and anti-termite. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Dimensions of wooden drums shall be as per IS 10418. All ferrous parts shall be

		treated with suitable rust protective finish or coating to avoid rusting during transit and storage. BIS certification mark shall be stamped on each cable drum.
(f)	Particular details on Drum	Each drum shall carry manufacturer's name or trade make, purchaser's name, address and contract no., Type of cable & voltage grade, Year of manufacture, Type of insulation e.g. HRPVC item no., No. of pairs and size of cables & Type, Cable code e.g. FRLS, No. of length on drum, if more than one, length of cable and net gross weight stencilled on both sides of drum. A tag containing same information shall be attached to the leading end of the cable. An arrow & suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.
(g)	Outermost layer	To be covered with waterproof polyethylene.

23.0 TECHNICAL PARAMETERS (C & I) As per Tables below:		
Parameter	*0.5 mm2 (IS & OS) type-F*	*0.5 mm2 (OS) type-G*
Mutual Capacitance (max.) at 0.8 kHz, nF/Km	*120*	*100*
Conductor Loop Resistance (max.), Ohm/Km	*78 (tinned)*	*78 (tinned)*
Insulation Resistance (min), M Ohm/ Km	*100*	*100*
Cross Talk attenuation (min) at 0.8kHz, dB	*60*	*60*
Characteristic impedance (max.) at 1 kHz	*320*	*340*
Attenuation (max.) at 1 kHz db/Km	*1.2*	*1.2*
Capacitance unbalance (max), pF/500m	*400*	*400*

Note:
1. Cable parameters indicated above are at 20 degC (+/- 3 degC)

24.0	TEST VOLTAGE & DURATION	
(a)	High Voltage Test, AC Tests	
(i)	Core to core	2 kV (max.) for 1 minute (max.)
(ii)	Core to shield	2 kV (max.) for 1 minute (max.)

Table C.1 **Identification of cable pairs other than two-pair cables without individual pair screens (quads)**

Pair no.	a-wire	b-wire	Pair no.	a-wire	b-wire
1	White	Blue	26	Red-Blue	Blue
2	White	Orange	27	Red-Blue	Orange
3	White	Green	28	Red-Blue	Green
4	White	Brown	29	Red-Blue	Brown
5	White	Grey	30	Red-Blue	Grey
6	Red	Blue	31	Blue-Black	Blue
7	Red	Orange	32	Blue-Black	Orange
8	Red	Green	33	Blue-Black	Green
9	Red	Brown	34	Blue-Black	Brown
10	Red	Grey	35	Blue-Black	Grey
11	Black	Blue	36	Yellow-Blue	Blue
12	Black	Orange	37	Yellow-Blue	Orange
13	Black	Green	38	Yellow-Blue	Green
14	Black	Brown	39	Yellow-Blue	Brown
15	Black	Grey	40	Yellow-Blue	Grey
16	Yellow	Blue	41	White-Orange	Blue
17	Yellow	Orange	42	White-Orange	Orange
18	Yellow	Green	43	White-Orange	Green
19	Yellow	Brown	44	White-Orange	Brown
20	Yellow	Grey	45	White-Orange	Grey
21	White-Blue	Blue	46	Orange-Red	Blue
22	White-Blue	Orange	47	Orange-Red	Orange
23	White-Blue	Green	48	Orange-Red	Green
24	White-Blue	Brown	49	Orange-Red	Brown
25	White-Blue	Grey	50	Orange-Red	Grey

NOTE Except in the case of bi-colour extrusion, the colour indicated first is known as the base colour, and is:

a) the extruded colour; and

b) the colour with the greater area of exposure on the finished wire.

Pair identification shall be provided with numbers at interval of not more than 250mm.

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 **2 X 660MW UDANGUDI STPP** TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES	SPECIFICATION NO. PE-TS-435-507-E004A	
		VOLUME II	
		SECTION II	
		REVISION 0	DATE: 24.02.2023
		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.

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SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	D	** M	C	N	
					M	C/N								
INSTRUCTIONS: 1. **Cable manufacturer to maintain records to show co-relation of raw materials to finished cables i.e. raw material batch/ lot no. should be traceable to the final cable drum number or batch no.** 2. **Cable manufacturer to maintain all quality records identified as per all QP stages enumerated below whether it is identified for BHEL verification or witness or not.**														
1.0	**RAW MATERIAL**													
1.1	Copper Rods/ Wires (For Conductor & drain wire)	**GENERAL:**												
		1. Physical properties	MA	Physical Tests	Sample/Batch	Sample/Batch	IS 613	IS 613	Inspection Report/ Test Cert.		P/ V	V	-	
		2. Elec. Properties	MA	Electrical Tests	Sample/Batch	Sample/Batch	-do-	-do-	-do-		P/ V	V	-	
		SPECIFIC CHECKS:												
		a) Make	MA	Verify	100%	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.		P	V	-	
		b) Grade	MA	-do-	-do-	-do-	IS 613	IS 613	-do-		P	V	-	

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Prepared by:	22.01.20	Priyanka	Checked by:	23/1/20	KUNAL GANDHI			Reviewed by:			
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					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9					
		c) Resistivity	MA	Electrical Tests	Manufacturer std.		IS 613	IS 613	-do-		P	V	-	
1.2	PVC Compound (for insulation)	**GENERAL :**												
		1. Physical properties	MA	Physical Tests	Sample/Batch	Sample/Batch	IS 5831	IS 5831	Inspection Report/ Test Cert.		P/ V	V	-	
		2. Elec. Properties	MA	Electrical Tests	Sample/Batch	Sample/Batch	-do-	-do-	-do-		P/ V	V	-	
		SPECIFIC CHECKS : a) Make	MA	Verify	100%	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.		P	V	-	
		b) Type/ Grade	MA	-do-	100%	100%	Approved datasheet	Approved datasheet	-do-		P	V	-	
		c) Shelf life/ Storage condition	MA	-do-	100%	100%	Compound Manufacturer std.	Compound Manufacturer std.	-do-		P	V	-	
1.3	Screen / Tapes/ Binders	1. Make	MA	Verify	100%	100%	Manufacturer approved source	Manufacturer approved source	TC & IR		P/ V	V	-	
		2. Dimension	MA	Measurement	Manufacturer std.	Manufacturer std.	Manufacturer datasheet/ Approved datasheet	Manufacturer datasheet/ Approved datasheet	TC & IR		P/ V	V	-	
		3. T.S. & Elongation	MA	Physical Tests	-do-	do-	Manufacturer datasheet	Manufacturer datasheet	-do-		P/ V	V	-	

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1	2	3	4	5	6		7	8	9	D	M	C	N	
					M	C/N								
		4. Chem. & Phys. Properties	MA	Chemical & Physical Tests	-do-	do-	Manufacturer std.	Manufacturer std.	-do-		P/V	V	-	
1.4	Fillers (as applicable)	1. Make	MA	Verify	100%	100%	Manufacturer approved source	Manufacturer approved source	COC/Test certificate		P	V	-	Filler material chosen shall be compatible with the temperature rating of the cable and shall have no deleterious effect on any other component of the cable
		2. Flame retardant & moisture resistant. (as applicable)	MA	Chemical/ Environ.	-do-	-do-	Appd. Data Sheet	Appd. Data Sheet	-do-		P/V	-	-	
1.5	Galvanised steel wire/strip for Armour (if applicable)	**GENERAL :**												
		1. Make	MA	Verify	Manufacturer std.	Manufacturer std.	Manufacturer approved source	Manufacturer approved source	Inspection Report/ Test Cert.		P	V	-	
		2. Dimension	MA	Measurement	-do-	-do-	Appd. Data Sheet	Appd. Data Sheet	-do-		P/V	-	-	
		3. Phy.and Elec. Properties	MA	Physical & Electrical Tests	Sample*	Sample*	-do-	-do-	-do-		P/V	-	-	* Sample from each armour size/Batch/ Lot
		4.Galvanization Quality	MA	Galv.Tests	-do-	-do-	IS 3975	IS 3975	-do-		P/V	-	-	

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					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9					
1.6	PVC compound for Sheath	**GENERAL :**												
		1. Physical properties	MA	Physical Tests	Sample/Batch	Sample/Batch	IS 5831	IS 5831	Inspection Report/ Test Cert.		P/ V	V	-	
		2. Elec. Properties	MA	Electrical Tests	Sample/Batch	Sample/Batch	-do-	-do-	-do-		P/ V	V	-	
		3. FRLS Properties (as applicable)	CR	Chemical/ Environ.	Sample/Batch	Sample/Batch	Approved datasheet	Approved datasheet	-do-		P/ V	V	-	
		SPECIFIC CHECKS :											-	
		a) Make	MA	Verify	100%	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.		P	V	-	
		b) Type/ Grade	MA	-do-	-do-	-do-	Approved datasheet	Approved datasheet	-do-		P	V	-	
		c) Shelf life/ Storage condition	MA	-do-	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-		P	V	-	
1.7	Wooden drums	1. Phy. & Constructional checks	MA	Visual	Mfr's Plant Std.	Mfr's Plant Std.	IS 10418	IS 10418	Inspection Report/ Test Cert.		P	V	-	
		2. Anti-termite treatment	MA	Chem.	-do-	-do-	Mfr's Plant Std.	Mfr's Plant Std.	COC		P	V	-	
1.8	Steel drums (If applicable)	1. Dimension	MA	Meas.	Mfr's Plant Std.	Mfr's Plant Std.	Approved drg	Approved drg	Inspection Report/ Test Cert.		P	V	-	

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1	2	3	4	5	6		7	8	9	D	M	C	N	
					M	C/N								
		2. Surface finish	MA	Visual	-do-	-do-	Surface shall be smooth	Surface shall be smooth	Inspection Report		P	V	-	
2.0	IN PROCESS												-	
2.1	Wire Drawing & Annealing.	1. Size	MA	Dimensional	Mfr's Plant Std.	Mfr's Plant Std.	Approved datasheet	Approved datasheet	Inspection Report		P	V	-	
		2. Surface finish	MA	Visual	-do-	-do-	Surface shall be smooth	Surface shall be smooth	-do-		P	V	-	
2.2	Tinning (Conductor or drain wire)	1. Size	MA	Dimensional	Plant Mfg. Std.	Plant Mfg. Std.	Mfr's Plant Std.	Mfr's Plant Std.	-do-		P	V	-	(Applicable only for tin-coated copper conductor and drain wire)
		2. Chemical test for tinning	CR	Chemical	-do-	-do-	IS 10810 - 4	IS 8130	-do-		P	V	-	
2.3	Stranding of wires	1. No. of wires	MA	Counting	Mfr's Plant Std.	Mfr's Plant Std.	Approved datasheet	Approved datasheet	-do-		P	V	-	
		2. Resistance	CR	Electrical	-do-	-do-	-do-	-do-	-do-		P	-	-	
		3. Sequence, lay length & Direction	MA	Visual, Meas	one Sample each size/lot	one Sample each size/lot	Mfr. Std	Mfr. Std.	-do-		P	-	-	
		4. Surface Finish	MA	Visual	100%	100%	Surface shall be smooth	Surface shall be smooth	-do-		P	-	-	

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					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9					
		5.Dimension	MA	Measurement	one Sample of each size/lot	one Sample of each size/lot	Appd. Data Sheet	Appd. Data Sheet	-do-		P	-	-	
2.4	Core Insulation (No repair permitted)	1. Surface finish	MA	Visual	100%	100%	Free from bulging burnt particles lumps, cuts & Scratches.	Free from bulging burnt particles lumps, cuts & Scratches.	Inspection Report		P	V	-	
		2 Insulation thickness (Min./ Max.)	CR	Measurement	one Sample of each size/lot	one Sample of each size/lot	Appd. data sheet	Appd.data sheet	-do-		P	-	-	
		3. Concentricity #	CR	Measurement	-do-	-do-	Mfr's Std.	Mfr's Std.	Inspection Report		P	V	-	# To be checked at starting & finish end of Extruded Length
		4 Dia over insulation	MA	Measurement	-do-	-do-	Appd.data sheet	Appd.data sheet	-do-		P	-	-	
		5. Core identification	MA	Visual	100%	100%	Appd.data sheet	Appd.data sheet	-do-		P	-	-	
		6. TS & % Elongation	MA	Mechanical	100%	100%	IS 1554/ IS 5831	IS 1554/ IS 5831	-do-		P	-	-	

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1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
2.5	Core pairing, screening (provision of drain wire & laying)	1. Pair identification	MA	Visual	100%	100%	Appd. Data Sheet	Appd. Data Sheet	Inspection Report		P	-	-	
		2.Wire size & tape size	MA	Measurement	100%	100%	-do-	-do-	-do-		P	-	-	
		3.Test for capacitance	CR	Elect. Test	100%	100%	-do-	-do-	-do-		P	-	-	
		4. Sequence of lay and lay length	MA	Visual meas	one Sample of each size/lot	one Sample of each size/lot	Appd. Data Sheet	Appd. Data Sheet	-do-		P	-	-	
		5. Screen overlap & coverage	MA	Measurement	-do-	-do-	-do-	-do-	-do-		P	-	-	
		6. Dia over laid up core	MA	Measurement	-do-	-do-	-do-	-do-	-do-		P	-	-	
		7. Continuity of drain & drain wire with Screen	MA	Elect. Test	100%	100%	<———No Discontinuity ———>		-do-		P		-	-
2.6	Inner Sheath Extrusion (if applicable)	1. Surface finish	MA	Visual	100%	100%	Free from bulging, burnt particles, lumps, cuts & Scratch.	Free from bulging, burnt particles, lumps, cuts & Scratch	-do-		P	-	-	
		2. Sheath thickness	CR	Measurement	One sample of each size/lot	One sample of each size/lot	Approved Data sheet	Approved Data sheet	-do-		P	-	-	
		3.Dia over inner sheath	MA	Measurement	-do-	-do-	Appd. Data Sheet	Appd. Data Sheet	-do-		P	-	-	

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					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			
		4. Colour					Appd. Data Sheet	ppd. Data Sheet						
2.7	Armouring (if applicable)	1. No.of wires/Strips	MA	Counting	At the start of the process	At the start of the process	Mftr's Std	Mftr's Std	-do-		P	-	-	
		2. Size of wire/ Strip	MA	Measurement	-do-	-do-	Appd. Data Sheet	Appd. Data Sheet	-do-		P	-	-	
		3. Lay Direction	MA	Visual	-do-	-do-	Mftr's Std	Mftr's Std	-do-		P	-	-	
		4. Lay Length	MA	Visual, Meas.	At the start of the process	At the start of the process	-do-	-do-	-do-		P	-	-	
		5. Coverage	MA	Measurement	-do-	-do-	Appd. Data Sheet	Appd. Data Sheet	-do-		P	-	-	
		6. Dia over armour	MA	Measurement	-do-	-do-	-do-	-do-	-do-		P	-	-	
2.8	Outer Sheath Extrusion	1. Surface Finish	MA	Visual	100%	100%	–	Free from Bulging, Burnt particles, lumps, cuts & scratches	-do-		P	-	-	
		2.Sheath thickness	CR	Measurement	One sample of each size/lot	One sample of each size/lot	Approved Data sheet	Approved Data sheet	-do-		P	-	-	

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					M	C/N				D	M	C	N	
1	2	3	4	5	6		7	8	9		**			
		3. Dia over outer sheath	MA	Measurement	-do-	-do-	Appd. Data Sheet	Appd. Data Sheet	-do-		P	-	-	
		4. Marking/ Colour / Embossing	MA	Visual	100%	100%	Appd. Data Sheet	Appd. Data Sheet	-do-		P	-	-	Sequential be done by printing marking shall
		5. TS & % Elongation	MA	Mechanical	100%	100%	IS 5831/IS 10810 part 7	IS 5831	-do-		P	-	-	
3.0	Final Inspection (Internal)	Routine Test (Refer Note-H)	CR	Electrical test & Measurement	100%	100%	#	#	-do-		P	V	V	# Refer Annexure-A to QP.
4.0	Final Inspection (External)	1. Finish & Length (Cable & cable drum)	MA	Visual, Measurement	One drum in each lot	One drum in each lot	Appd. Data Sheet	Free from Bulging, Burnt particles, lumps, cuts & scratches/ Approved data sheet	Inspection Report		P	W	W	

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1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
		2. Dimensions	MA	Measurement	As per std.	As per std.	Appd. Data sheet	Appd. Data sheet	Inspection Report		P	W	W	
		3. Armouring - Coverage	MA	Measurement	-do-	-do-	-do-	-do-	-do-		P	W	W	# Refer Annexure-A to QP.
		4. Marking/Colour/ pair identification (Cable & cable drum)	MA	Visual	-do-	-do-	-do-	-do-	-do-		P	W	W	
		5. Acceptance Tests (Refer Note-H)	CR	Phy & Elect. Tests	#	#	#	-do-	-do-		P	W	W	
		6. Type & FRLS Tests (Refer Note-H)	CR	Measurement	#	#	#	Appd. Data sheet	-do-		P	W	W	
5.0	Packing	Sealing Identification	MA	Visual	100%	100%	As per Mfr. Std.	As per Mfr. Std.	-do-		P	W	-	

NOTES: -	
(A)	JOINTS IN CONDUCTOR AND ARMOUR SHALL BE AS PERMITTED BY IS 8130 & IS 1554-1 RESPECTIVELY.
(B)	NO REPAIR OF CORE INSULATION PERMITTED.
(C)	CABLE ENDS SHALL BE SEALED
(D)	RECORD OF RAW MATERIAL, PROCESS & ALL STAGES SHALL BE CERTIFIED BY VENDORS QC. AND ARE LIABLE TO AUDIT CHECK BY PURCHASER.

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	22.01.2020	Priyanka	Checked by:	23/11/2020	KUNAL GANDHI			Reviewed by:			
Reviewed by:		MANISH	Reviewed by:		RK JAISWAL			Approved by:			

23/1/2020

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-507-E004, REV 02.	DATE:
		PROJECT:		PO NO.:	DATE:
		ITEM: SCREENED CONTROL CABLES	SYSTEM:	SECTION: II	SHEET 11 OF 11

(E)	FILLERS/DUMMY CORES ETC. SHALL BE AS PER BHEL SPECIFICATION
(F)	WHEREVER EXTENT OF CHECK FOR STAGE IS MENTIONED AS SAMPLES AND NOT DEFINED IN QP, THE SAME SHALL BE AS PER VENDORS SAMPLING PLAN AGREED BY PURCHASER.
(G)	VENDOR SHALL FURNISH COMPLIANCE CERTIFICATE TO THE INSPECTION AGENCY CONFIRMING THE PACKING AS PER BHEL SPECIFICATION.
(H)	FOR LIST OF TYPE TESTS, ROUTINE TESTS & ACCEPTANCE TESTS; REFER ANNEXURE 1 TO QP.

LEGENDS:
*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C**: CUSTOMER,
P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR, **CR:** CRITICAL

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	22.01.2020	Priyanka.	Checked by:	23/1/2020	KUNDAN GANDHI		
Reviewed by:		MANISH	Reviewed by:	23/1/2020	R K JAISWAL		

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

	ANNEXURE - I TO QP	CUSTOMER: TANGEDCO	PROJECT TITLE: 2 X 660MW UDANGUDI STPP	SPECIFICATION NUMBER: PE-TS-435-507-E004A
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R2	SPECIFICATION TITLE:
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TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS

A. Type Test Conduction:

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

2. Sampling:
   a) Type tests (except for Sl. no. b & c below) to be conducted on all sizes (2P, 4P etc.) of each type (F & G type)/ lot.
   b) Electrical & C&I tests 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 tests 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% drums, in line with the applicable standards and as per the Manufacturing Quality Plan approved for the project for every lot offered for inspection.

D. ADS: Approved datasheet.

NOTE: LOT shall be defined as per IS: 1554 Part-1.

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 8130, IS 10810 Pt 1	*In process records shall be furnished to inspector at the time of inspection.*
II.	Tin coating test (for tinned copper)	For copper conductor only	T, A	IS 8130, IS 10810 Pt 4	
III.	Resistance test	For Al/Cu	T, A, R	IS 8130, IS 10810 Pt 5	
IV.	Diameter test	For conductor	T, A	ADS	

	ANNEXURE - I TO QP	CUSTOMER: TANGEDCO	PROJECT TITLE: 2 X 660MW UDANGUDI STPP	SPECIFICATION NUMBER: PE-TS-435-507-E004A
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R2	SPECIFICATION TITLE:
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S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
2.0	Tests for Armour Wires/Strips				
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	T,A	IS 3975, IS 10810 Pt 36	
II.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	T, A	IS 3975, IS 10810 Pt 37	
III.	Elongation at break test	Applicable for GS wire/Strip only	T, A	IS 3975, IS 10810 Pt 37	
IV.	Torsion test	For GS round wire only	T, A	IS 3975, IS 10810 Pt 38	
V.	Winding test	For GS strip only	T, A	IS 3975, IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Aluminium wire & GS wire	T, A	IS 3975, IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	T, A	IS 3975, IS 10810 Pt 40 , IS: 2633	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	T, A	IS 3975, 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	IS 5831, IS 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for PVC insulation & PVC outer sheath	T, A	IS 5831, IS 10810 Pt 7	
(a)	Before ageing		T, A	IS 5831, IS 10810 Pt 7	
(b)	After ageing		T, A	IS 5831, IS 10810 Pt 7	
III.	Ageing in air oven	For PVC insulation & PVC outer sheath	T	IS 5831, IS 10810 Pt 11	
IV.	Loss of mass in air oven test	For PVC insulation & PVC outer & Inner sheath	T	IS 5831, IS 10810 Pt 10	
V.	Hot deformation test	For PVC insulation & PVC outer & Inner sheath	T	IS 5831, IS 10810 Pt 15	
VI.	Heat shock test	For PVC insulation & PVC outer & Inner sheath	T	IS 5831, IS 10810 Pt 14	
VII.	Shrinkage test	For PVC insulation & PVC outer & Inner sheath	T	IS 5831, IS 10810 Pt 12	
VIII.	Thermal stability test	For PVC insulation & PVC outer sheath	T	IS 5831, IS 1554-1	
IX.	Bleeding & Blooming test	Applicable for PVC insulation & PVC outer sheath	T	IS 5831, IS 10810 Pt 19	
X.	Cold bend test	For PVC insulation & PVC outer & Inner sheath	T	IS 5831, IS 10810 Pt 20	
XI.	Cold impact test	For PVC insulation & PVC outer & Inner sheath	T	IS 5831, IS 10810 Pt 21	

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		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R2	SPECIFICATION TITLE:
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S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
XII.	Colour fastness to water	For PVC insulation & PVC outer sheath	T	IS 10810 Pt 18, Appendix-A of IS: 5831	
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	
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	A	ADS	
5.0	Tests for Drain Wire				
I.	Annealing test	For copper conductor only	T, A	IS 8130, IS 10810 Pt 1	*In process records shall be furnished to inspector at the time of inspection.*
II.	Tin coating test (for tinned copper)	For copper conductor only	T, A	IS 8130, IS 10810 Pt 4	
III.	Resistance test	For Cu Conductor	T, A, R	IS 8130, IS 10810 Pt 5	
IV.	Diameter test	For conductor	T, A	ADS	
6.0	FRLS Tests				
I.	Oxygen index test	For PVC outer sheath & Fillers only	T, A	ASTMD 2863	Applicable for Inner Sheath if the same is indicated in Datasheet-A
II.	Smoke density test	For PVC outer sheath & Fillers only	T, A	ASTMD 2843	
III.	Acid gas generation test	For PVC outer sheath & Fillers only	T, A	IEC-754-1	
IV.	Temperature Index Test	For PVC outer sheath only	T	ASTMD 2863	
7.0	Flammability Tests				
I.	Flammability test for bunched cables	For complete cable	T,A	IEC-60332 (Part-3-23, CAT B).	Test & Category applicable as indicated in Datasheet-A
II.	Flammability test for single cable	For complete cable	T,A	IEC:60332 Part-1	
III.	Swedish chimney test	For complete cable	A	SEN SS 424 1475 (Class F3)	
IV.	Flammability test	For complete cable	A	IEEE: 60383	

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S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
8.0	Electrical Tests				
I.	High Voltage Test	For complete cable	T, A, R	IS 1554, IS: 10810 Pt 45	
II.	Insulation Resistance Test (Volume resistivity method)	For complete cable	T, A, R	IS 1554, IS: 10810 Pt 43	
III.	L/R Ratio	For complete cable	A, R	BS:5308 Part II	
IV.	Spark Test	Online Process during Extrusion of Insulation	Online	BS:5308 Part II	
V.	Thermal ageing test	For complete cable	T	IS-1554 Pt-I	
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, R	ADS	
V.	Noise interference	For complete cable	T, A	ADS	
10.0	Anti-rodent and Termite Repulsion test	For PVC outer sheath only	A	Refer Note	Test applicable as indicated in Datasheet-A
11.0	Anti-Fungal Test	For PVC outer sheath only	A	Self-certification by vendor for anti-fungal property.	Test applicable as indicated in Datasheet-A
12.0	Special Tests				
I.	Hydrolytic Stability	For complete cable	A(**)	ASTM D 3137	Test applicable as indicated in Datasheet-A
II.	Ultraviolet Test	For complete cable	A(**)	BS EN ISO 4892-2	

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

Note: Few chippings of PVC compound are slowly ignited in a porcelain dish in a muffle furnace at about 600 deg. C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). A drop of aqueous sodium sulphide solution is placed on a thick filter paper and it is allowed to soak. The spot is touched with a drop of above extract. A black spot indicates the presence of anti-termite & rodent compound (lead).