

**TELANGANA STATE POWER
GENERATION CORPORATION LIMITED
YADADRI TPS, 5X800MW**

VOLUME-II

**TECHNICAL SPECIFICATION
FOR
*SCREENED CONTROL CABLE***

SPECIFICATION NO: *PE-TS-417-507-E005*

REVISION: 00



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



**TECHNICAL SPECIFICATION FOR
SCREENED CONTROL CABLES**

5X800MW YADADRI TPS

SPECIFICATION NO. PE-TS-417-507-E005

VOLUME II

SECTION : CONTENTS

REVISION 0

DATE: 10.07.2019

SHEET 1 OF 1

CONTENTS

<u>S. NO.</u>	<u>DESCRIPTION</u>	<u>NO. OF SHEETS</u>
1.	SECTION – I	
	COMPLIANCE CERTIFICATE	01
	SPECIFIC TECHNICAL REQUIREMENTS	02
	DATA SHEET-A	04
	ANNEXURE BI	02
	DATA SHEET-C	04
	ANNEXURE I (BOQ CUM UN-PRICED SCHEDULE)	01
2.	SECTION – II	
	STANDARD TECHNICAL SPECIFICATION	03
	QUALITY PLAN (ALONGWITH ANNEXURE I TO QP)	09
	TOTAL NO. OF SHEETS=	28
	(INCLUDING COVER/ CONTENT/SEPARATOR SHEETS)	



**TECHNICAL SPECIFICATION FOR
SCREENED CONTROL CABLES**

SPECIFICATION NO. PE-TS- 417-507-E005

VOLUME II

SECTION I

REVISION 0

DATE: 10.07.2019

SHEET 1 of 1

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 deviations 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



**TECHNICAL SPECIFICATION FOR
SCREENED CONTROL CABLES**

5X800MW YADADRI TPS

SPECIFICATION NO. PE-TS-417-507-E005

VOLUME II

SECTION: I

REVISION 0

DATE: 10.07.2019

SHEET 1 OF 2

SECTION - I

SPECIFIC TECHNICAL REQUIREMENTS



TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES

5X800MW YADADRI TPS

SPECIFICATION NO. PE-TS-417-507-E005

VOLUME II

SECTION: I

REVISION 0

DATE: 10.07.2019

Sheet 2 of 2

1.0 SCOPE OF ENQUIRY

- 1.1 Design, Manufacture, Inspection and Testing at Manufacturer's works, proper packing and delivery to site of Screened Control Cable conforming to this specification.
- 1.2 It is not the intent to specify herein all the details of design & manufacture of material. However, the material shall conform in all respects to high standard of design, engineering & workmanship and shall be capable of performing in continuous commercial operation at site condition.
- 1.3 Technical requirements of Screened Control Cable are indicated in Data Sheet-A & Section-II.
- 1.4 The requirements of Section-I shall prevail and govern in case of conflict between the corresponding requirements of Section-I and Section-II.
- 1.5 The documents shall be in English language and MKS system of units.

2.0 BILL OF QUANTITIES

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

Bidder's offer shall be for complete scope as per specification. Part offers are not acceptable.

4.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

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

Sl. No.	Drawing / Document Description	Drawing / Document no	Document Type	First Submission	Resubmission
1	Technical Data sheet – Screened Control cables	PE-V0-417-507-E141	Primary	Within 14 days of the PO date	Within 10 days of comments
2	Cross-sectional Drgs.- Screened Control Cables	PE-V0-417-507-E143	Primary	Within 14 days of the PO date	Within 10 days of comments
3	Quality Plan - Screened Control Cables	PE-V0-417-507-E916	Primary	Within 14 days of the PO date	Within 10 days of comments
4	Type Test Reports - Screened Control Cables	PE-V0-417-507-E142	Secondary	Within 1 month of the PO date	Within 10 days of comments

- 4.2 Drawings/documents shall be submitted through Document Management System (DMS).



TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES

5X800MW YADADRI TPS

SPECIFICATION NO. PE-TS-417-507-E005

VOLUME II

SECTION I

REVISION 0

DATE: 10.07.2019

SHEET 1 of 4

DATA SHEET-A

1.0	Type of Cable	Flame Retardant Low Smoke (FR-LS)
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, ASTMD:2843, ASTMD:2863, ASTM D 3137:81, IEC-60754-1, IEC:60332 Part-1, IEC:60332 Part-3-23, Cat-B., BS-5308,ASTM B-33
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
		<i>Non-Compacted, Electrolytic</i>
		<i>Tinned</i>
(b)	Standard Applicable	IS: 8130
(c)	Shape	Circular
(d)	Min. number of strands, Dia and cross sectional area.	7, 0.3 mm (nom.) of each strand, 0.5 sq.mm
6.0	INSULATION	
(a)	Material	Extruded HR PVC 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.)	As per IS 5831 1×10^{13} ohm-cm at 27 deg. C & 1×10^{10} ohm-cm at 85 deg. C.
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	Twin twisted with lay of 60 mm (For 0.5 Sq.mm)
(c)	Diameter of core	In accordance with clause 6 (f)
8.0	IDENTIFICATION OF CORES	As per Annexure-BI
9.0	INDIVIDUALLY SCREENED	
(a)	Material	Aluminium-Mylar tape
(b)	Coverage	100%
(c)	Overlap	Minimum 25%
(d)	Min. thickness (Micron)	28 micron
10.0	OVERALL SCREENED	



TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES

5X800MW YADADRI TPS

SPECIFICATION NO. PE-TS-417-507-E005

VOLUME II

SECTION I

REVISION 0

DATE: 10.07.2019

SHEET 2 of 4

(a)	Material	Aluminium-Mylar tape
(b)	Coverage	100%
(c)	Overlap	Minimum 25%
(d)	Min. thickness (Micron)	60 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 (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 HR PVC Type ST-2 (anti rodent, anti termite & moisture resistant properties)
(b)	Standard Applicable	IS: 5831
(c)	Colour	Black
(d)	Whether FR-LSH 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)	Non -Hygroscopic with FRLS properties (As Required For Maintaining Cable Circularity)
(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-hygroscopic and non-wicking non-metallic undersheath
15.0	ARMOUR	
(a)	Applicable	YES
(b)	Material:	Galvanised Steel Wire/Strip, conforming to (i) Type 'a' / 'b' as per Table-5 of IS 1554-I and (ii) IS 3975.
(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 HR PVC Type ST2 (anti rodent, anti termite & moisture resistant properties)
(b)	Standard Applicable	IS: 1554 (Part-1) & IS: 5831
(c)	Colour	Grey
(d)	Whether FR-LSH	Yes
(e)	Method of application	Extruded
(f)	Thickness of outer sheath	As per IS: 1554 Part-1 (i.e. Min thickness shall be 1.8 mm)
(g)	Other properties	Resistant to water, termite & rodent attack
(h)	Marking	Cable size (cross section area and no. of pairs),



TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES

5X800MW YADADRI TPS

SPECIFICATION NO. PE-TS-417-507-E005

VOLUME II

SECTION I

REVISION 0

DATE: 10.07.2019

SHEET 3 of 4

		voltage grade, Type of Insulation e.g. HRPVC, FRLS, Manufacturer's name and/ or trade name, and year of manufacture @ 5m (by embossing) 'BHEL-PEM' and 'TSGENCO' Name IS No. @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 ASTM D 2863)
(b)	Temperature index	Min. 250°C at oxygen index value of 21 (As per ASTM D 2863)
(c)	Acid gas generation	Max. 20% by weight (As per IEC-60754-1)
(d)	Smoke density rating	Max. 60% (As per ASTM D 2843): 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	NO
(iv)	Flammability test as per IS-10810 Part 62, Cat B	NO
iv)	Swedish Chimney test SEN-SS-424-1475-F3	YES
18.0	Anti-rodent and Termite repulsion Test	YES
19.0	Special Tests	
(a)	Hydrolytic Stability Test	NO (Refer Clause no 3.4 of Section-II).
(b)	Ultraviolet Radiation Test	NO (Refer Clause no 3.4 of Section-II).
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
(c)	Tolerance on drum length	±5%
(d)	Painting	Entire surface to be painted
(e)	Construction Details	Anti-Rodent & as per Clause no 4.2 of Section-II of this technical specification
(f)	Particular details on Drum	Clause no 4.3 of Section-II of this technical specification. Further customer specific marking requirement (if any) shall be informed later.
(g)	Outermost layer	To be covered with waterproof polyethylene.

23.0 TECHNICAL PARAMETERS (C & I) As per Tables below:

Parameter	0.5 mm ² (IS & OS) Type-F	0.5 mm ² (OS) Type-G
Mutual Capacitance (max.) at 0.8 kHz, nF/Km	120	120



TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES

5X800MW YADADRI TPS

SPECIFICATION NO. PE-TS-417-507-E005

VOLUME II

SECTION I

REVISION 0

DATE: 10.07.2019

SHEET 4 of 4

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

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.)

Note:

Over the individual pair screening tape two laps 0.05mm thick (min.) polyester tape shall be applied with minimum overlap of 25%. Metallic side of the screen shall be in contact with drain wire.



**TECHNICAL SPECIFICATION FOR
SCREENED CONTROL CABLES**

5X800MW YADADRI TPS

SPECIFICATION NO.
PE-TS-417-507-E005

VOLUME NO. II

SECTION I

REV NO. : 0 DATE 10.07.2019

SHEET: 1 OF 2

ANNEXURE: B-I

**CORE IDENTIFICATION / PAIR
IDENTIFICATION**



TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES

5X800MW YADADRI TPS

SPECIFICATION NO.
PE-TS-417-507-E005

VOLUME NO. II

SECTION I

REV NO. : 0 DATE 10.07.2019

SHEET: 2 OF 2

ANNEXURE: B-I

The cable cores shall be colour coded as mentioned below:

PAIR	CORE	COLOUR
1st	1st	Blue
1st	2nd	Red
2nd	1st	Grey
2nd	2nd	Yellow
3rd	1st	Green
3rd	2nd	Brown
4th	1st	White
4th	2nd	Black

Each four pair is laid to form one unit and wound with Mylar tape. The cores of each unit shall then be identified by indelible printed colour bands for cables of more than 4-pair. Eg. All eight cores of the first unit shall have a single band of pink color (preferably rose pink).

Unit No No.	COLOUR OF BANDS	BAND MARKS
1.	PINK	= === ==
2.		= === ==
3.		= === ==
4.		= === ==
5.	ORANGE	= === ==
6.		= === ==
7.		= === ==
8.		= === ==
9.	VIOLET	= === ==
10.		= === ==
11.		= === ==
12.		= === ==

The dimension L (distance between the markings) shall be limited to 50 mm. The bands shall be neat and cover at least 2/3 of the periphery of the core.

Eg: A grey wire having 3 orange bands is the first core of the second pair of the Seventh unit.

Band markings shall not be easily erasable and shall also meet Bleeding and Blooming Test and color fastness to water test requirement as per relevant standard.



TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES

5X800MW YADADRI TPS

SPECIFICATION NO. PE-TS-417-507-E005

VOLUME II

SECTION I

REVISION 0

DATE: 10.07.2019

SHEET 1 of 4

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		



TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES

5X800MW YADADRI TPS

SPECIFICATION NO. PE-TS-417-507-E005

VOLUME II

SECTION I

REVISION 0

DATE: 10.07.2019

SHEET 2 of 4

	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	



TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES

5X800MW YADADRI TPS

SPECIFICATION NO. PE-TS-417-507-E005

VOLUME II

SECTION I

REVISION 0

DATE: 10.07.2019

SHEET 3 of 4

	d) Calculated dia under outersheath	mm	
	e) Oxygen index (as per ASTM D 2863)	-	
	f) Temperature index (in deg. C as per ASTM D 2863)	deg. C	
	g) Maximum acid gas generation as per IEC754-1	%	
	h) Maximum smoke density rating as per ASTM D 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		



TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES

5X800MW YADADRI TPS

SPECIFICATION NO. PE-TS-417-507-E005

VOLUME II

SECTION I

REVISION 0

DATE: 10.07.2019

SHEET 4 of 4

	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	-	

ANNEXURE I - BOQ-CUM-PRICE SCHEDULE FOR SCREENED CONTROL CABLE

1.0) MAIN SUPPLY									
Overall Screened Cable (Type-G)									
1100V grade twisted paired cable with stranded high conductivity annealed, tinned electrolytic copper extruded HR PVC insulation (Type-C), overall screened with Aluminium Mylar tape & drain wire, extruded FRLS HR PVC inner sheath (Type ST2) , Galvanised steel round wire(if dia under armour is upto 13 mm) or formed wire(if dia under armour is more than 13 mm) armour as per IS 3975 and IS 1554 part-I, with overall FRLS HR PVC outer sheath (Type ST2), generally conforming to IS:1554 Part-I (latest)									
S.No.	Item code	Item Description	UOM	Order Quantity	Quantity Stage 1	Quantity Stage 2	Drum Length	Unit Price (Ex-Works) Rs	Total Price (Ex-Works) Rs
1	507-31025-A	1.1kV TYPE G(O) 2P - 0.5 ARMOURED	KM	167	69	98	1000 Mtr	0.0603*X/167	0.0603*X
2	507-31029-A	1.1kV TYPE G(O) 4P - 0.5 ARMOURED	KM	211	87	124	1000 Mtr	0.0937*X/211	0.0937*X
3	507-31033-A	1.1kV TYPE G(O) 8P - 0.5 ARMOURED	KM	455	184	271	1000 Mtr	0.3336*X/455	0.3336*X
4	507-31017-A	1.1kV TYPE G(O) 12P - 0.5 ARMOURED	KM	72	29	43	1000 Mtr	0.0664*X/72	0.0664*X
Individual & Overall Screened Cable (Type-F)									
1100V grade twisted paired cable with stranded high conductivity annealed, tinned electrolytic copper extruded HR PVC insulation (Type-C), individual & overall screened with Aluminium Mylar tape & drain wire, extruded FRLS HR PVC inner sheath (Type ST2) Galvanised steel round wire(if dia under armour is upto 13 mm) or formed wire(if dia under armour is more than 13 mm) armour as per IS 3975 and IS 1554 part-I, with overall FRLS HR PVC outer sheath (Type ST2), generally conforming to IS:1554 Part-I (latest)									
5	507-31009-A	1.1kV TYPE F(IO) 4P - 0.5 ARMOURED	KM	300	122	178	1000 Mtr	0.1703*X/300	0.1703*X
6	507-31013-A	1.1kV TYPE F(IO) 8P - 0.5 ARMOURED	KM	179	73	106	1000 Mtr	0.1691*X/179	0.1691*X
7	507-31001-A	1.1kV TYPE F(IO) 12P - 0.5 ARMOURED	KM	22	9	13	1000 Mtr	0.0262*X/22	0.0262*X
8	507-31005-A	1.1kV TYPE F(IO) 20P - 0.5 ARMOURED	KM	42	17	25	1000 Mtr	0.0804*X/42	0.0804*X
TOTAL MAIN SUPPLY PRICE EX-WORKS									X
2.0) MANDATORY SPARES									
Overall Screened Cable (Type-G) (Same as Main Supply)									
S.No.	Item code	Item Description	UOM	Quantity		Drum Length	Unit Price (Ex-Works) Rs	Total Price (Ex-Works) Rs	
1	507-31025-A	1.1kV TYPE G(O) 2P-0.5 ARMOURED	KM	7		1000 Mtr			
2	507-31029-A	1.1kV TYPE G(O) 4P-0.5 ARMOURED	KM	9		1000 Mtr			
3	507-31033-A	1.1kV TYPE G(O) 8P-0.5 ARMOURED	KM	19		1000 Mtr			
4	507-31017-A	1.1kV TYPE G(O) 12P-0.5 ARMOURED	KM	3		1000 Mtr			
Individual & Overall Screened Cable (Type-F) (Same as Main Supply)									
5	507-31009-A	1.1kV TYPE F(IO) 4P - 0.5 ARMOURED	KM	12		1000 Mtr			
6	507-31013-A	1.1kV TYPE F(IO) 8P - 0.5 ARMOURED	KM	8		1000 Mtr			
7	507-31001-A	1.1kV TYPE F(IO) 12P - 0.5 ARMOURED	KM	1		1000 Mtr			
8	507-31005-A	1.1kV TYPE F(IO) 20P - 0.5 ARMOURED	KM	2		1000 Mtr			
TOTAL MANDATORY SPARE SUPPLY PRICE EX-WORKS									

Notes:-

1	Bidder has to quote Total Ex-works price for Main Supply cables . Based on this price (Total EX-works for Main Supply cables) respective unit price for all main supply cables shall be derived, as per formulae indicated above. Further, while quoting Mandatory Spares price, bidder has to keep the unit prices same as unit price of respective Main Supply cables.
2	Delivery schedule shall be as per NIT.
3	The bidder shall indicate the unit price of each type and size of cables listed as per the BOQ in the Price Schedule. The unit price shall apply for adjustment of variation in quantity as stipulated above.
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 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 final drum length to complete the supply (except where the total ordered quantity is one single drum length of 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 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.
7	Unit price of cables quoted by bidder shall be inclusive of type test charges. No separate charges shall be payable for type tests.



**TECHNICAL SPECIFICATION FOR
SCREENED CONTROL CABLES**

SPECIFICATION NO. PE-TS- 417-507-E005

VOLUME II

SECTION II

REVISION 0

DATE: 10.07.2019

SHEET 1 OF 3

SECTION-II

STANDARD TECHNICAL REQUIREMENTS



TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES

SPECIFICATION NO. PE-TS- 417-507-E005

VOLUME II

SECTION II

REVISION 0

DATE: 10.07.2019

SHEET 2 OF 3

1.0 CODES AND STANDARDS

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

2.0 TECHNICAL REQUIREMENTS

- 2.1 Screened Control Cable shall be supplied as per technical particulars specified in Data Sheet – A.

3.0 QUALITY ASSURANCE, TESTING & INSPECTION

- 3.1 Bidder shall confirm compliance with the BHEL Standard Quality Plan (PE-QP-999-507-E004, Rev-1) 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, routine / acceptance testing and special testing requirements shall be as per Annexure –I to QP. Charges for all these tests for all the equipment & components shall be deemed to be included in the bid price (except UV Radiation & Hydraulic Stability test).
- 3.4 The charges of UV Radiation test & Hydrolytic Stability test (if applicable) shall be reimbursed extra at actual against original money receipt of Govt. Lab. (CPRI/ ERDA etc).
- 3.5 Cost of cables consumed for testing shall be to bidder's account.

4.0 PACKING

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



TECHNICAL SPECIFICATION FOR SCREENED CONTROL CABLES

SPECIFICATION NO. PE-TS- 417-507-E005

VOLUME II

SECTION II

REVISION 0

DATE: 10.07.2019

SHEET 3 OF 3

- 4.3 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.

		QUALITY PLAN SHEET 1 OF 9		CUSTOMER :		PROJECT :			SPECIFICATION : PE-TS-417-507-E005			
				BIDDER/ :		QUALITY PLAN			NUMBER :			
				VENDOR :		NUMBER: PE-QP-999-507-E004, REV 01.			TECHNICAL SPECIFICATION			
		SYSTEM		ITEM :INSTRUMENTATION CABLES			SECTION II			VOLUME II		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11

Instructions:
 1. Cable manufacturer to maintain records to show co-relation of raw materials to finished cables i.e. raw material batch/ lot no. should be traceable to the final cable drum number or batch no.
 2. Cable manufacturer to maintain all quality records identified as per all QP stages enumerated below whether it is identified for BHEL verification or witness or not.

1.0	RAW MATERIAL											
1.1	Copper Rods/ Wires (For Conductor & drain wire)	GENERAL : 1. Physical properties 2. Elec.Properties SPECIFIC CHECKS : a) Make b) Grade c) Resistivity	MA	Physical Tests	Sample/Batch	Relevant Standard/ Approved datasheet	Relevant Standard/ Approved datasheet	Inspection Report/ Test Cert.	2/3	-	1/2	
			MA	Electrical Tests	Sample/Batch	-do-	-do-	-do-	2/3	-	1/2	
			MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.	3/2	-	1	
			MA	-do-	-do-	Relevant Std./ Approved datasheet	Relevant Std./ Approved datasheet	-do-	3/2	-	1	
			MA	Electrical Tests	Manufacturer std.	Relevant Std.	Relevant Std.	-do-	3/2	-	1	
1.2	PVC Compound (for insulation)	GENERAL : 1. Physical properties 2. Elec.Properties SPECIFIC CHECKS : a) Make b) Type/ Grade c) Shelf life/ Storage condition	MA	Physical Tests	Sample/Batch	Relevant Standard/ Approved datasheet	Relevant Standard/ Approved datasheet	Inspection Report/ Test Cert.	2/3	-	1/2	
			MA	Electrical Tests	Sample/Batch	-do-	-do-	-do-	2/3	-	1/2	
			MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.	3/2	-	1	
			MA	-do-	-do-	Approved datasheet	Approved datasheet	-do-	3/2	-	1	
			MA	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	3/2	-	1	
1.3	Screen / Tapes/ Binders	1. Make 2. Dimension 3. T.S. & Elongation 4. Chem. & Phys. Properties	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	TC & IR	3/2	-	1/2	
			MA	Measurement	Manufacturer std.	Manufacturer datasheet/ Approved datasheet	Manufacturer datasheet/ Approved datasheet	TC & IR	3/2	-	1/2	
			MA	Physical Tests	-do-	Manufacturer datasheet	Manufacturer datasheet	-do-	3/2	-	1/2	
			MA	Chemical & Physical Tests	-do-	Manufacturer std.	Manufacturer std.	-do-	3/2	-	1/2	
1.4	Fillers (as applicable)	1. Make 2. Flame retardant & moisture resistant (as applicable)	MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/Test certificate	3/2	-	1	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
			MA	Chemical/ Environ.	-do-	Appd. Data Sheet	Appd. Data Sheet	-do-	3/2	-	2	

BHEL		PARTICULARS	BIDDER/VENDOR	
		NAME		
		SIGNATURE		
		DATE		
BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN		CUSTOMER :		PROJECT :			SPECIFICATION : PE-TS-417-507-E005				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER: PE-QP-999-507-E004, REV 01.			NUMBER : SPECIFICATION TECHNICAL SPECIFICATION TITLE OF SCREENED CONTROL				
		SHEET 2 OF 9		SYSTEM		ITEM :INSTRUMENTATION CABLES			SECTION II VOLUME II				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	P	W	V	11
1.5	Galvanised steel wire/strip for Armour (if applicable)	GENERAL : 1. Make 2. Dimension 3. Phy.and Elec. Properties 4. Galvanization Quality	MA	Verify	Manufacturer std.	Manufacturer approved source Relevant Standard/Appd. Data Sheet	Manufacturer approved source Relevant Standard/Appd. Data Sheet	Inspection Report/ Test Cert. -do-	2/3	-	1		* Sample from each armoursize/ Batch/Lot.
			MA	Measurement	-do-			-do-	2/3	-	2		
			MA	Physical & Electrical Tests	Sample*	-do-		-do-	2/3	-	2		
			MA	Galv. Tests	-do-	Relevant Standard/ Mfr. Std.	Relevant Standard/ Mfr. Std.	-do-	2/3	-	2		
1.6	PVC compound for Sheath	GENERAL : 1. Physical properties 2. Elec.Properties 3. FRLS Properties (as applicable) SPECIFIC CHECKS : a) Make b) Type/ Grade c) Shelf life/ Storage condition	MA	Physical Tests	Sample/Batch	Relevant Standard/ Approved datasheet	Relevant Standard/ Approved datasheet	Inspection Report/ Test Cert.	3/2	-	1/2		#If applicable
			MA	Electrical Tests	Sample/Batch	-do-	-do-	-do-	3/2	-	1/2		
			CR	Chemical/ Environ.	Sample/Batch	-do-	-do-	-do-	3/2	-	1/2		
			MA	Verify	100%	Manufacturer approved source	Manufacturer approved source	COC/ Test Cert.	3/2	-	1		
			MA	-do-	-do-	Approved datasheet	Approved datasheet	-do-	3/2	-	1		
			MA	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	3/2	-	1		
1.7	Wooden drums	1. Phy. & Constructional checks 2. Anti termite treatment	MA	Visual	Mfr's Plant Std.	IS 10418	IS 10418	Inspection Report/ Test Cert. COC	3/2	-	1		
			MA	Chem.	-do-	Mfr's Plant Std.	Mfr's Plant Std.		3/2		1		
1.8	Steel drums #	1. Dimension 2. Surface finish	MA	Meas.	Mfr's Plant Std.	Approved drg/BHEL Spec	Approved drg/BHEL Spec	Inspection Report/ Test Cert.	3/2	-	1		
			MA	Visual	-do-	Surface shall be smooth	Surface shall be smooth	Inspection Report	3/2		1		
2.0 IN PROCESS													
2.1	Wire Drawing & Annealing.	1. Size 2. Surface finish 3. % of Elongation	MA	Dimensional	Mfr's Plant Std.	Approved datasheet	Approved datasheet	Inspection Report	2	-	1		(Applicable only for tin-coated copper conductor and drain wire)
			MA	Visual	-do-	Surface shall be smooth	Surface shall be smooth	-do-	2	-	1		
			MA	Mechanical	-do-	Relevant std./Approved data sheet	Relevant std./Approved data sheet	-do-	2	-	1		
			MA	Dimensional	Plant Mfg. Std.	Approved datasheet	Approved datasheet	-do-	2	-	1		
			CR	Chemical	-do-	Relevant Standard	Relevant Standard	-do-	2	-	1		
			MA	Counting	Mfr's Plant Std.	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-		
2.2	Tinning (Conductor or drain wire)	1. Size 2. Chemical test for tinning	MA	Dimensional	Plant Mfg. Std.	Approved datasheet	Approved datasheet	-do-	2	-	1		
			CR	Chemical	-do-	Relevant Standard	Relevant Standard	-do-	2	-	1		
2.3	Stranding of wires	1. No.of wires	MA	Counting	Mfr's Plant Std.	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-		
			PARTICULARS		BIDDER/VENDOR								
BHEL			NAME										
			SIGNATURE										
			DATE				BIDDER'S/VENDORS COMPANY SEAL						

		QUALITY PLAN SHEET 3 OF 9		CUSTOMER :			PROJECT :			SPECIFICATION : PE-TS-417-507-E005			
				BIDDER/ VENDOR :			QUALITY PLAN			NUMBER :			
				SYSTEM			NUMBER: PE-QP-999-507-E004, REV 01.			SPECIFICATION TECHNICAL SPECIFICATION			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION II VOLUME II			REMARKS	
1	2	3	4	5	6	7	8	9	10	P	W	V	11
2.4	Core Insulation (No repair permitted)	2. Resistance	CR	Electrical	-do-	-do-	-do-	-do-	2	-	-	# To be checked at starting & finish end of	
		3. Sequence, lay length	MA	Visual, Meas	one Sample of each size/lot	Mfr. Std./	Mfr. Std./	-do-	2	-	-		
		4. Direction	MA	Visual	100%	Approved datasheet	Approved datasheet	-do-	2	-	-		
		4. Surface Finish	MA	Measurement	one Sample of each size/lot	Surface shall be smooth	Surface shall be smooth	-do-	2	-	-		
		5.Dimension	MA	Measurement		Appd. Data Sheet/Relevant std.	Appd. Data Sheet/Relevant std.	-do-	2	-	-		
		1. Surface finish	MA	Visual	100%	Free from bulging burnt particles lumps, cuts & Scratches.	Free from bulging burnt particles lumps, cuts & Scratches.	Inspection Report	2	-	1		
		2 Insulation thickness	CR	Measurement	one Sample of each size/lot	Appd.data sheet/	Appd.data sheet/	-do-	2	-	-		
2.5	Core pairing, screening (provision of drain wire & laying)	(Min./ Max.)	CR	Measurement	-do-	Relevant Std.	Relevant Std.	Inspection Report	2	-	1		
		3. Concentricity #	CR	Measurement	-do-	Mfr's Std./Appd. data sheet	Mfr's Std./Appd. data sheet	-do-	2	-	-		
		4 Dia over insulation	MA	Measurement	-do-	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-		
		5. Core identification	MA	Visual	100%	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-		
		6. TS & % Elongation	MA	Mechanical	100%	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-		
		1. Pair identification	MA	Visual	100%	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	Inspection Report	2	-	-		
		2.Wire size & tape size	MA	Measurement	100%	-do-	-do-	-do-	2	-	-		
		3.Test for capacitance	CR	Elect. Test	100%	-do-	-do-	-do-	2	-	-		
		4. Sequence of lay and lay length	MA	Visual meas	one Sample of each size/lot	Appd. Data Sheet	Appd. Data Sheet	-do-	2	-	-		
		5. Screen overlap & coverage	MA	Measurement	-do-	& MFRs. Std.	& MFRs. Std.	-do-	2	-	-		
		6. Dia over laid up core	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-		
		7. Continuity of drain & drain wire with Screen	MA	Elect. Test	100%	<-----No Discontinuity ----->	-do-	2	-	-			
		PARTICULARS		BIDDER/VENDOR									
		BHEL		NAME									
		SIGNATURE											
		DATE											
BIDDER'S/VENDORS COMPANY SEAL													

	QUALITY PLAN		CUSTOMER :			PROJECT :			SPECIFICATION : PE-TS-417-507-E005			
			BIDDER/ :			QUALITY PLAN			NUMBER :			
	SHEET 4 OF 9		VENDOR :			NUMBER: PE-QP-999-507-E004, REV 01.			SPECIFICATION TECHNICAL SPECIFICATION			
			SYSTEM			ITEM :INSTRUMENTATION CABLES			SECTION II VOLUME II			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.6	Inner Sheath Extrusion (if applicable)	1. Surface finish	MA	Visual	100%	Free from bulging, burnt particles,lumps cuts & scratches.	Free from bulging, burnt particles,lumps cuts & scratches.	-do-	2	-	-	
		2. Sheath thickness	CR	Measurement	One sample of ech size/lot	Relevant std./Approved Data sheet	Relevant std./Approved Data sheet	-do-	2	-	-	
		3.Dia over inner sheath	MA	Measurement	-do-	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-	
		4. Colour	MA	Visual	100%	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-	
2.7	Armouring (If Applicable)	1. No.of wires/Strips	MA	Counting	At the start of the process	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-	
		2. Size of wire/ Strip	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
		3. Lay Direction	MA	Visual	-do-	-do-	-do-	-do-	2	-	-	
		4. Lay Length	MA	Visual, Meas.	At the start of the process	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-	
		5. Coverage	MA	Measurement	-do-	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-	
		6. Dia over armouring	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
2.8	Outer Sheath Extrusion	1. Surface Finish	MA	Visual	100%	-	Free from Bulging Burnt particles, lumps, cuts & scratches	-do-	2	-	-	
		2.Sheath thickness	CR	Measurement	One sample of ech size/lot	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-	-	
		3. Dia over outer sheath	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN SHEET 5 OF 9		CUSTOMER :		PROJECT :			SPECIFICATION : PE-TS-417-507-E005				
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER: PE-QP-999-507-E004, REV 01.			SPECIFICATION TECHNICAL SPECIFICATION TITLE OF SCREENED CONTROL				
				SYSTEM		ITEM :INSTRUMENTATION CABLES			SECTION VOLUME II				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	P	W	V	11
3.0	Final Inspection	4. Marking/ Colour/ Embossing	MA	Visual	100%	Appd. Data Sheet	Appd. Data Sheet	-do-	2	-	-	Sequential marking shall be done by printing	
		5. TS & % Elongation	MA	Mechanical	100%	Relevant Standard/ Appd. Data Sheet	Relevant Standard/ Appd. Data Sheet	-do-	2	-			
		1. Finish & Length	MA	Visual, Measurement	One drum in each lot	Relevant Standard/ Appd. Data Sheet	Free from Bulging	Inspection Report	2	1	-		
		2. Dimensions	MA	Measurement	As per std.	Appd. Data sheet	Burnt particles, lumps, cuts & scratches/ Approved Data Sheet	Inspection Report	2	1	-		
		3. Armouring - Coverage No.of Wires/Strips	MA	Visual & Meas.	-do-	-do-	-do-	-do-	2	1	-	Refer Annexure-I to QP for sampling plan.	
		4. Marking/Colour/ pair identification	MA	Visual	-do-	-do-	-do-	-do-	2	1	-		
		5. Test for screening	CR	Elect. Test	-do-	-do-	-do-	-do-	2	1	-		
		6. Acceptance Tests (Refer Note-H)	CR	Phy & Elect. Tests	sample	-do-	-do-	-do-	2	1			
		7. Type & FRLS Tests (Refer Note-H)	CR	Measurement	Sample	Appd. Data sheet	Appd. Data sheet	-do-	2	1	-		
		NOTES:- (A) JOINTS IN WIRE SHALL BE AS PERMITTED BY REL STD / BHEL SPECIFICATION. VENDOR TO CERTIFY THE SAME. (B) NO REPAIR OF CORE INSULATION PERMITTED (C) CABLE ENDS SHALL BE SEALED AS PER REL. STD./ BHEL SPECIFICATION (D) RECORD OF RAW MATERIAL, PROCESS & ALL STAGES SHALL BE CERTIFIED BY VENDORS QC. AND ARE LIABLE TO AUDIT CHECK BY PURCHASER. (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 REL. STD./ BHEL SPECIFICATION. (H) FOR LIST OF TYPE TESTS, ROUTINE TESTS & ACCEPTANCE TESTS; REFER ANNEXURE I TO QP.											
LEGEND : P : PERFORMER W: WITNESS V: VERIFIER 1- BHEL/CUSTOMER 2-VENDOR 3 SUB VENDOR CHP: CUSTOMER HOLD POINT TC : Test Certificates, Spec. : Specification Mfg. : Manufacturer.													
			PARTICULARS		BIDDER/VENDOR								
BHEL			NAME										
			SIGNATURE										
			DATE		BIDDER'S/VENDORS COMPANY SEAL								

	ANNEXURE - D TO QP	CUSTOMER:	PROJECT TITLE: 5X800MW YADADRI TPS	SPECIFICATION NUMBER: PE-TS-417-507-E005
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R1	SPECIFICATION TITLE:
	Page 6 of 9	SYSTEM	ITEM: SCREENED CONTROL CABLES	DOC. NO.

TYPE/ ACCEPTANCE/ ROUTINE TEST REQUIREMENTS

A. Type Test Conduction:

- Tests for which "T" is indicated in the 'Test Conduction Required As' column below shall be conducted as Type Test.
- Sampling:
 - Type 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.
 - Electrical & C&I tests to be conducted on each size of each type of cables /lot.
 - FRLS & Flammability tests to be conducted only on one sample/ lot, irrespective of size/type.

B. Acceptance Test Conduction:

- Tests for which "A" is indicated in the 'Test Conduction Required As' column below shall be conducted as Acceptance tests.
- Sampling:
 - 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.
 - Electrical & C&I tests to be conducted on each size of each type of cables /lot.
 - FRLS & Flammability tests to be conducted only on one sample/ lot, irrespective of size/type.

C. Routine Test Conduction:

- Tests for which "R" is indicated in the 'Test Conduction Required As' column below shall be conducted as Routine tests.
- Sampling:
Routine testing shall be conducted 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 10810 Pt 1	<i>In process records shall be furnished to inspector at the time of inspection.</i>
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	IS 10810 Pt 5	
IV.	Diameter test	For conductor	T, A	ADS	

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL

	ANNEXURE - D TO QP	CUSTOMER:	PROJECT TITLE: 5X800MW YADADRI TPS	SPECIFICATION NUMBER: PE-TS-417-507-E005
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R1	SPECIFICATION TITLE:
	Page 7 of 9	SYSTEM	ITEM: SCREENED CONTROL CABLES	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
2.0	Tests for Armour Wires/Strips				
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	T, A	IS 10810 Pt 36	
II.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	T, A	IS 10810 Pt 37	
III.	Elongation at break test	Applicable for GS wire/Strip only	T, A	IS 10810 Pt 37	
IV.	Torsion test	For GS round wire only	T, A	IS 10810 Pt 38	
V.	Winding test	For GS strip only	T, A	IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Aluminium wire & GS wire	T, A	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 40 , IS: 2633	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	T, A	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 10810 Pt 6	
II.	Tensile strength and elongation test at break	Applicable for PVC insulation & PVC outer sheath	T, A	IS 10810 Pt 7	
(a)	Before ageing		T, A	IS 10810 Pt 7	
(b)	After ageing		T, A	IS 10810 Pt 7	
III.	Ageing in air oven	For PVC insulation & PVC outer sheath	T	IS 10810 Pt 11	
IV.	Loss of mass in air oven test	For PVC insulation & PVC outer & Inner sheath	T	IS 10810 Pt 10	
V.	Hot deformation test	For PVC insulation & PVC outer & Inner sheath	T	IS 10810 Pt 15	
VI.	Heat shock test	For PVC insulation & PVC outer & Inner sheath	T	IS 10810 Pt 14	
VII.	Shrinkage test	For PVC insulation & PVC outer & Inner sheath	T	IS 10810 Pt 12	
VIII.	Thermal stability test	For PVC insulation & PVC outer sheath	T	IS 1554-1	
IX.	Bleeding & Blooming test	Applicable for PVC insulation & PVC outer sheath	T	IS 10810 Pt 19	
X.	Cold bend test	For PVC insulation & PVC outer & Inner sheath	T	IS 10810 Pt 20	
XI.	Cold impact test	For PVC insulation & PVC outer & Inner sheath	T	IS 10810 Pt 21	
XII.	Colour fastness to water	For PVC insulation & PVC outer sheath	T	IS 10810 Pt 18, Appendix-A of IS: 5831	

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL

	ANNEXURE - D TO QP	CUSTOMER:	PROJECT TITLE: 5X800MW YADADRI TPS	SPECIFICATION NUMBER: PE-TS-417-507-E005
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R1	SPECIFICATION TITLE:
	Page 8 of 9	SYSTEM	ITEM: SCREENED CONTROL CABLES	DOC. NO.

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
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 10810 Pt 1	<u>In process records shall be furnished to inspector at the time of inspection.</u>
II.	Tin coating test (for tinned copper)	For copper conductor only	T, A	IS 10810 Pt 4	
III.	Resistance test	For Cu Conductor	T, A, R	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	IS 10810 Pt 58 / ASTMD 2863	<u>Applicable for Inner Sheath if the same is indicated in Datasheet-A</u>
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	IS 10810 Pt 59 / IEC-754-1	
IV.	Temperature Index Test	For PVC outer sheath only	T	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 B).	<u>Test & Category applicable as indicated in Datasheet-A</u>
II.	Flammability test for single cable	For complete cable	T,A	IS: 10810 Pt 61 / IEC:60332 Part-1	
III.	Swedish chimney test	For complete cable	A	SEN SS 424 1475 (Class F3)	
IV.	Flammability test	For complete cable	A	IEEE: 60383	

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL

	ANNEXURE - D TO QP	CUSTOMER:	PROJECT TITLE: 5X800MW YADADRI TPS	SPECIFICATION NUMBER: PE-TS-417-507-E005
		BIDDER/VENDOR:	QUALITY PLAN NUMBER : PE-QP-999-507-E004, R1	SPECIFICATION TITLE:
	Page 9 of 9	SYSTEM	ITEM: SCREENED CONTROL CABLES	DOC. NO.

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: 10810 Pt 45	
II.	Insulation Resistance Test (Volume resistivity method)	For complete cable	T, A, R	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	<u>Test applicable as indicated in Datasheet-A</u>
11.0	Anti-Fungal Test	For PVC outer sheath only	A	<u>Self-certification by vendor for anti-fungal property.</u>	<u>Same shall be applicable as per the project requirement to be furnished later.</u>
12.0	Special Tests				
I.	Hydrolytic Stability	For complete cable	A ^(**)	ASTM D 3137	<u>Test applicable as indicated in Datasheet-A</u>
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).

BHEL	PARTICULARS	BIDDER/ VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S / VENDORS COMPANY SEAL