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

CONTENTS

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

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

1.0 PURPOSE

This specification is intended for finalization of contract between BHEL PEM and Bidder. Standard technical detail as indicated in the specification shall be agreed upon between BHEL PEM and bidder.

2.0 SCOPE OF ENQUIRY

2.1 Design, Manufacture, Inspection and Testing at Manufacturer's works, proper packing and delivery to site of Screened Control Cable conforming to this specification.

2.2 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.

2.3 Technical requirements of Screened Control Cable are indicated in Data Sheet-A & Section-II.

2.4 The stipulation of Data Sheet-A shall prevail in case of any conflict between the stipulations of Data Sheet-A & Section-II.

2.5 The documents shall be in English language and MKS system of units.

3.0 TECHNICAL

S.No.	Reference clause No. of Section II (if any)	Specific Requirement/ Change
1	3.1	Bidder shall confirm compliance with the BHEL Standard Quality Plan (PE-QP-999-507-E004, Rev-2) 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 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.

4.0 BILL OF QUANTITIES

The bidder to quote for items as BOQ-cum-price schedule attached with NIT.

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

5.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

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

Sl. No.	Drawing / Document Description	Drawing / Document no	Document Type
1	Technical Data sheet – Screened Control cables	PE-V0-417-507-E141	Primary
2	Cross-sectional Drgs.- Screened Control Cables	PE-V0-417-507-E143	Primary
3	Quality Plan - Screened Control Cables	PE-V0-417-507-E916*	Primary
4	Type Test Reports - Screened Control Cables	PE-V0-417-507-E142	Secondary

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

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

5.3 Supplier to submit the drawing/documents submission/resubmission schedule as & when required by BHEL.

5.4 Supplier to submit detailed 'bill of material' (BoM) at the time of drawing/document submission after placement of PO. Each item of the BoM to be uniquely identified with item code no. or item serial no.

5.5 Supplier to ensure that all items which will find separate mention in the packing list are covered in this detailed BoM.

5.6 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."

DATA SHEET-A

1.0	Type of Cable	Flame Retardant Low Smoke Halogen(FR-LSH)
2.0	Standard applicable in general (Latest amendment to be referred if any)	IS: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 and cross sectional area.	7, 0.3 mm (nom.) dia,of each, 0.5 sq.mm (0.8 mm conductor dia)
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.)	$1x10^{13}$ ohm-cm at 27 deg. C & $1x10^{10}$ ohm-cm at 85 deg. C.
7.0	**LAYING OF CORES**	
(a)	Maximum lay of individual twisted pair	Twin twisted with lay of 60 mm (For 0.5 Sq.mm)
(b)	Diameter of core	In accordance with clause 6 (f)
8.0	**IDENTIFICATION OF CORES**	As per Annexure-B
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**	
(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.) .0.8 mm is the dia. of conductor.
12.0	**BEDDING / BINDER/ TAPE**	
(a)	Material	Mylar tape.
13.0	**INNER SHEATH**	
(a)	Material	Extruded HR PVC Type ST-2
(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)	Same as inner sheath (with moisture resistant / non-hygroscopic 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-hygroscopic and non-wicking non-metallic cord
15.0	***ARMOUR***	
(a)	*Applicable*	*YES*
(b)	Material:	*Galvanised Steel Wire/Strip,* conforming to IS 3975.
(c)	Standard Applicable	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	IS: 1554 (Part-1) & IS: 5831
(g)	Other properties	Resistant to water, oil, acid, alkali, 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,*

		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 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)	Flammability test as per IS-10810 Part 62, Cat B	*YES*
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	Non-returnable wooden drums, 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 mm2 (IS & OS) Type-F*	*0.5 mm2 (OS) Type-G*
Mutual Capacitance (max.) at 0.8 kHz, nF/Km	*120*	*120*
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.)

ANNEXURE: B

CORE IDENTIFICATION / PAIR IDENTIFICATION

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.

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

STANDARD TECHNICAL REQUIREMENTS

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 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.

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.

Supplier Logo	MANUFACTURING QUALITY PLAN	SPEC. NO : PE-RC-999-507-E005 Rev: 00	DATE: 15/02/2020
	CUSTOMER : TSGENCO	QP NO. : PE-V0 - 417-507-E916 Rev: 01	DATE: 02/11/2021
	PROJECT: 5 x 800 MW YADADRI TPS	PO NO.: R-31/21	DATE: 30/06/2021
	ITEM: Screened Control Cables	SYSTEM: Cable	Cat Plan –Cat-I	Page 1 of 8

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/Wire (For Conductor & drain wire)	**GENERAL**													
		1. Physical properties	MA	Physical Tests	Sample/ Batch	Sample/ Batch	Sample/ Batch	IS -613	IS -613	Inspection Report / Test Certificate	✓	P/ V	V	V	
		2. Electrical Properties	MA	Electrical Tests	Sample/ Batch	Sample/ Batch	Sample/ Batch	-do-	-do-	-do-	✓	P/ V	V	V	
		SPECIFIC CHECKS													
		a) Make	MA	Verify	100%	100%	100%	Manufacturer approved source	Manufacturer approved source	COC / Test Certificate	✓	P	V	V	
		b) Grade	MA	-do-	-do-	-do-	-do-	IS -613	IS -613	-do-	✓	P	V	V	
		c) Resistivity	MA	Electrical Tests	Manufa cturer std.	Manufa cturer std.	Manufa cturer std.	IS -613	IS -613	-do-	✓	P	V	V	
1.2	PVC Compound (for insulation)	**GENERAL**													
		1. Physical properties	MA	Physical Tests	Sample/ Batch	Sample/ Batch	Sample/ Batch	IS -5813	IS - 5813	Inspection Report / Test Certificate	✓	P	V	V	
		2. Electrical Properties	MA	Electrical Tests	Sample/ Batch	Sample/ Batch	Sample/ Batch	-do-	-do-	-do-	✓	P	V	V	
		SPECIFIC CHECKS													
		a) Make	MA	Verify	100%	100%	100%	Manufacturer approved source	Manufacturer approved source	Test Certificate	✓	P/ V	V	V	
		b) Type/ Grade	MA	-do-	-do-	-do-	-do-	Approved datasheet	Approved datasheet	-do-	✓	P/ V	V	V	

Supplier Logo	MANUFACTURING QUALITY PLAN	SPEC. NO : PE-RC-999-507-E005 Rev: 00	DATE: 15/02/2020
	CUSTOMER : TSGENCO	QP NO. : PE-V0 - 417-507-E916 Rev: 01	DATE: 02/11/2021
	PROJECT: 5 x 800 MW YADADRI TPS	PO NO.: R-31/21	DATE: 30/06/2021
	ITEM: Screened Control Cables	SYSTEM: Cable	Cat Plan –Cat-I	Page 2 of 8

SL NO.	COMPONENT /OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY 10 **			REMARKS
1	2	3	4	5	6			7	8	9	D				
					M	C	N					M	C	N	
		c) Shelf life/ Storage condition	MA	-do-	-do-	-do-	-do-	Compound Manufacturer std.	Compound Manufacturer std.	-do-	✓	P/ V	V	V	
1.3	Screen / Tape/ Binder	1. Make	MA	Verification	100%	100%	100%	Manufacturer approved source	Manufacturer approved source	Test Certificate/ Inspection Report	✓	P/ V	V	V	
		2. Dimension	MA	Measurement	Manuf acturer std.	Manuf acturer std.	Manuf acturer std.	Manufacturer data sheet / Approved data sheet	Manufacturer data sheet / Approved data sheet	Test Certificate/ Inspection Report	✓	P/ V	V	V	
		3. T.S. & Elongation	MA	Physical Tests	-do-	-do-	-do-	Manufacturer data sheet	Manufacturer data sheet	Test Certificate/ Inspection Report	✓	P/ V	V	V	
1.4	Fillers (as applicable)	1. Make	MA	Verify	100%	100%	100%	Manufacturer approved source	Manufacturer approved source	COC / Test Certificate	✓	P	V	V	Fillers material chosen shall be compatible with the temperature rating of the cable and shall have no deleterious effect on any other component of cable
		2. Flame retardant & moisture retardant (as applicable)	MA	Chemical / Environ	100%	100%	100%	Approved data sheet	Approved data sheet	COC / Test Certificate	✓	P/ V	V	V	
1.5	Galvanized steel wire/strip for Armour (as applicable)	GENERAL													
		1. Make	MA	Verify	Manuf acturer std.	Manuf acturer std.	Manuf acturer std.	Manufacturer approved source	Manufacturer approved source	Test Certificate/ Inspection Report	✓	P	V	V	* Sample from each armour Size/ Batch/ lot
		2. Dimension	MA	Measurement	-do-	-do-	-do-	Approved data sheet	Approved data sheet	-do-		P/ V	V	V	
		3. Physical & Electrical properties	MA	Physical & Electrical Tests	Sample*	Sample *	Sample*	-do-	-do-	-do-	✓	P/ V	V	V	
		4.Galvanizatio n Quality	MA	Galv.Tests	-do-	-do-	-do-	IS 3975	IS 3975	-do-		P/ V	V	V	

Supplier Logo	MANUFACTURING QUALITY PLAN	SPEC. NO : PE-RC-999-507-E005 Rev: 00	DATE: 15/02/2020
	CUSTOMER : TSGENCO	QP NO. : PE-V0 - 417-507-E916 Rev: 01	DATE: 02/11/2021
	PROJECT: 5 x 800 MW YADADRI TPS	PO NO.: R-31/21	DATE: 30/06/2021
	ITEM: Screened Control Cables	SYSTEM: Cable	Cat Plan –Cat-I	Page 3 of 8

SL NO.	COMPONENT /OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY 10			REMARKS
1	2	3	4	5	6			7	8	9	*	**			
					M	C	N				D	M	C	N	
1.6	PVC Compound for Sheath	**GENERAL**													
		1. Physical properties	MA	Physical Tests	Sample/ Batch	Sample/ Batch	Sample/ Batch	IS 5831	IS 5831	Inspection report/ Test Certificate	✓	P	V	V	
		2. Electrical Properties	MA	Electrical Tests	Sample/ Batch	Sample/ Batch	Sample/ Batch	-do-	-do-	-do-	✓	P	V	V	
		3. FRLS properties (as applicable)	CR	Chemical / Environ	Sample/ Batch	Sample/ Batch	Sample/ Batch	Approved data sheet	Approved data sheet	-do-	✓	P/ V	V	V	
		SPECIFIC CHECKS													
		a) Make	MA	Verify	100%	100%	100%	Manufacturer approved source	Manufacturer approved source	COC / Test Certificate	✓	P/ V	V	V	
		b) Type/Grade	MA	-do-	-do-	-do-	-do-	Approved data sheet	Approved data sheet	-do-	✓	P/ V	V	V	
		c) Shelf life / Storage condition	MA	-do-	-do-	-do-	-do-	Compound Manufacturer Standard	Compound Manufacturer Standard	-do-	✓	P/ V	V	V	
1.7	Wooden Drum	1. Phy. & Constructional checks	MA	Visual	Manuf acturer std.	Manuf acturer std.	Manuf acturer std.	IS 10418	IS 10418	Inspection report/ Test Certificate	✓	P	V	V	
		2. Anti-termite treatment	MA	Chemical	-do-	-do-	-do-	Manufacturer std.	Manufacturer std.	COC	✓	P	V	V	
1.8	Steel Drum (if applicable)	1. Dimension	MA	Measurement	Manufa cturer std.	Manufa cturer std.	Manufa cturer std.	Approved drawing	Approved drawing	Test Certificate	✓	P	V	V	
		2. Surface finish	MA	Visual	-do-	-do-	-do-	–	Surface shall be smooth	-do-	✓	P	V	V	
2.0	IN PROCESS														
2.1	Wire Drawing & Annealing	1. Size	MA	Dimensional	Manufa cturer std.	Manufa cturer std.	Manufa cturer std.	Approved data sheet	Approved data sheet	Inspection report	✓	P	V	V	
		2. Surface finish	MA	Visual	-do-	-do-	-do-	–	Surface shall be smooth	-do-	✓	P	V	V	

Supplier Logo	MANUFACTURING QUALITY PLAN	SPEC. NO : PE-RC-999-507-E005 Rev: 00	DATE: 15/02/2020
	CUSTOMER : TSGENCO	QP NO. : PE-V0 - 417-507-E916 Rev: 01	DATE: 02/11/2021
	PROJECT: 5 x 800 MW YADADRI TPS	PO NO.: R-31/21	DATE: 30/06/2021
	ITEM: Screened Control Cables / SYSTEM: Cable	Cat Plan –Cat-I	Page 4 of 8

SL NO.	COMPONENT /OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY 10			REMARKS
					6					9	*	**			
1	2	3	4	5	M	C	N	7	8		D	M	C	N	
2.2	Tinning (Conductor or drain wire)	1. Size	MA	Dimensional	Manufacturer std.	Manufacturer std.	Manufacturer std.	Manufacturer std.	Manufacturer std.	Inspection report	✓	P	V	V	
		2. Chemical test for tinning	CR	Chemical	-do-	-do-	-do-	IS- 10810-4	IS- 8130	-do-	✓	P	V	V	
2.3	Stranding of Wires	1. No. of wires	MA	Counting	Manufacturer std.	Manufacturer std.	Manufacturer std.	Approved data sheet	Approved data sheet	-do-	✓	P	V	V	
		2. Resistance	CR	Electrical	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	V	V	
		3. Sequence, lay length & Direction	MA	Visual Measurement	One sample of each size/Lot	One sample of each size/Lot	One sample of each size/Lot	Manufacturer std.	Manufacturer std.	-do-	✓	P	V	V	
		4. Surface Finish	MA	Visual	100 %	100 %	100 %	Surface shall be smooth	Surface shall be smooth	-do-	✓	P	V	V	
		5. Dimension	MA	Measurement	One sample of each size/Lot	One sample of each size/Lot	One sample of each size/Lot	Approved data sheet	Approved data sheet	-do-	✓	P	V	V	
2.4	Core Insulation (No repair submitted	1. Surface finish	MA	Visual	100%	100%	100%	Free from bulging, burnt, particles, lumps, cuts & scratches	Free from bulging, burnt, particles, lumps, cuts & scratches	Inspection report	✓	P	V	V	
		2. Insulation thickness (Min/Max)	CR	Measurement	One sample of each size/Lot	One sample of each size/Lot	One sample of each size/Lot	Approved data sheet	Approved data sheet	-do-	✓	P	V	V	
		3. Concentricity #	CR	Measurement	-do-	-do-	-do-	Manufacturer std.	Manufacturer std.	-do-	✓	P	V	V	# To be checked at starting and finish end of extruded length
		4. Dia over insulation	MA	Measurement	-do-	-do-	-do-	Approved data sheet	Approved data sheet	-do-	✓	P	V	V	

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	PROJECT: 5 x 800 MW YADADRI TPS	PO NO.: R-31/21	DATE: 30/06/2021
	ITEM: Screened Control Cables	SYSTEM: Cable	Cat Plan –Cat-I	Page 5 of 8

SL NO.	COMPONENT /OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY 10			REMARKS
1	2	3	4	5	6			7	8	9	*	**			
					M	C	N				D	M	C	N	
		5. Core identification	MA	Visual	100%	100%	100%	-do-	-do-	-do-	✓	P	V	V	
		6. T.S. & % Elongation	MA	Mechanical	100%	100%	100%	IS- 1554-I IS- 5831	IS- 1554-I IS- 5831	-do-	✓	P	V	V	
2.5	Core pairing, screening (provision of drain wire & laying)	1. Pair identification	MA	Visual	100%	100%	100%	Approved data sheet	Approved data sheet	Inspection report	✓	P	V	V	
		2. Wire size and tape size	MA	Measurement	100%	100%	100%	-do-	-do-	-do-	✓	P	V	V	
		3. Test for capacitance	CR	Electrical test	100%	100%	100%	-do-	-do-	-do-	✓	P	V	V	
		4. Sequence of lay and lay length	MA	Visual	One sample of each size/Lot	One sample of each size/Lot	One sample of each size/Lot	-do-	-do-	-do-	✓	P	V	V	
		5.Screen overlap and coverage	MA	Measurement	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	V	V	
		6. Dia over laid up core	MA	Measurement	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	V	V	
		7. Continuity of drain and drain wire with screen	MA	Electrical Test	100%	100%	100%	------No discontinuity------		-do-	✓	P	V	V	
2.6	Inner Sheath extrusion (as applicable)	1. Surface finish	MA	Visual	100%	100%	100%	---	Free from bulging, burnt, particles, lumps, cuts & scratches	-do-	✓	P	V	V	
		2. Thickness	CR	Measurement	One sample of each size/Lot	One sample of each size/Lot	One sample of each size/Lot	Approved data sheet	Approved data sheet	-do-	✓	P	V	V	
		3. Dia over inner sheath	MA	-do-	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	V	V	

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	PROJECT: 5 x 800 MW YADADRI TPS	PO NO.: R-31/21	DATE: 30/06/2021
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SL NO.	COMPONENT /OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY 10			REMARKS
1	2	3	4	5	6			7	8	9	*	**			
					M	C	N				D	M	C	N	
2.7	Armouring (as applicable)	1. No. of wires/strip	MA	Counting	At the start of process	—	—	Manufacturer std.	Manufacturer std.	Inspection report	✓	P	V	V	
		2. Size of wire / strip	MA	Measurement	-do-	—	—	Approved data sheet	Approved data sheet	-do-	✓	P	V	V	
		3. Lay direction	MA	Visual	-do-	—	—	Manufacturer std.	Manufacturer std.	-do-	✓	P	V	V	
		4. Lay length	MA	Visual & Measurement	-do-	—	—	-do-	-do-	-do-	✓	P	V	V	
		5. Coverage	MA	Measurement	-do-	—	—	Approved data sheet	Approved data sheet	-do-	✓	P	V	V	
		6. Dia over armouring	MA	Measurement	-do-	—	—	-do-	-do-	-do-	✓	P	V	V	
2.8	Outer Sheath Extrusion	1 Surface finish	MA	Visual	100%	—	—	—	Free from bulging, burnt, particles, lumps, cuts & scratches	-do-	✓	P	V	V	
		2. Sheath Thickness	CR	Measurement	One sample of each size/Lot	—	—	Approved data sheet	Approved data sheet	-do-	✓	P	V	V	
		3. Dia over outer sheath	MA	Measurement	-do-	—	—	-do-	-do-	-do-	✓	P	V	V	
		4. Marking/ colour/ Embossing	MA	Visual	100%	—	—	-do-	-do-	-do-	✓	P	V	V	Sequential marking to be done
		5. T.S. & % Elongation	MA	Mechanical	100%	—	—	IS- 5831 / IS- 10810 Part 7	IS- 5831	-do-	✓	P	V	V	
3.0	Final Inspection (INTERNAL)	1. Routine Test (Refer Note-H)	CR	Electrical Test & Measurement	100%	100%	100%	#	#	-do-	✓	P	V	V	# Refer Annexure –A to QP

Supplier Logo	MANUFACTURING QUALITY PLAN	SPEC. NO : PE-RC-999-507-E005 Rev: 00	DATE: 15/02/2020
	CUSTOMER : TSGENCO	QP NO. : PE-V0 - 417-507-E916 Rev: 01	DATE: 02/11/2021
	PROJECT: 5 x 800 MW YADADRI TPS	PO NO.: R-31/21	DATE: 30/06/2021
	ITEM: Screened Control Cables	SYSTEM: Cable	Cat Plan –Cat-I	Page 7 of 8

SL NO.	COMPONENT /OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY 10 **			REMARKS
1	2	3	4	5	6			7	8	9	*				
					M	C	N				D	M	C	N	
4.0	Final Inspection (EXTERNAL)	1. Finish & length (Cable & cable drum)	MA	Visual	One drum in Each lot	One drum in Each lot	One drum in Each lot	Approved data sheet	Free from Porosity, Bulging. Burnt particles, lumps, cuts & scratches	Inspection report	✓	P	W	W	# Refer Annexure –A to QP
		2. Dimension	MA	Measurement	As per Std.	As per Std	As per Std	Approved data sheet	Approved data sheet	-do-	✓	P	W	W	"W" at client column shall be considered as hold point
		3. Armouring - Coverage	MA	Measurement	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W	
		4. Marking/ Colour/ pair identification (Cable & Cable drum	MA	Visual	-do-	-do-	-do-	-do-	-do-	-do-	✓	P	W	W	
		5. Acceptance Test (Refer Note-H)	CR	Physical & Electrical Test	Sample #	Sample #	Sample #	#	-do-	-do-	✓	P	W	W	
		6. Type & FRLS Test (Refer Note-H)	CR	As per Std	Sample #	Sample #	Sample #	-do-	Approved data sheet	-do-	✓	P	W	W	
5.0	Packing	End sealing/ Polythene wrapping	MA	Visual	100%	100%	100%	Approved data sheet	Approved data sheet	-do-	✓	P	W	W	

NOTES:

A. Joints in conductors & armour shall be as permitted by IS:8130 & IS:7098 –I respectively.

B. No repair of core insulation permitted.

C. Cable end 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.

SL NO.	COMPONENT /OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK			REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY 10			REMARKS
1	2	3	4	5	6			7	8	9		**			
					M	C	N				D	M	C	N	

E. Fillers/dummy cores etc Shall be as per specification.

F. Wherever extent of check for stage is mentioned as 'sample' & 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 IS/ BHEL specification.

H. For list of routine tests, acceptance tests & type tests refer annexure to QAP.

I. 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.

J. 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.

K. BHEL reserves the fight to perform repeat test if required

L. Photographs of cable to be despatched shall be sent to BHEL purchase group for review prior to issue of MDCC.

M. " W " at client column shall be considered as hold point

N. All inspection/verification reports along with material certificates shall be reviewed at the time of witness point.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION, **D**: DOCUMENTATION

** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: TSGENCO/TPIA

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

MA: MAJOR, **MI**: MINOR, **CR**: CRITICAL, **D**: DOCUMENTATION

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 one size (2P, 4P etc.) of each type (F or G type) /lot.
b) Electrical and C&I tests to be conducted on each size of each type of cables/ lot.
c) FRLS &Flammability Test 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 and C&I tests to be conducted on each size of each type of cables/ lot.
c) FRLS & Flammability Test 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 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 considered as per IS: 1554Part-I.

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	***In-process records shall be furnished to inspector at time of inspection.***
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	

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
2.0	**Tests for Armour Wires/Strips**				
I.	Measurement of dimensions	Applicable for Aluminium wire & GS wire/Strip	T,A	IS 10810 Pt 36	
II.	Tensile test	Applicable for Aluminium wire & GS wire/Strip	T, A	IS 10810 Pt 37	
III.	Elongation at break test	Applicable for GS wire/Strip only	T, A	IS 10810 Pt 37	
IV.	Torsion test	For GS round wire only	T, A	IS 10810 Pt 38	
V.	Winding / Adhesion Test	For GS strip only	T, A	IS 10810 Pt 39	
VI.	Resistivity test	Applicable for Aluminium wire & GS wire	T, A	IS 10810 Pt 42	
VII.	Uniformity of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 40	
VIII.	Mass of Zinc coating test	For G. S. wires/Strip only	T, A	IS 10810 Pt 41	
3.0	**Physical Tests for XLPE Insulation & PVC sheath**				
I.	Test for thickness and 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			
(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 & inner sheath	T	IS 10810 Pt 60	
IX.	Bleeding & Blooming test	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	

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**				
VI.	Annealing test	For copper conductor only	T, A	IS 10810 Pt 1	***In-process records shall be furnished to inspector at time of inspection.***
VII.	Tin coating test (for tinned copper)	For copper conductor only	T, A	IS 10810 Pt 4	
VIII.	Resistance test	For Al/Cu	T, A, R	IS 10810 Pt 5	
IX.	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	Applicable for Inner Sheath also, 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	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)	Test & Category applicable as indicated in Datasheet-A
II.	Flammability test for single cable	For complete cable	T,A	IS: 10810 Pt 61 / IEC:60332 Part-1	

S. No.	TEST	APPLICABLE FOR	TEST CONDUCTION REQUIRED AS	REFERENCE STANDARD	REMARKS
III.	Swedish chimney test	For complete cable	A	SEN SS 424 1475 (Class F3)	
IV.	Flammability test	For complete cable	A	IEEE: 60383	
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-Part-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 if indicated in Datasheet-A
11.0	Anti-Fungal Test	For PVC outer sheath only	A	Self-certification by vendor for anti-fungal property	Same shall be applicable as per the project requirement and Datasheet-A.
12.0	Special Tests				
I.	Hydrolytic Stability Test	For complete cable	A(**)	ASTM D 3137	Test applicable if indicated in Datasheet-A
II.	Ultraviolet Radiation 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: A few chipping of the PVC compound is slowly ignited on a porcelain dish or cubicle in a muffle furnace at about 600-degree C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). Place a drop of aqueous sodium sulphide solution on a thick filter paper and allow soaking. Touch the spot with a drop of above extract. A black spot indicates the presence of lead, the anti-termite and rodent compound.

5 x 800 MW YADADRI TPS

BOQ-CUM-PRICE SCHEDULE FOR SCREENED CONTROL CABLE

Overall Screened Cable (Type-G)				
S.No.	**Item code**	**Item Description**	**UOM**	**Order Quantity**
1	507-31025-A	1.1kV TYPE G(O) 2P - 0.5 ARMOURED	KM	60
2	507-31029-A	1.1kV TYPE G(O) 4P - 0.5 ARMOURED	KM	40
3	507-31033-A	1.1kV TYPE G(O) 8P - 0.5 ARMOURED	KM	100
4	507-31017-A	1.1kV TYPE G(O) 12P - 0.5 ARMOURED	KM	20
Individual & Overall Screened Cable (Type-F)				
5	507-31009-A	1.1kV TYPE F(IO) 4P - 0.5 ARMOURED	KM	70
6	507-31013-A	1.1kV TYPE F(IO) 8P - 0.5 ARMOURED	KM	60
7	507-31001-A	1.1kV TYPE F(IO) 12P - 0.5 ARMOURED	KM	10
8	507-31005-A	1.1kV TYPE F(IO) 20P - 0.5 ARMOURED	KM	15

भेल BHEL	**PRE-QUALIFICATION REQUIRMENTS FOR SCREENED CONTROL CABLE YADADRI TPS 5X800MW**	PE-PQ-417-507-E016 REVISION NO. 00 DATE 23/09/2022 SHEET NO. 1 OF 1

ITEMS : Screened Control Cable **SCOPE :** Supply : YES; Erection & Commissioning : NO;	
1.0	Vendor should be a manufacturer of screened/ instrumentation control cables.
2.0	Availability of test reports of tests on FRLS screened control cables to establish in-house Capability to carry out all routine, type acceptance as per relevant IS/ International Standards (except UV radiation & hydrolytic stability Test which can be conducted at Govt. Lab/ Govt. approved Independent lab).
3.0	Capacity of manufacturing 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 300 Km of Screened Control cables in one or more orders and at least 125 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:

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 and 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
23-9-22	23.09.22	23/9/2022	23/9/22
ABHINAV BANSHIWALA MANAGER	N.N.JAJWARE SR. MANAGER	PRAVEEN DUTTA A.G.M.	DEBASISA RATH A.G.M.(DH-ELEC)

Annexure-1

INTEGRITY PACT

Between

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

and

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

Preamble

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

_____

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

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

Section 1- Commitments of the Principal

1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles: -

1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3 The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

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

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

2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he/ she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant Indian Penal Code (IPC) and Prevention of Corruption Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

2.1.4 Foreign Bidder(s)/ Contractor(s) shall disclose the name and address of agents and representatives in India and Indian Bidder(s)/ Contractor(s) to disclose their foreign principals or associates. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

2.3 The Bidder(s)/ Contractor(s) shall not approach the Courts while representing the matters to IEMs and shall await their decision in the matter.

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

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

Section 4 - Compensation for Damages

4.1 If the Principal has disqualified the Bidder (s) from the tender process before award / order acceptance according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.

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

Section 5 - Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 (three) years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason or action can be taken as per the separate "Guidelines on Banning of Business dealings with Suppliers/ Contractors", framed by the Principal.

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

6.1 The Principal will enter into Integrity Pacts with identical conditions as this Integrity Pact with all Bidders and Contractors.

6.2 In case of Sub-contracting, the Principal Contractor shall take the responsibility of the adoption of Integrity Pact by the Sub-contractor(s) and ensure that all Sub-contractors also sign the Integrity Pact.

6.3 The Principal will disqualify from the tender process all Bidders who do not sign this Integrity Pact or violate its provisions.

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

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

Section 8 -Independent External Monitor(s)

8.1 The Principal appoints competent and credible panel of Independent External Monitor (s) (IEMs) for this Integrity Pact. The task of the IEMs is to review independently and objectively, whether and to what extent the parties comply with the obligations under this Integrity Pact.

8.2 The IEMs are not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.

8.3 The IEMs shall be provided access to all documents/ records pertaining to the Contract, for which a complaint or issue is raised before them as and when warranted. However, the documents/records/information having National Security implications and those documents which have been classified as Secret/Top Secret are not to be disclosed.

8.4 The Principal will provide to the IEMs sufficient information about all meetings among the parties related to the Contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the IEMs the option to participate in such meetings.

8.5 The advisory role of IEMs is envisaged as that of a friend, philosopher and guide. The advice of IEMs would not be legally binding and it is restricted to resolving issues raised by a Bidder regarding any aspect of the tender which allegedly restricts competition or bias towards some Bidders. At the same time, it must be understood that IEMs are not consultants to the Management. Their role is independent in nature and the advice once tendered would not be subject to review at the request of the organization.

8.6 For ensuring the desired transparency and objectivity in dealing with the complaints arising out of any tendering process or during execution of Contract, the matter should be examined by the full panel of IEMs jointly, who would look into the records, conduct an investigation, and submit their joint recommendations to the Management.

8.7 The IEMs would examine all complaints received by them and give their recommendations/ views to the CMD, BHEL at the earliest. They may also send their report directly to the CVO, in case of suspicion of serious irregularities requiring legal/ administrative action. Only in case of very serious issue having a specific, verifiable Vigilance angle, the matter should be reported directly to the Commission. IEMs will tender their advice on the complaints within 30 days.

8.8 The CMD, BHEL shall decide the compensation to be paid to the IEMs and its terms and conditions.

8.9 IEMs should examine the process integrity, they are not expected to concern themselves with fixing of responsibility of officers. Complaints alleging mala fide on the part of any officer of the Prinicpal should be looked into by the CVO of the Principal.

8.10 If the IEMs have reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant Indian Penal Code / Prevention of Corruption Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the IEMs may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.11 After award of work, the IEMs shall look into any issue relating to execution of Contract, if specifically raised before them. As an illustrative example, if a Contractor who has been awarded the Contract, during the execution of Contract, raises issue of delayed payment etc. before the IEMs, the same shall be examined by the panel of IEMs. Issues like warranty/ guarantee etc. shall be outside the purview of IEMs.

8.12 However, the IEMs may suggest systemic improvements to the management of the Principal, if considered necessary, to bring about transparency, equity and fairness in the system of procurement.

8.13 The word `Monitor' would include both singular and plural.

Section 9 - Pact Duration

9.1 This Integrity Pact shall be operative from the date this Integrity Pact is signed by both the parties till the final completion of contract for successful Bidder, and for all other Bidders 6 months after the Contract has been awarded. Any violation of the same would entail disqualification of the bidders and exclusion from future business dealings.

9.2 If any claim is made/ lodged during currency of this Integrity Pact, the same shall be binding and continue to be valid despite the lapse of this Pact as specified above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 - Other Provisions

10.1 This Integrity Pact is subject to Indian Laws and exclusive jurisdiction shall be of the competent Courts as indicated in the Tender or Contract, as the case may be.

10.2 Changes and supplements as well as termination notices need to be made in writing.

10.3 If the Bidder(s)/ Contractor(s) is a partnership or a consortium or a joint venture, this Integrity Pact shall be signed by all partners of the partnership or joint venture or all consortium members.

10.4 Should one or several provisions of this Integrity Pact turn out to be invalid, the remainder of this Integrity Pact remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders / contractors who have entered into this Integrity Pact with the Principal would be competent to participate in the bidding. In other words, entering into this Integrity Pact would be a preliminary qualification.

10.6 In the event of any dispute between the Principal and Bidder(s)/ Contractor(s) relating to the Contract, in case, both the parties are agreeable, they may try to settle dispute through Mediation before the panel of IEMs in a time bound manner. In case, the dispute remains unresolved even after mediation by the panel of IEMs, either party may take further action as the terms & conditions of the Contract. The fees/expenses on dispute resolution through mediation shall be shared by both the parties. Further, the mediation proceedings shall be confidential in nature and the parties shall keep confidential all matters relating to the mediation proceedings including any settlement agreement arrived at between the parties as outcome of mediation. Any views expressed, suggestions, admissions or proposals etc. made by either party in the course of mediation shall not be relied upon or introduced as evidence in any further arbitral or judicial proceedings, whether or not such proceedings relate to the dispute that is the subject of mediation proceedings. Neither of the parties shall present IEMs as witness in any Alternative Dispute Resolution or judicial proceedings in respect of the dispute that was subject of mediation.

For & On behalf of the Principal
(Office Seal)

नेत्रपाल सिंह / Netrapal Singh
वरिष्ठ अभियंता (पी.जी.-I) / Sr. Engineer (PG-I)
भारत हेवी इलेक्ट्रिकल्स लिमिटेड / Bharat Heavy Electricals Ltd.
पावर सेक्टर–परियोजना अभियांत्रिकी प्रबंधन
Power Sector-Project Engineering Management
पीपीईआई भवन, एच.आर.डी.आई. एण्ड ईएसआई कॉम्पलेक्स
PPEI Bldg, H.R.D.I. & ESI Complex,
प्लाट नं. 25, सेक्टर 16 ए, नोएडा –201301
Plot No. 25, Sec. 16 A, Noida - 201301

Place
Date

Witness:_____
(Name & Address) _____
_____

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

Witness:_____
(Name & Address) _____
_____