

 BHEL – ISG BANGALORE	INDENT SPECIFICATION OF INSTRUMENTATION CABLES FOR CHP-VMAS SYSTEM ,2X660MW, STAGE-V, UNIT #7 AND 8, SURATGARH SCTPS	TECH SPEC NO: RRVUNL/ELEC/197
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REF: IS-1-13-2000

CUSTOMER: RRVUNL

**TECHNICAL SPECIFICATIONS
OF INSTRUMENTATION CABLES FOR CHP-VMAS SYSTEM
2X660MW SUPER CRITICAL THERMAL POWER STATION,
STAGE-V, UNIT #7 AND 8 AT SURATGARH, RAJASTHAN**

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ENCLOSURES:

1. ANNEXURE-I – Typical Technical particulars of Instrumentation Cable.
2. ANNEXURE-II – Type, Acceptance and Routine Test procedure.

NOTE: Kindly note that supplier shall not be allowed to revise price bid, if there is no change in technical specifications/quantity from BHEL. Please comply with all clauses in the specification. Technical 'No Deviation' format shall be duly stamped and signed along with technical offer. In absence of above, BHEL presumes that there is no technical deviation.

In case any technical clarification is required, kindly email to vraov@bhel.in and mas@bhel.in, with a copy to sbanra@bhel.in and kms@bhel.in

 PREPARED CHECKED BY V. VENKATESHWAR RAO	 APPROVED BY SANGEETHA MA
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SECTION I: SITE CONDITIONS

1.1 GENERAL SITE CONDITIONS		
1.	Owner / Purchaser	: Rajasthan Rajya Vidyut Utpadan Nigam Ltd. (RRVUNL)
2.	Engineer/consultant	: Tata Consulting Engineers Ltd (TCE) 73/1, St. Marks Road, Bangalore – 560 001
3.	Project Title	: 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan
4.	Project location	: Prabat Nagar, Suratgarh, Sriganganagar district, Rajasthan.
5.	Elevation (above Sea level)	: 186 m (approximate)
6.	Temperatures : Monthly basis	: Mean of daily max. 32.8 deg.C (in the month of May) Mean of daily min. 17.6 deg.C (in the month of Jan)
7.	Temperatures : Annual basis	: Mean of daily max. 32.3 deg.C Mean of daily min. 19.6 deg.C
8.	Highest temperature recorded	: 50 deg.C
9.	Lowest temperature recorded	: (-) 2.8 deg.C
10.	Design temperature	: 50 deg. C
11.	Relative humidity	: Varies between 21% and 81%
12.	Annual average rain fall	: 312 mm
13.	Annual mean wind speed : Calculations for wind effect shall be in accordance with IS:875-1987(Part-3) taking into account the following	: 4 km/hr a) Basic wind speed = 47 m/sec b) Factor K1 = 1.07 c) Category of terrain = Category 2 d) K3 – as per IS 875
14.	Seismic data (As per IS: 1893 latest issue)	: Zone II, Designs & design coefficients will be based on IS 1893:2002
15.	Nearest railway station	: Suratgarh JN
16.	Nearest airport	: Jaipur
1.2 POWER SUPPLY SYSTEMS		
1.2.1 MV System		
	System Voltage	: 6.6 kV $\pm$ 10%, 3 Phase, 3 wire
	System Frequency	: 50 Hz $\pm$ 5%
	Combined Variation	: 10% (absolute)
	System Fault level	: 40 kA for 3s
	System Earthing	: Non effectively earthed
	Drives	: 161-1500 kW
1.2.2 LV System		
	System A.C voltage	: 415 V $\pm$ 10%, 3 ph, 3- wire
	System Frequency	: 50 Hz $\pm$ 5%
	Combined Variation	: 10% (absolute)
	System fault level	: 50 kA for 1s
	System Earthing	: Solidly grounded
	Panel space heater, lighting, AC Control & Protection Supply	: 240V, Single phase
	Drives	: up to 160kW
1.2.3 DC System		
	System Voltage	: 220V, +10%, -15%, 2-wire
	Fault level	: 20 kA
	System Earthing	: Unearthed

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SECTION II: APPLICABLE STANDARDS

All the Cables to be supplied under this specification shall be in accordance with the applicable section of the latest version of the relevant Indian Standards, IEC publications and other standards as listed, except where modified and/or supplemented by the specification. The design and testing shall follow the following standards:

Sl. No.	Standard	Description
1.	IS: 8130	Specification for conductors for Insulated electric cables and flexible cords
2.	IS: 3975	Specification for mild steel wires, formed wired and tapes for armouring of cables.
3.	IS: 10810	Methods of testing of cables
4.	IS: 1554 Part-1	Specification for PVC insulated (Heavy duty) electric cables for working voltages up to 3.3 KV and including 11 KV
5	IS: 5831/84	Specification for PVC insulation and Sheath of Electric Cables
6	IS: 3961	Recommended current ratings for cables
7	IEC-60189-2	Low frequency cables and wires with PVC insulation and sheath Cables in pairs and triples.
8	Class F3 of Swedish standard SENS-424-1475, IEC-60332 Part 1, IEEE 383, IS-10810 Part-53, IS 10810 Part-61 & 62 (Category-A),	Flammability Tests
9	ASTMD-2843, ASTMD-2863, IEC-60754 Part-1	FRLS Tests
10	BS EN ISO 4892-2	Ultraviolet test
11	IS: 10418	Specification for Drums for Electric cables
12	Indian Electricity Rules, 1956 Chapter 10	-

This above list is not exhaustive. Standards not listed above but are applicable also to be followed to meet the requirement.

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SECTION III: SCOPE OF WORK

Design, manufacture, testing and supply of the following:

1. Individual & Overall Screened Cable (Type-F):

The instrumentation cables shall be 1100 V grade, Annealed, tinned stranded copper conductor, 0.75 sq mm , twisted into pairs, PVC insulated , individual & overall screened with Aluminium Mylar tape & drain wire, inner PVC sheathed, GS wire armour as per IS 3975 and IS 1554 part-1 and overall sheathed with FRLS PVC, generally conforming to IS:1554 part-1 and as per **Annexure-1**.

Sl. No.	ITEM DESCRIPTION	QTY in Meters
1	4Px0.75 Sq.mm ,F-Type, Instrumentation Cable	25000

Note: Above quantity may vary during detail engineering. Unit rate shall be furnished for all items. For variation in quantities, unit rate shall be applicable.

Bidder to submit the following along with the bid:

- i. Price schedule shall be submitted strictly in the format given.
- ii. Separate list of deviations, if any.

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SECTION IV: TECHNICAL SPECIFICATION

1. All the instrumentation cables shall be Armoured, twisted, shielded multipair, pre fabricated, flame retardant low smoke (FRLS) type. The Cables shall be provided in non-returnable drums. The drum length shall be 1000m (+/-5%).
2. All instrumentation cables covered in this specification shall comply with IS 1554-I, IS-694,IS-8130, IS-5831, IS-3975,IEEE-383,SEN 4241475 CLASS F3,IEC-332 Part-I, ANSI MC 96.1, IS-8784, IS-10810 (latest editions) and its amendments read along with this specification.
3. The conductor shall be of minimum 0.75-sq.mm size, high conductivity, and multi-stranded copper for all types of instrumentation cables.
4. The colour of inner and outer sheath shall be black PVC compound. Fillers in multiple conductor cables shall be flame retardant and moisture resistant. Cable accessories such as harnessing components, markers, bedding, cable jointer, binding tape etc. shall also have flame retardant quality.
5. All instrumentation cables shall be provided with overall shielding. However, multi-pair cables carrying analog signals shall be provided with individual pair shielding in addition to overall shielding.
6. Individual Shielding shall be of Aluminium mylar tape of minimum 0.028 mm thickness with a minimum overlap of 20%. Overall Shielding shall be of Aluminium mylar tape of minimum 0.055 mm thickness with a minimum overlap of 20%.
7. Separate drain wires for individual pair shield (wherever applicable) as well as overall shield shall be provided. Drain wire shall be of stranded Annealed tinned copper of size/No. of strands 0.75sq.mm/7 strands.
8. A pair of two insulated conductors twisted together designated alphabet 'p' printed on a binding tape at 200 mm interval
9. Maximum length of lay in the finished cable shall be 120 mm.
10. The outer sheath of the instrumentation cables shall meet the following minimum requirements:
 - a. An Oxygen index of not less than 29% and a Temperature index of not less than 250deg.C as per ASTMD-2863.
 - b. Maximum acid gas generation by weight as per IEC-754-I shall not be more than 20%.
 - c. Smoke Density Rating shall not be more than 60% during Smoke Density Test as per ASTMD-2843. The results of smoke density test shall be plotted on a curve indicating light absorption vs. time as per ASTMD2843. The average area under the curve (smoke density rating) shall not be more than 60%.
 - d. The finished cable shall pass the flammability test as per IS: 10810 part-53, IEC-60322-1 and IEEE-383. In addition, it shall also pass flammability test as per Class F3 of Swedish Standard SEN-424-1475.
 - e. Cables shall pass the Ultraviolet tests as per BS EN ISO 4892-2
11. Element identification shall be as per IEC-60189-2.
12. Core wrapping shall be by non-hygroscopic material by taping or by extrusion.
13. Rip cord shall be non-metallic under the core wrapping.
14. All instrumentation cables shall be suitable for continuous operation at 70deg.C. The cables shall be suitable for laying in wet or dry locations in trays, conduits, ducts, trenches and underground buried installations.
15. The capacitance unbalance between any two pairs shall not exceed 400pF for 500m length of cable.
16. Minimum insulation resistance per km shall be 500 mega Ohm.
17. Mutual capacitance of any pair of conductors shall not exceed 120 nF/km.
18. Minimum Cross Talk attenuation (min) at 0.8 kHz shall be 60 dB.
19. Maximum attenuation at 1.0 kHz shall be 1.2db/Km.

ISSUED BY : PE-ELEC	REV : 00	DATE OF ISSUE : 11-Sep-2019	SHEET 5 OF 8
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20. The supplier shall furnish all documentary evidence including cross-sectional drawings, test certificates to substantiate the suitability of cables offered for different applications.
21. Manufacturer's name, year of manufacture, type of insulation, number of pair, cable size, Voltage grade, Type of cable (ie. F), and "FRLS" shall be embossed on outer sheath of cable in every 1 mtr interval and Customer name (ie. BHEL-ISG) and 'RRVUNL' shall be embossed on outer sheath of cable in every 1 mtr interval. Also, sequential length marking shall be embossed on outer sheath of cable in every 1 mtr interval.
22. Manufacturer's name, year of manufacture, country of manufacture, number of pair, cable size, Voltage grade, Type of cable (ie. F), length of cable, direction of rotation of drum and gross weight shall be marked on drum.

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SECTION V: INSPECTION AND TESTING

Instrumentation cable shall be tested at manufacturers work in presence of BHEL/RRVUNL representative as per approved QAP. QAP shall be submitted by Bidder for approval by BHEL/RRVUNL.

Inspection notice shall be issued fifteen (15 days) in advance along with internal (manufacturer) TCs.

All materials, components covered under this specification shall be procured, manufactured, inspected and tested as per approved Quality plan only.

TESTS:

All tests shall be conducted as per attached **ANNEXURE-2**, bidder shall submit the signed and sealed copy the same.

1. **U.V Radiation Test:** The bidder shall furnish the type test report carried out in within last five years of the date of bid opening. The report should be for the test conducted either in government approved third party laboratory or witnessed by client (such as major utilities/ industries) on identical/ similar cables to those ordered under this contract.
In case bidder is not meeting the above requirement or in case type test report is not found to be meeting the specification/ relevant standard requirements, then bidder has to conduct the above test without any commercial implication to BHEL.
2. Cables/other consumables consumed during the inspection/testing shall be in bidders account, no separate charges are applicable for the same.

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SECTION VI: DOCUMENTATION

The following documentation shall be submitted to BHEL at different stages of the Project. In preparing and submitting the documentation, the requirements given in subsequent clauses shall be strictly adhered to.

Sl. No.	Description	Category	No. of copies
1.	Data sheet & Cross section details and QAP	For approval	4
2.	De-rating factors for various conditions	For review	4
3.	Type Test Certificates/Internal test report	For review/Inspection	4
4.	Packing/drum details	For information	4
5.	Storage instructions for long period storage	For information	4
6.	Erection instructions	For information /distribution	10
7.	Final Documents includes Catalogues, Operation and Maintenance manual , Inspection report ,data sheet , test certificate, QAP etc	For Distribution	10

Data to be furnished by the vendor after the award of contract

1.0 Construction details including type of material used and thickness of each material for each type of cable in a tabular form.

2.0 Instruction Manuals

- i. Two (2) numbers of copies of instruction manuals, descriptive bulletins etc. shall be furnished prior to dispatch of cables. The manual shall include amongst others, the following particulars.
- ii. General information.
- iii. Principal technical data.
- iv. Description of insulation, sheathing and screening. This should include data on resistance to attack by chemicals, fungus, termites, rodents, water and ultra-violet radiation.
- v. Installation and termination instructions.
- vi. Type test certificates for all types of cables included in the order and special tests on FRLS/FS cables.

3.0 Test Certificates.

4.0 Any other information specifically called for by PURCHASER or ENGINEER subsequent to order.

Notes:

- i. All drawings, documents and catalogues shall be available in soft copy.
- ii. Manually prepared drawings are not acceptable
- iii. For all technical tables, diagrams, calculations, results, drawings, test data and scales adopted in the design the standard international unit system (SI) as per International Organization for Standardization (ISO) shall be uniformly employed.
- iv. All engineering documents and drawings shall be of international A series size, i.e., of A0, A1, A2, A3 and A4.

ANNEXURE - I : Typical Technical Particulars Of Instrumentation Cable

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Technical Particulars of Instrumentation Cables (Type F)

S.No.	Particulars	Unit	2Pr x 0.5 Sq.mm.	4Pr x 0.5 Sq.mm.
1	Manufacturer's name	-		
2	Reference design standards	-	Gen. conf. to IS-1554-1/80, IS-694/90, IS-8130/84, IS-5831/84, IS-3975, IEC-60189-2, ASTM-D-2943, ASTM-D-2963, IEC-60754-1, IEC-60332-1, IEEE-383, SEN 424 1475 Class F3, IS-10810 Part-53, IS-10810 part-61 & part-62, Cat-A and this data sheet	
3	Conductor size	sq. mm	0.5	0.5
4	Rated Voltage	V	1100V (RMS) operation voltage	
5	Number of pairs	No.	2	4
6	Cable suitable for both earthed & unearthed system	-	Yes Suitable for Both Earthed and Un Earthed System	
7	Conductor			
a)	Material	-	High conductivity Annealed Tinned copper of Class 2 Gen. as per IS 8130	
b)	Reference Standard	-	IS: 8130	
c)	Grade	-	Electrolytic	
d)	No. of strands	No.	7	
e)	Diameter of strands (nom.)	mm	0.3	
f)	Approx. dia of conductor	mm/		
	Cross Section area	sq. mm	0.5	
g)	Maximum conductor resistance per Km at 20°C (Loop resistance)	ohm	74.80	74.80
8	Insulation			
a)	Reference Standard	-	IS 5831	
b)	Material composition	-	Extruded PVC Type A	
c)	Minimum thickness	mm	0.62	
d)	Nom. Thickness	mm	0.8	
e)	Max. thickness	mm	Minimum thickness mentioned in above shall be maintained	
f)	Minimum volume resistivity as per IS 5831	Ohm cm	1 x 10 ¹³ at 20°C & 1 x 10 ¹⁰ at 70°C	
g)	Dielectric constant	-	3 to 6	
h)	The insulation will withstand conductor operating temp. of 70°C	-	Yes	
i)	Core diameter including insulation (Approx.)	mm	2.58	2.58
9	Core laying			
a)	Whether cores are twisted.	-	Yes	
b)	Maximum lay of twist	mm	120 mm (Min. 9 to 10 Twist) (As per Specification of RRVNIL/ELEC/006 CI NO-9)	
10	Individual Shield			
a)	Material	-	Aluminium Mylar tape	
b)	Thickness of tape	mm	(28 micron)	
c)	Coverage/ Overlap	%	100% Coverage; 20% Overlapping (Min.)	
d)	Noise interference better than	dB	60 dB	
11	Drain wire for individual shield			
a)	Reference standard	-	Gen. as per IS 8130	
b)	Size/ No. of strands	sq. mm/ no.	0.5sq.mm / 7 strand	
c)	Material	-	ATC	
d)	Resistance of drain wire per km at 20 deg.C	ohm	Less than 30 Ohm/km	
12	Overall shield			
a)	Material	-	Aluminium Mylar tape	
b)	Thickness of tape	mm	(55 micron)	
c)	Coverage/Overlap	%	100% Coverage; 20% Overlapping (Min.)	
d)	Noise interference better than	dB	60 dB	
13	Drain wire for overall shield			
a)	Reference standard	-	Gen. as per IS 8130	
b)	Size/ No. of strands	sq. mm/ no.	0.5sq.mm / 7 strand	
c)	Material	-	ATC	
d)	Resistance per Km at 20°C	Ohm/ km	Less than 30 Ohm/km	
14	Fillers if applicable		Yes (If applicable) Flame retardant and moisture resistant filler shall be provided where ever necessary at manufacture's discretion (material of filler shall be same as inner sheath)	

Technical Particulars of Instrumentation Cables (Type F)

S.No.	Particulars	Unit	2Pr x 0.5 Sq.mm.	4Pr x 0.5 Sq.mm.
	Rip Cord		Non metallic ripcord shall be provided under inner sheath	
15	Inner sheath			
	a) Material, type and standard	-	Extruded PVC ST1 / IS : 5831	
	b) Whether FRLS	-	NO	
	c) Colour	-	Black	
	d) Method of application	-	By Extrusion	
	e) Thickness (min)	mm	0.3	
16	Armour			
	a) Material	-	Round wire	Round wire
	b) Minimum Coverage	%	96%	
	c) Method of jointing	-	Welding or Brazing	
	d) Breaking load of joint	-	Gen. as per IS 3975	
	e) Size (approx.)	mm	1.4	1.4
	f) Dia Over armour (Approx.)	mm	13.82	15.87
	g) No. of wires	mm	23	26
17	Outer sheath			
	a) Reference standard	-	IS 5831	
	b) Material	-	Extruded PVC ST1 with FRLS Properties (Resistance to water, UV radiation & Fungus.)	
	c) Minimum thickness of sheath	mm	1.24	1.40
	d) Calculated dia under outersheath	mm		
	e) Oxygen index (as per ASTM D 2863)	-	Not less than 29%	
	f) Temperature index (in deg. C as per ASTM D)	-	Not less than 250 deg C	
	g) Maximum acid gas generation as per IEC 754-	%	Maximum 20%	
	h) Maximum smoke density rating as per	%	Maximum 60%	
	i) Colour of outer sheath	-	Black	
18	Dia over bld-up core (Approx.)	mm	9.76	11.81
19	Dia under armour (Approx.)	mm	11.02	13.07
20	Dia above armour (Approx.)	mm	13.82	15.87
21	Overall diameter of cable	mm	17	19.5
22	Tolerance on overall diameter	mm	± 1mm	
23	Weight of			
	conductor including drain wire (Approx.)	Kgs. / km	29	55
	PVC (Insulation, sheath & fillers) (Approx.)	Kgs. / km	140	196
	Armour (Approx.)	Kgs. / km	262	296
	Cable (approx.)	Kgs. / km	470	601
24	Cable parameters at 20°C (± 3 deg. C)			
	a) Conductor resistance (max) (loop Resistance)	Ohm/ km	74.8	
	b) Insulation resistance (min)	M-Ohm	500 M ohm/km at 20° C (min)	
	c) Mutual capacitance at 0.8KHz (max)	nF/ km	120	
	d) Cross talk at 0.8KHz (min)	dB	69	
	e) Attenuation at 1 KHz (max)	dB/ km	1.2	
	f) Characteristic impedance max.	Ohm	320	
	g) Max. capacitance unbalance b/w any two pairs for 500 mtr length of cable		Max. capacitance unbalance will be equals to 400 pF/500 meters	
25	Continuous operating temp. (deg.C)	deg. C	70	
26	Whether complete cable Flame retardant as per IS-10010 Part- 61 & 62 (Category-A)	-	Yes	
27	Whether complete cable passes Swedish Chimney test as per SEN 4241475 (F3), IS-10010 Part- 53, IEC-60332-1 IEC-60332-3	-	Yes	
28	Identification			
	a) Length of cable marked at every mtr.	-	Yes	
	b) FRLS marked at every 5 mtrs	-	Provided at every 1 mtr. on outer sheath	
	c) Each core of the pair numbered	-	Not Applicable	
	d) Conductor Identification details for pairs	-	As per Annexure	

Technical Particulars of Instrumentation Cables (Type F)

S.No.	Particulars	Unit	2Pr x 0.5 Sq.mm.	4Pr x 0.5 Sq.mm.
	e) Details of cable markings	-		
29	Test voltage			
	a) High voltage test/ Dielectric Strength			
	i) Voltage (KV), Core - Core	kV(rms)	3	
	ii) Duration	min	5	
	b) High Voltage test			
	i) Voltage (KV), Core - Screen	kV(rms)	3	1.5
	ii) Duration	min	5	1
	c) Resistance to direct current test	-		
	Voltage	KV	1.2	
	Duration	hrs	240	
30	Min bending radius	mm	12 times Overall diameter	
31	Ovality at any cross section	mm	Not more than 1 mm	
32	Variation of dia through out cable length		±1mm	
33	Cable cross-sectional drawings for each type of cable furnished		Yes	
34	i) Length of single coil in a drum	M	1000	1000
	ii) Marking on drum	-	The drum shall be marked up with the following information; Reference standard, manufacturer's name, type of cable and voltage grade, number of pairs, cross-sectional area of conductor, length of cable on drum, number of lengths on drum (if more than one) direction of rotation, approximate gross weight, country and year of manufacture etc	
	iii) Seasoned wood drum provided	-	Yes	
	iv) Both ends of cable to be sealed with PVC/ Rubber caps to prevent water/ moisture ingress		Yes	
	v) Gross weight (approx.)	kg	535	691
	vi) Net weight (approx.)	kg	470	601
35	Type test procedures as per BHEL Technical Spec. and other relevant standards enclosed.		Yes	
36	Anti termite & rodent test		Yes	
37	Ultraviolet test		H V radiation test shall be conducted as per BS EN ISO 4092-2 for 14 days.	
38	Binder tape over each pair		Two cores shall be twisted together to form a pair and polyester binder tape designated by alphabet "p" within every 200 mm interval shall be applied over each pair.	
39	Drum length tolerance(%)		±5%	±5%
40	Mandatory Spare Drum (500 Mtr) for each size		BHEL will handover at end of the contract.	

ANNEXURE FOR PAIR / UNIT IDENTIFICATION AS PER IEC-60189-2 - REV01

PAIR	a-wire	b-wire	
1	White	Blue	First unit
2	White	Orange	
3	White	Green	
4	White	Brown	
5	Red	Blue	2nd unit
6	Red	Orange	
7	Red	Green	
8	Red	Brown	
9	Black	Blue	3rd unit
10	Black	Orange	
11	Black	Green	
12	Black	Brown	
13	Yellow	Blue	4th unit
14	Yellow	Orange	
15	Yellow	Green	
16	Yellow	Brown	
17	WHITE-blue	Blue	5th unit
18	WHITE-blue	Orange	
19	WHITE-blue	Green	
20	WHITE-blue	Brown	

For 2P and 4P - Pairs shall be colour coded as given above.

For 8P, 12P, 16P and 20P - 4 pairs shall be twisted together to form a unit and pairs of each unit shall be colour coded as given above. Also, each unit of the cable shall be identified by an open helical lapping of non-hygroscopic and non-wicking material (polyester tape) of distinctive colour as per Table-1 given below.

TABLE -1
Unit Identification

Unit no.	1	2
Colour of lapping	Blue	Orange
Unit no.	3	4
Colour of lapping	Green	Brown
Unit no.	5	
Colour of lapping	Grey	



**DESIGN CALCULATIONS FOR LV
CABLES SELECTION AND SIZING**

DOC. NO. PE-DC-392-507-E002

REVISION NO. 07

DATE 16-08-2014

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**DATA SHEET-C
SCREEN CONTROL CABLE**

1	Type of cable	FRLS SCREENED CONTROL CABLES
2	Standards Applicable	
A	IS-1554-I	General Construction & tests for cables.
B	SEN-SS-424-1475, IEC-60332 Part 1	Flammability Tests
C	ASTMD-2843, ASTMD-2863, IEC-754 Part-1	FRLS Tests
3	Voltage grade	1.1 kV
4	CONDUCTOR	
	Material	High conductivity multi stranded annealed tinned Copper
	Conductor size	0.5 sq. mm. (7/ 0.3 mm.)
	Conductor size for PA system	(1)0.75 sq. mm. (strands dia 0.193 mm, no. of strands as per cross section area) (2) 0.5 sq. mm. (strands dia 0.193 mm, no. of strands as per cross section area)
5	INSULATION	
	Material	PVC Type A as per IS- 1554 Part-I & IS- 5831
	Application	Extruded
	Insulation thickness(Nominal)	0.6mm
6	ARMOURING	
	Material	Galvanized steel round wire/ strip as per IS-3975 & IS-1554 Part-I
	Minimum coverage	90%
	Breaking load of joints	95% of normal armour
	Method of jointing	Welding
7	LAYING OF CORES	
	Min. number of twist per Metre for paired cables	20
	Maximum lay of individual twisted pair	50 mm

9.0	INDIVIDUALLY SCREENED	
a)	Material	Aluminium-Mylar tape



**DESIGN CALCULATIONS FOR LV
CABLES SELECTION AND SIZING**

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b)	Coverage	100%
c)	Overlap	Minimum 20%
d)	Min. thickness (Micron)	28 micron
10.0 OVERALL SCREENED		
a)	Material	Aluminium-Mylar tape
b)	Coverage	100%
c)	Over lap	Minimum 20%
d)	Min. thickness (Micron)	55 micron
11.0 DRAIN WIRE		
To be provided separately for individual pair shield (wherever applicable) and overall shield.		
a)	Material	Annealed tinned copper drain wire
b)	Size	0.5 sq. mm.
12.0 BEDDING		
a)	Material	Flame retardant Mylar tape
13.0 INNER SHEATH		
a)	Material	Extruded PVC Type ST1 as per IS- 5831
b)	Whether FRLS	No
c)	Fillers	Acceptable
d)	Material of fillers	Same as inner sheath
e)	Method of application	
i)	With fillers	Pressure / Vacuum Extrusion
ii)	With out fillers	Pressure Extrusion
f)	Inner sheath Thickness	As per IS-1554 Part-1
14.0 FILLERS		
a)	Fillers	Acceptable, only if Flame Retardant & Moisture Resistant
15.0 OUTER SHEATH		



**DESIGN CALCULATIONS FOR LV
CABLES SELECTION AND SIZING**

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a)	Material	Extruded PVC Type ST1 as per IS- 5831
b)	Thickness	As per IS-1554 Part-1
c)	Application	Extruded
d)	Colour	Black
e)	Whether FRLS	YES
f)	Other properties	The sheath shall be resistant to water, UV radiation, fungus, termite and rodent attack
16.0	FRLS/ FLAMMABILITY TESTS	
a)	Oxygen Index	29% Minimum as per ASTM D 2863
b)	Temperature Index	250 °C Minimum as per ASTM D 2863
c)	Acid gas generation	less than 20% by weight (As per IEC-754-1)
d)	Average area under curve (Smoke density rating)	Not more than 60% (As per ASTM D 2843)
e)	Flammability Test	Cable shall pass test under fire condition as per 10810-Part-53 Cable shall also pass test under fire condition as per 10810-Part-61 & 62. Category group shall be considered as Category 'A'. The finished cable shall pass flammability test as per IEEE-383.
f)	UV Radiation Test (As per BS EN ISO 4892-2)	yes
g)	High Voltage Test, AC & DC Tests Core to core & Core to shield	As per IS-1554 (Part-1)
h)	Anti-fungal, Anti-rodent and Termite repulsion Test	yes
17.0	TOLERANCE ON OVERALL DIAMETER	
		± 2mm max.
18.0	VARIATION IN DIA & OVALITY AT ANY CROSS-SECTION	
		Not more than 1 mm.
19.0	DRUM LENGTH	
a)	Standard drum length	1000 metres upto 12P 500 metres above 12P
b)	Tolerance on drum length :	±5%
20.0	MARKING	
a)	Marking provided on outer sheath :	Cable size (cross section area and no. of cores) and voltage grade @ 1m (by embossing) Type of insulation, Type of inner & outer sheath

R-04

R-05



**DESIGN CALCULATIONS FOR LV
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		e.g. "FRLS" etc, @ 1m (by embossing) Manufacturer's name and/ or trade name, and year of manufacture @ 1m (by embossing) BHEL- ISG and 'RRVUNL' @1m (by embossing) Progressive sequential marking @ 1m (by embossing)
--	--	--

STANDARD CABLE PARAMETERS FOR INSTRUMENTATION CABLE

Parameter	0.5 mm ² (IS & OS) type-F	0.5 mm ² (OS) type-G/ 0.75 mm ² (OS) type-G
Mutual Capacitance (max.) at 0.8 kHz, nF/Km	Data shall be furnished after finalization of order	Data shall be furnished after finalization of order
Conductor Loop Resistance (max.), Ohm/Km	Data shall be furnished after finalization of order	Data shall be furnished after finalization of order
Insulation Resistance (min), M Ohm/ Km	500	500/500
Cross Talk attenuation (min) at 0.8kHz, dB	Data shall be furnished after finalization of order	Data shall be furnished after finalization of order
Characteristic impedance (max.) at 1 kHz	Data shall be furnished after finalization of order	Data shall be furnished after finalization of order
Attenuation (max.) at 1 kHz dB/Km	Data shall be furnished after finalization of order	Data shall be furnished after finalization of order

R-05

Note:

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

ANNEXURE - 2

TYPE, ACCEPTANCE & ROUTINE TEST PROCEDURE

S.No.	Test Description	Reference documents for test procedure	TEST CONDUCTION REQUIRED AS
	Test for Conductor:-		
1	Annealing Test (Before stranding)	IS: 10810 Part -1 & IS: 8130	T, A (*)
2	Resistance Test at 20 Deg.C	IS: 10810 Part -5 & IS: 8130	T, A, R
3	Tin coating test (for tinned copper)	IS: 10810 Part -4 & IS: 8130	T
4	Diameter test	IS: 10462 Part -1	T
	Physical Test for PVC insulation & PVC sheath:-		
5	Test for thickness	IS: 10810 Part-6, IS:1554 Part-1, IS:694 & BHEL Spec. as per Approved Data-sheet	T, A
6	Tensile strength & Elongation test (Before & After Ageing)	IS: 10810 Part-7 & IS: 1554 Part-1	T, A
7	Ageing in air oven	IS: 10810 Part -11 & IS: 5831	T
8	Loss of mass test	IS: 10810 Part -10 & IS: 5831	T(**)
9	Hot Deformation test	IS: 10810 Part -15 & IS: 5831	T(**)
10	Heat Shock test	IS: 10810 Part -14 & IS: 5831	T
11	Shrinkage test	IS: 10810 Part -12 & IS: 5831	T
12	Thermal stability test	IS: 10810 Part - 60 & IS: 5831	T
13	Bleeding & Blooming test	IS: 10810 Part - 19 & IS: 5831	T
14	Volume resistivity	IS: 10810 Part - 43 & IS: 5831	T
15	Cold bend test	IS: 10810 Part - 20 & IS: 5831	T
16	Cold impact test	IS: 10810 Part - 21 & IS: 5831	T
17	Colour fastness to water	Appendix-A of IS:5831, IS: 10810 Part - 18	T
18	Oxygen index test	ASTM-D-2863, IS:10810 Part-58	T, A
19	Smoke density test	ASTM-D-2843, IS:10810 Part-63	T, A
20	Acid gas generation test	IEC-60754 Part-1, IS:10810 Part-59	T, A
21	Temperature index test	ASTM-D-2863, IS:10810 Part-58	T, A
	Tests for filler		
22	Oxygen index test	ASTM-D-2863, IS:10810 Part-58	T
23	Temperature index test	ASTM-D-2863, IS:10810 Part-58	T
	Acid gas generation test	IEC-60754 Part-1, IS:10810 Part-59	T
	Tests for Al.mylar screen		
24	Continuity test	Plant standard	T, A(*)
25	Shield thickness	Approved data sheet	T
26	Minimum Overlap	Approved data sheet	T
27	Noise interference test	Approved data sheet	T
	Tests for Drain Wire		
28	Annealing Test (Before stranding)	IS:10810 Part-1 & IS:8130	T, A
29	Drain wire resistance with shield at 20 deg. C	Approved datasheet	T, A, R
30	Tin coating test (for tinned copper)	IS:10810 Part-4 & IS:8130	T, A
31	Diameter test	Approved datasheet	T
32	Continuity test	Plant standard	T
	Tests for Armour		
33	Dimensions of armour wire	IS: 3975 & IS: 10810 Part-36	T, A
34	Tensile Strength & % Elongation test	IS: 3975 & IS: 10810-37	T, A
35	Torsion test	IS: 3975 & IS: 10810-38	T, A
36	Winding test	IS: 3975 & IS: 10810-39	T, A
37	Uniformity of zinc coating test	IS: 3975 & IS: 10810-40	T, A
38	Mass of zinc coating test	IS: 3975 & IS: 10810-41	T, A
39	Armour wire resistivity at 20 Deg.C	IS: 3975 & IS: 10810-42	T, A

S.No.	Test Description	Reference documents for test procedure	TEST CONDUCTION REQUIRED AS
	Tests for finished cable		
40	Insulation resistance constant	IS: 10810 Part -43 & IS: 5831/84, BS:5308	T, A
41	High Voltage test	IS:1554-I/88, IS: 10810-45 & Approved Data-sheet.	T, R, A
42	Flame retardance test	IEC-60332-1, IS:10810 Part-61, IS:10810 Part-62 (Cat-A)	T, A
43	Flammability test	SEN 424 1475 (F3), IS:10810 Part-53, IEC-60332-1, IEEE-383	T
44	Noise interference test	Approved data sheet	T
45	Dimensional checks	IS:10810 Part-6 & Approved data sheet	T, A
46 a)	Mutual capacitance between core to core	Approved data sheet / As per plant standard	T, A
46 b)	Capacitance between core to screen	As per plant standard	T, A
47	Conductor Loop Resistance	Approved datasheet	T, A
48	Cross talk test	Approved data sheet / As per plant standard	T, A
49	Attenuation test	Approved data sheet / As per plant standard	T, A
50	Characteristic impedance	Approved data sheet / As per plant standard	T, A
51	Maximum capacitance unbalance	Approved datasheet	T, A
52	Drain wire continuity test	Approved data sheet / As per plant standard	T
53	Rodent & Termite Repulsion test for outer sheath	Approved data sheet / As per plant standard	T
54 ****	UV radiation test	BS EN ISO 4892-2	T(****)

LEGENDS:

T= TYPE TEST

A= ACCEPTANCE TEST

R= ROUTINE TEST

* Internal inprocess test report to be furnished.

** Applicable for outer sheath only

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

**** **Type Test Certificate for multi pair Instrumentation Cable shall be submitted for review.**

		END USER : RRVUNI, CUSTOMER : BHARAT HEAVY ELECTRICALS LIMITED		PROJECT: 2X 660 MW, Stage-V, Unit 7 & 8, Suratgarh-Project @ Rajasthan		SPECIFICATION : SPECIFICATION FOR INSTRUMENT CABLE NUMBER :					
		BIDDER/ VENDOR		BHEL DOC NO:		SPECIFICATION TITLE :- TECHNICAL SPECIFICATION FOR INSTRUMENT CABLE					
QUALITY PLAN SHEET 1 OF 5		SYSTEM		ITEM : INSTRUMENTATION CABLES							
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	P W V	11	
1.0	RAW MATERIAL										
1.1	PVC Compound (for insulation and sheath)	1. Physical properties 2. Elec. Properties (INSULATION) 3. FRLS Properties (outer sheath)	MA MA CR	Physical Tests Electrical Tests Environmental	Sample Sample Sample	Relevant Standard/ Appd. Data Sheet/ BHEL Specification -do- -do-	Relevant Standard/ Appd. Data Sheet/ BHEL Specification -do- -do-	Log Book/ Test Cert. -do- -do-	3/2 - 2 3/2 - 2 3/2 - 2	* Sample from each Batch/Lot.	
1.2	Galvanised steel wire/strip	1. Phys. and Elec. Properties 2. Dimension 3. Galvanization Quality	MA MA MA	Physical & Electrical Tests Measurement Galv. Tests	Sample* -do- -do-	Relevant Standard/ Appd. Data Sheet/ BHEL Specification -do- -do-	Relevant Standard/ Appd. Data Sheet/ BHEL Specification -do- -do-	-do- -do- -do-	3/2 - 2 3/2 - 2 3/2 - 2		
1.3	Copper Rods/ Wires (For conductor/ drain wire)	1. Physical Properties 2. Electrical properties	MA CR	Physical Tests Electrical Tests	do- -do-	Relevant Standard/ Appd. Data Sheet/ BHEL Specification -do-	Relevant Standard/ Appd. Data Sheet/ BHEL Specification -do-	-do- -do-	3/2 - 2 3/2 - 2		
1.4	Fillers	1. FRLS Properties	CR	Chemical/ Environ. Test	-do-	-do-	-do-	-do-	3/2 - 2		
1.5	Screen	1. Dimension	MA	Measurement	do-	Appd. Data Sheet	Appd. Data Sheet	TC & IR	3/2 - 2		
BHEL			PARTICULARS								
			NAME								
			SIGNATURE								
			DATE								
										BIDDERS/VENDORS COMPANY SEAL	

		END USER : RRVUNL, CUSTOMER : BHARAT HEAVY ELECTRICALS LIMITED		PROJECT: 2X 660 MW, Stage-V, Unit 7 & 8, Suratgarh-Project @ Rajasthan			SPECIFICATION : SPECIFICATION FOR INSTRUMENT CABLE NUMBER :					
		BIDDER/ VENDOR		BHEL DOC NO.:			SPECIFICATION TITLE :- TECHNICAL SPECIFICATION FOR INSTRUMENT CABLE					
QUALITY PLAN SHEET 2 OF 5		SYSTEM		ITEM : INSTRUMENTATION CABLES								
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	P	W	V	11
2.0	IN PROCESS	2. Mech. Prop.	MA	Mech test	-do-	MFRS. STD.	MFRS. STD.	TC & IR	3/2	-	2	(Applicable only for drain wire in case of un-tinned conductor)
2.1	Wire Drawing, Tinning and Annealing	1. Physical, Electrical, surface finish & dimension	CR	Phy.&Elect. Tests Visual & Meas.	Sample	Relevant Std./ BHEL Specn.	Relevant Std./ BHEL Specn.	Log Book	2	-	1	
		2. Chemical test for Tinning	CR	Chemical Test (Iodine/plate test)	Sample	-do-	-do-	-do-	2	-	-	
2.2	Stranding of wires	1. No. of wires	MA	Counting	Sample	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	2	-	-	
		2. Sequence, lay length & Direction	MA	Visual, Meas	Sample	Relevant Standard/ Vendor's Spec.	Relevant Standard/ Vendor's Spec.	-do-	2	-	-	
		3 Surface Finish	MA	Visual	Sample	-do-	-do-	-do-	2	-	-	
		4.Dimension	MA	Measurement	Sample	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	2	-	-	
2.3	Core Insulation (No repair permitted)	1. Surface finish	MA	Visual	100%	-	Free from bulging burnt particles lumps, cuts & scratches.	-do-	2	-	1	
		2 Insulation thickness	CR	Measurement	Sample	Appd.data sheet/ Relevant Std.	Appd.data sheet/ Relevant Std.	-do-	2	-	-	
BHEL			PARTICULARS									
			NAME									
			SIGNATURE									
			DATE		2							
BIDDER'S/VENDORS COMPANY SEAL												

		END USER : RRVNL,CUSTOMER : BHARAT HEAVY ELECTRICALS LIMITED		PROJECT:2X 660 MW,Stage-V,Unit 7 & 8,Suratgarh-Project @ Rajasthan		SPECIFICATION : SPECIFICATION FOR INSTRUMENT CABLE NUMBER :						
		BIDDER/ VENDOR		BHEL DOC NO:		SPECIFICATION TITLE :- TECHNICAL SPECIFICATION FOR INSTRUMENT CABLE						
QUALITY PLAN SHEET 3 OF 5		SYSTEM		ITEM :INSTRUMENTATION CABLES								
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
2.4	Core pairing, screening (provision of drain wire & laying)	3. Concentricity #	CR	Measurement	Sample	Mfrs Std./ Appd data sheet	Mfrs Std./ Appd data sheet	Log Book	2	-	-	# To be checked at starting & finish end of Extruded Length
		4. Dia over insulation	MA	Measurement	Sample	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	2	-	-	
		5. Spark test or water Immersion test	CR	Electrical	100%	Mfrs Std.	Mfrs Std.	-do-	2	-	1	
		6. Core identification	MA	Visual	100%	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	Relevant Standard/ Appd. Data Sheet/ BHEL Specification	-do-	2	-	-	
		1. Pair identification	MA	Visual	100%	BHEL Spec. & appd. Data sheet	BHEL Spec. & appd. Data sheet	Log Book	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	Sample	BHEL Spec. & MFRs. Std.	BHEL Spec. & MFRs. Std.	-do-	2	-	-	
		5. Screen overlap & coverage	MA	Measurement	Sample	BHEL Spec.	BHEL Spec.	-do-	2	-	-	
		6. Dia over laid up core	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
2.5	InnerSheath Extrusion	7. Continuity of drain & drain wire with screen	MA	Elect. Test	100%	<----- No Discontinuity ----->		-do-	2	-	-	(Applicable for armoured cables)
		1. Surface finish	MA	Visual	100%	-	Free from bulging, burnt particles, lumps cuts & scratches.	-do-	2	-	-	
		2. Sheath thickness	MA	Measurement	Sample	BHEL Spec. & appd. Data sheet	BHEL Spec. & appd. Data sheet	-do-	2	-	-	
BHEL			PARTICULARS									
			NAME									
			SIGNATURE									
			DATE									
			BIDDERS/VENDORS COMPANY SEAL									

		END USER : RRVUNL,CUSTOMER : BHARAT HEAVY ELECTRICALS LIMITED		PROJECT:2X 660 MW,Stage-V,Unit 7 & 8,Suratgarh-Project @ Rasjasthan			SPECIFICATION : SPECIFICATION FOR INSTRUMENT CABLE NUMBER :					
		BIDDER/ VENDOR		BHTEL DOC NO:			SPECIFICATION TITLE :- TECHNICAL SPECIFICATION FOR INSTRUMENT CABLE					
QUALITY PLAN SHEET 4 OF 5		SYSTEM			ITEM :INSTRUMENTATION CABLES							
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	11	
2.6	Armouring	3.Dia over inner	MA	Measurement	Sample	BHTEL Spec. & appd. Data sheet	BHTEL Spec. & appd. Data sheet	-do-	2	-	-	
		1.No.of wires/Strips	MA	Counting	At the start of the process	BHTEL Specn./ Appd. Data sheet	BHTEL Specn./ Appd. Data sheet	-do-	2	-	-	
		2. Lay Direction	MA	Visual	-do-	-do-	-do-	-do-	2	-	-	
		3. Lay Length	MA	Visual, Meas.	At the start of the process	Rel. Std./ BHTEL Specn./ Appd. Data sheet	Rel. Std./ BHTEL Specn./ Appd. Data sheet	Log Book	2	-	-	
		4. Coverage	MA	Measurement	-do-	BHTEL Specn./ Appd. Data sheet	BHTEL Specn./ Appd. Data sheet	-do-	2	-	-	
2.7	Outer Sheath Extrusion	5. Dia over	MA	Measurement	-do-	-do-	-do-	-do-	2	-	-	
		1. Surface Finish	MA	Visual	100%	-	Free from Bulging, Burnt particles, lumps, cuts & scratches	Log Book	2	-	-	
		2.Sheath thickness	MA	Measurement	Sample	BHTEL Specn./ Appd. Data sheet	BHTEL Specn./ Appd. Data sheet	Log Book	2	-	-	
		3. Dia over outer sheath	MA	Measurement	Sample	-do-	-do-	-do-	2	-	-	
		4. Marking	MA	Visual	100%	BHTEL Specn./ Appd. Data sheet	BHTEL Specn./ Appd. Data sheet	Test Report	2	-	-	
2.8	Finished Cable	1. Routine Test	CR	Elec. & Meas.	100%	BHTEL Specn./ Appd. Data sheet	BHTEL Specn./ Appd. Data sheet	Test Report	2	-	1	Sequential marking shall be done by printing * One Drum/Size/ Lot
		2. Type & FRLS Tests	CR	Elec, Phy & Meas.	Sample *	BHTEL Specn./ Appd. Data sheet	BHTEL Specn./ Appd. Data sheet	Test Report	2	-	1	
PARTICULARS												
BHTEL												
NAME												
SIGNATURE												
DATE												
BIDDERS/ VENDORS COMPANY SEAL												

		END USER : RRVUNL, CUSTOMER : BHARAT HEAVY ELECTRICALS LIMITED		PROJECT: 2X 660 MW, Stage-V, Unit 7 & 8, Suratgarh-Project @ Rajasthan		SPECIFICATION : SPECIFICATION FOR INSTRUMENT CABLE NUMBER :						
		BIDDER/ VENDOR		BHTEL DOC NO:		SPECIFICATION TITLE:- TECHNICAL SPECIFICATION FOR INSTRUMENT CABLE						
QUALITY PLAN SHEET 5 OF 5		SYSTEM		ITEM : INSTRUMENTATION CABLES								
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	11	12	
3.0	Final Inspection	1. Finish & Length	MA	Visual	(See remark)	BHTEL specn./ Revelant Std	Free from Bulging Burnt particles, lumps, cuts & scratches	Test Report	2	1	-	One drum in a lot
		2. Dimensions	MA	Measurement	Sample Lengths	BHTEL specn./ Approved Data Sheet	BHTEL specn./ Approved Data Sheet	Test Report	2	1	-	
		3. Armouring - Coverage No. of wires/Strips	MA	Visual & Meas.	Sample	-do-	-do-	-do-	2	1	-	
		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	CR	Phy & Elect. Test	Sample as per IS 1584	-do-	-do-	-do-	2	1	-	Flammability test shall be performed only on one size per lot FRLS tests shall be conducted on each size of every lot of cables
		7. Type & FRLS Tests	CR	Measurement	Sample #	BHTEL Specn. / Appd. Data Sheet / appd. TTP	BHTEL Specn. / Appd. Data Sheet / appd. TTP	-do-	2	1	-	#1. Physical/ Electrical/ Mechanical/ standard technical parameters: One size of each type [INDI & OVERALL/ OVERALL] per lot. 2. Flammability tests : Only one size per lot.

NOTES :-

(A) JOINTS IN WIRE SHALL BE AS PERMITTED BY REL STD / BHTEL SPECIFICATION. VENDOR TO CERTIFY THE SAME.

(B) NO REPAIR OF CORE INSULATION PERMITTED

(C) CABLE ENDS SHALL BE SEALED AS PER REL. STD. / BHTEL 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 BHTEL 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.

(H) VENDOR SHALL FURNISH COMPLIANCE CERTIFICATE TO THE INSPECTION AGENCY CONFIRMING THE PACKING AS PER REL. STD. / BHTEL SPECIFICATION.

(I) FOR LIST OF TYPE TESTS, ROUTINE TESTS & ACCEPTANCE TESTS; REFER TYPE TEST PROCEDURE FOR INSTRUMENT CABLES: PE-V0-392-507-ES03

LEGEND : P : PERFORMER W: WITNESSER V: VERIFIER 1- BHTEL/CUSTOMER 2-VENDOR 3-SUB VENDOR CIP: CUSTOMER HOLD POINT

BHTEL	PARTICULARS	
	NAME	
	SIGNATURE	
	DATE	
		BIDDER'S/VENDORS COMPANY SEAL