

शारीरी एवं सुरक्षा दिनांक एवं हस्ताक्षर		उत्पाद मानक		ST 51021																																									
		PRODUCT STANDARD		पृष्ठ का Page 1 of 4																																									
शारीरी एवं सुरक्षा अधिकाधिक जानकारी	SUPERSEDES INVENTORY NO	PURCHASE SPECIFICATION FOR OVERALL SHIELDED GROUP CABLES (FIRE RETARDENT LOW SMOKE (FRLS) TYPE)																																											
		1.0 APPLICATION : This deals with the specification of group cables for instrumentation and control of the TG-set. The cables shall be used for connection between junction boxes and C & I cabinets, between various C&I cabinets, between C&I cabinets & valve actuators, between C&I cabinets & MCC and between C&I cabinets & UCB . The cables shall be terminated by soldering/screw/ maxi-termi termination method. 2.0 REFERENCE STANDARDS : The application standards are IS:9938, IS:8130, IS:5831, IS:10810, ASTM-D2863, IEC:754-I, IEC:332-I, IEEE:383. Assistance has been taken from VDE :0815 in preparing this specification. The latest revision of the referred standards shall be followed. 3.0 GENERAL SPECIFICATIONS : The cable shall be suitable for transmission of analog/binary/digital signals of magnitude 60V/20mA DC , which require protection against stray fields. The cables shall be laid in conduits or covered cable trays separately from power/control cables. 4.0 PAIR CABLES : 4.1 CONDUCTOR : Each core shall be stranded bare copper conductor of 0.5 sq. mm (7 x 0.3) cross-sectional area. The conductor shall be made of annealed high conductivity copper complying to IS:8130. 4.2 INSULATION : Each core shall be insulated by extrusion process with PVC , Type - C as per IS:5831. Diameter of core shall strictly be 1.5 +/- 0.1 mm and shall not be outside these limits in any case. 4.3 PAIRING : Every two such cores shall be twisted together to form a pair (25 to 40 lays per meter). The pairs shall then be stranded to form the cables. 4.4 OVERALL SHIELDING : All stranded pairs together shall be shielded with aluminium mylar tape to provide 100 % coverage. Tape thickness shall be minimum 0.06 mm. Taping shall be done with at least 20 % overlap. A continuous multi-strand drain wire of tinned copper with cross-section of 0.5 sq. mm shall also be provided. 4.5 SHEATHING : The cable shall then be sheathed with FRLS PVC, Type – ST2 as per IS:5831 by extrusion process. The colour of sheath shall be blue. Minimum sheath thickness shall be 1.8 mm . Overall diameter of the cable and tolerance on overall diameter shall be indicated in offer.																																											
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राखी पूरी सूची को अधिकृत किया है		a) Conductor resistance of the loop : < 78.4 ohm / km b) Insulation resistance : > 100 Mohm / km c) Mutual capacitance at 0.8 KHz : < 100 nF / km d) High voltage test : (i) conductor to conductor : 2000 V rms, 50 Hz for 1 min (ii) conductor to shield : 500 V rms, 50 Hz for 1 min e) Operating voltage of cable : 225V peak (max) f) Coupling capacitance at 0.8 KHz : < 200 pF / 100 m g) Cross talk attenuation at 0.8 KHz (min) : 60 dB h) Image attenuation at 1 KHz (max) : 1.2 dB/km i) Characteristic impedance (max) : 340 ohm																																					
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INVENTORY P-6337		Example : A grey wire coded with two black coloured rings indicates that it belongs to 6 th pair. Similarly a grey wire with three rings belongs to the 10 th pair.																																					
5.0 CABLES WITH INDIVIDUAL WIRES (WITHOUT PAIRING) : GENERAL SPECIFICATIONS : Same as 4.0 expect that the cores shall be stranded together instead of having twisted pairs and colour coding shall be as per Table -2. The colour of rings shall be as given in clause 4.7.		<table border="1"> <tr> <td>निर्माणकर्ता</td> <td>SC</td> <td></td> <td></td> </tr> <tr> <td>WORKED BY</td> <td></td> <td></td> <td></td> </tr> <tr> <td>जांचकर्ता</td> <td>SC</td> <td></td> <td></td> </tr> <tr> <td>CHECKED BY</td> <td></td> <td></td> <td></td> </tr> </table>				निर्माणकर्ता	SC			WORKED BY				जांचकर्ता	SC			CHECKED BY																					
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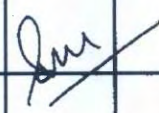
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used for any purpose other than that intended by the company.	6.0 GENERAL : 6.1 IDENTIFICATION MARKING : Durable identification marking shall be provided repeatedly on the outer sheathing at distance of 1000mm as per the following example : For 8 pair cables : FRLS - 225V - 8 X 2 X 0.5 - BHEL (HW) - SEQUENTIAL LENGTH For 8 wire cables : FRLS - 225V - 8 X 1 X 0.5 - BHEL (HW) - SEQUENTIAL LENGTH 6.2 Quantity : as per enquiry 6.3 Cable data sheets and Q A plan shall be submitted by the vendor for BHEL or their customers approval. 7.0 TEST AND INSPECTION : The cable shall be inspected at suppliers works by BHEL's representative before despatch. The supplier shall arrange all equipment and other facilities required for such inspection. Inspection shall be carried out on all or less batches of the product as felt necessary by BHEL and as per approved QA plan. 3 copies of test certificates for all acceptance tests (as per clause 7.2) and routine tests (as per clause 7.3) shall be furnished. 7.1 All test as per the standards specified in this specification shall be carried out on the conductor and the material used for insulation and sheathing. 7.2 ACCEPTANCE TESTS 7.2.1 Water immersion test shall be carried out as per VDE 0815. 7.2.2 All tests vis-à-vis clause 4.6 7.2.3 Additional tests as per clause 7.2.5 for FRLS cables.																																											
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सामग्री सूची संख्या INVENTORY NO.	SUPERSEDES INVENTORY NO.	7.2.4 Static Noise interference test shall be carried out as per IEEE transaction on Industry and General Application, March 1967. Minimum shield efficiency of the cable shall be 70 dB.			
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QAX	S.K.CHAUHAN	जांचकर्ता CHECKED BY																										
सहमत विभाग AGREED DEPTT.	नाम NAME	परिष्कारकर्ता SUPERVISED BY																										
	दिनांक एवं हस्ताक्षर DATE & SIGNATURE																											
REV.NO. Dt.		स्वीकृति APPROVED : K.B.BATRA निर्माण PREPARED : CIE जारी ISSUED : TSX																										
		दिनांक DATE : 20-4-06																										
सामग्री सूची संख्या INVENTORY NO P-6338																												

दिनांक एवं स्थान SIGN & DATE		उत्पाद मानक		ST 51022																																			
		PRODUCT STANDARD		पृष्ठ	का																																		
समय की सीमा INVENTORY NO	समय की सीमा को अधिकृत करता है	4.5 SHEATHING : The cable shall then be sheathed with FRLS PVC, Type-ST2 as per IS:5831 by extrusion process. The colour of sheath shall be blue. Minimum sheath thickness shall be 1.8 mm. Overall diameter & tolerance of the cable shall be indicated in the offer.																																					
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.		4.6 ELECTRICAL PROPERTIES (20 deg C) : a) Conductor resistance of the loop : < 78.4 ohm / km b) Insulation resistance : > 100 Mohm / km c) Mutual capacitance at 0.8 KHz : < 120 nF / km d) High voltage test : (i) conductor to conductor : 2000 V rms, 50 Hz for 1 min (ii) conductor to shield : 500 V rms, 50 Hz for 1 min e) Operating voltage of cable : 225V peak (max) f) Coupling capacitance at 0.8 KHz : < 200 pF / 100 m g) Cross talk attenuation at 0.8 KHz (min) : 60 dB h) Image attenuation at 1 KHz (max) : 1.2 dB/km i) Characteristic impedance (max) : 320 ohm																																					
स्वातंत्र्यकार एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रयोग एवं प्रसारण के बिना किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए।		4.7 COLOUR CODING : For identification the wires of pairs shall be coded by 8 basic colours of the insulation as per Table-1. Different pairs with same colour combination shall be differentiated by marking different number of rings of black colour as per Table -1. For black and brown coloured cores, the rings shall be of white colour. The colours shall be as per IS:9938.																																					
<table border="1"> <thead> <tr> <th rowspan="2">Pair No.</th> <th colspan="4">Basic colour of wire</th> <th>Ring Group</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th></th> </tr> </thead> <tbody> <tr> <td></td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> <td></td> </tr> <tr> <td></td> <td>9</td> <td>10</td> <td>11</td> <td>12</td> <td></td> </tr> <tr> <td>a - wire</td> <td>Blue</td> <td>Gray</td> <td>Green</td> <td>White</td> <td></td> </tr> <tr> <td>b - wire</td> <td>Red</td> <td>Yellow</td> <td>Brown</td> <td>Black</td> <td></td> </tr> </tbody> </table>		Pair No.	Basic colour of wire				Ring Group	1	2	3	4			5	6	7	8			9	10	11	12		a - wire	Blue	Gray	Green	White		b - wire	Red	Yellow	Brown	Black		The vertical lines under the column 'Ring Group' in the above table indicates the number of rings marked at every 60 mm approximate length on the wires. The number of rings on the wires indicates the group / unit no. of the wires required for wiring purposes. The ring marking shall be durable and distinct.		
Pair No.	Basic colour of wire				Ring Group																																		
	1	2	3	4																																			
	5	6	7	8																																			
	9	10	11	12																																			
a - wire	Blue	Gray	Green	White																																			
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समय की सीमा INVENTORY	दिनांक एवं स्थान SIGN & DATE	निर्माणकर्ता WORKED BY	SC	जांचकर्ता CHECKED BY	SC																																		

निर्माण एवं हस्ताक्षर SIGN & DATE		उत्पाद मानक PRODUCT STANDARD		ST 51022	
				पृष्ठ का Page 3 of 4	
समुपरी सूची संख्या INVENTORY NO. P-6338	समुपरी सूची संख्या SUPERSEDES INVENTORY NO.	Example : A grey wire coded with two black coloured rings indicates that it belongs to 6th pair. Similarly a grey wire with three rings belongs to the 10th pair. 5.0 GENERAL : 5.1 IDENTIFICATION MARKING : Durable identification marking shall be provided repeatedly on the outer sheathing at distance of 1000 mm as per the following example : For 8 pair cables : FRLS - 225V - 8 X 2 X 0.5 - BHEL (HW)-SEQUENTIAL LENGTH 5.2 Quantity & Type of Cable: 2 pair to 12 pair as per enquiry. 5.3 Cable data sheets and Q A plan shall be submitted by the vendor for BHEL or their customer's approval. 6.0 TEST AND INSPECTION : The cable shall be inspected at suppliers works by BHEL's representative before dispatch. The supplier shall arrange all equipment and other facilities required for such inspection. Inspection shall be carried out on all or less batches of the product as felt necessary by BHEL and as per approved QA plan. 3 copies of test certificates for all acceptance tests (as per clause 6.2) and routine tests (as per clause 6.3) shall be furnished. 6.1 All test as per the standards specified in this specification shall be carried out on the conductor and the material used for insulation and sheathing. 6.2 ACCEPTANCE TESTS 6.2.1 Water immersion test shall be carried out as per VDE 0815. 6.2.2 All tests vis-à-vis clause 4.6 6.2.3 Additional tests as per clause 6.2.5 for FRLS cables. 6.2.4 Static Noise interference test shall be carried out as per IEEE transaction on Industry and General Application, March 1967. Minimum shield efficiency of the cable shall be 70 dB. 6.2.5 ADDITIONAL TESTS FOR FRLS CABLES : (i) Oxygen index test on outer sheath as per ASTM – D2863. Minimum value of oxygen index should be 29. (ii) Temperature index of outer sheath shall be carried out as per ASTM – D2863 or by extrapolation as per BICC Handbook, Chapter 6 on "Cables in Fire". A number of measurements up to 120 °C shall be taken and results plotted in a graph and then extrapolated. Minimum value of temperature index shall be 250 °C.			
निर्माण एवं हस्ताक्षर SIGN & DATE 20/10/06	स्वतंत्र अधिकार एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत की विद्युत नियंत्रण, की संपत्ति है इसका प्रयोग एवं प्रसारण अन्य से किसी भी तरह प्रयोग जो कि कंपनी के हित में प्रतिस्पर्धा को न किया जाए।	निर्माणकर्ता WORKED BY SC			
निर्माण एवं हस्ताक्षर SIGN & DATE 20/10/06	स्वतंत्र अधिकार एवं गोपनीय इस दस्तावेज में दी गई सूचना भारत की विद्युत नियंत्रण, की संपत्ति है इसका प्रयोग एवं प्रसारण अन्य से किसी भी तरह प्रयोग जो कि कंपनी के हित में प्रतिस्पर्धा को न किया जाए।	जांचकर्ता CHECKED BY SC			

विनांक एवं दिनांक SIGN & DATE		उत्पाद मानक		ST 51022	
		PRODUCT STANDARD		पृष्ठ का Page 4 of 4	
श्रमजी सूची संख्या INVENTORY NO. P-6338	सुपरसेड्स INVENTORY NO.	(iii) Acid gas generation on outer sheath by weight as per IEC-754-1. It shall be less than 20%. (iv) Smoke generation of outer sheath material under fire as per ASTM- D2843. Maximum smoke density rating shall be 60%. (v) Flammability characteristics of cables as per IEC - 332 , Part - 1 (vi) Flammability characteristics of cables as per IEEE - 383 . (vii) Flammability characteristics of cables as per Swedish Standard S5 .4241475 for class 6.2.6 The cable shall be inspected vis-à-vis clause 4.0. and following measured values shall also be noted: 1. Conductor cross sectional area. 2. Core diameter. 3. Thickness of aluminium mylar tape used for shielding. 4. Percentage overlap of two consecutive turns of the mylar tape. 5. Sheath thickness. 6. Diameter of the drain wire. 7. Overall diameter of the cable. 6.2.7 Colour coding as per Table - 1 shall be checked . Fastness of ring marking shall also be Checked.			
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of Bharat Heavy Electrical. Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.		6.3 ROUTINE TETS 6.3.1 HV test as per clause 4.6 6.3.2 Conductor resistance as per clause 4.6 6.3.3 Insulation resistance as per clause 4.6 7.0 PACKING AND DESPATCH : 7.1 The tolerance on the drum size coil of 1000 M/500M shall be 5% both on minus and plus side. The tolerance on the overall ordered length of each type cable shall be 5% on minus side and zero on the plus side. Maximum 10% of the ordered quantity can be dispatched in shorter lengths, but pieces less than 125M will not be accepted. 7.2 Length of the coil and type of the cable will be distinctly marked on each cable drum.			
स्वत्वधिकार एवं गोपनीय इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रयोग एवं आरक्षण स्वयं से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए ।	हस्ताक्षर एवं दिनांक SIGN & DATE 	निर्माणकर्ता WORKED BY SC	जांचकर्ता CHECKED BY SC		



CONTROL & INSTRUMENTATION ENGINEERING

Doc. No. 418101B6007 R01

Date: 01.08.14

ITEM: Low Halogen Low Smoke (LHLS) Group Cables

Addendum to Specification no. ST51021 REV 00 & Specification no. ST51022 REV 00

The following specifications shall be followed for Group cables:-

1. The Group Cables shall be EPR (Ethylene- Propylene) insulated & LHLS (Low Halogen Low Smoke) sheathed unarmoured overall shielded 500V grade cable.
2. The Cable requirement is for NPCIL project.
3. Cables technical requirement shall be foremost governed by NPCIL specification (sh 2 to 10 of this Addendum).
4. Other requirements shall be governed by BHEL specification ST51021 & ST51022.
5. Any deviation/ equivalent standard w.r.t. Addendum/ Specifications will be subject to BHEL approval.
6. Data sheet and type test shall be subject to BHEL approval.
7. All items shall be procured from same vendor.

(Suresh Chandra)

(Rajnish Gupta)

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C-2-4-9-1 TECHNICAL SPECIFICATION FOR ETHYLENE-PROPYLENE RUBBER INSULATED, LOW HALOGEN LOW SMOKE SHEATHED INSTRUMENTATION CABLES

1. SCOPE

Manufacture, testing, packing, delivery and guarantee of following cables generally conforming to IS-6380 for use in Nuclear Power Plant:

- a. Various sizes of annealed bare copper conductor, Ethylene-Propylene Rubber (EPR) insulated and Low Halogen Low Smoke (LHLS) sheathed unarmoured, overall shielded 500 V grade instrumentation cables.

~~b. Annealed bare copper conductor, Ethylene-Propylene Rubber (EPR) insulated and Low Halogen Low Smoke (LHLS) sheathed unarmoured, unshielded 1100V grade control cables for interconnecting 24 VDC/220V DC/240V AC Control Power Supply (DCPS), Switch Fuse Unit(SFU), Battery, Standby Battery Charger(SBC) and Distribution Panels.~~

Type of pair, conductor size and quantity of cables shall be decided by the TG vendor.

2.0 APPLICABLE SPECIFICATIONS AND DRAWINGS

- 2.1 **IS-9968 (Part-I):** Specification for elastomer insulated cables for working voltage upto and including 1100 volts.

- 2.2 **IS-6380:** Specification for elastomeric insulation and sheath of electric cables.

- 2.3 **IS-8130:** Specification for conductors for insulated electric cables and flexible cords.

- 2.4 **ASTM-D-2843:** Standard test method for density of smoke from the burning or decomposition of plastics.

OR

- 2.5 **IS-10810-63:** Measurement of Smoke density of electric cables under fire conditions (supplier to indicate the acceptance criteria which is equivalent to ASTM-D-2843 vide clause no.6.5 of the specification.)

- 2.6 **ASTM-D-2863:** Standard method for measuring the minimum oxygen concentration to support candle like combustion of plastic (oxygen index and temperature index).

OR

- 2.7 **IS-10810-58:** Methods of tests for cables : Oxygen Index test.

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- 2.8 **IEC-754-1:** Determination of the amount of halogen acid gas evolved during the combustion of polymeric materials taken from cables.

OR

- 2.9 **IS-10810-59:** Determination of the amount of halogen acid gas evolved during the combustion of polymeric materials taken from cables.
- 2.10 **Swedish Svensk-Standard -424-14-75 (Class F-3):** Swedish Chimney Flame Test

OR

- 2.11 **IS-10810-61:** Flame Retardant Test
- 2.12 **NES 713:** Determination of the toxicity index of the products of combustion from small specimens of materials.
- 2.13 **IS-10810:** Methods of tests for cables.

3.0 **MATERIALS AND WORKMANSHIP**

3.1 **Materials**

The materials and processes for the components of cables and their assembly shall be chosen as specified here-in. Use of any substitute materials shall be suitably qualified in terms of its electrical, mechanical and physical properties and the details shall be submitted by supplier for purchaser's approval. All the materials and processes which are not specified herein shall be chosen so as to enable the purchased product to meet the performance requirements of this specification. The construction of cable shall in general conform to IS-9968-part-I.

3.2 **Workmanship**

Workmanship shall be of high industrial quality to ensure the product to be uniform in quality and free from all defects and deformities so as to perform its required function in the specified environment as mentioned in this specification over an expected plant life of 40 years.

4.0 **GENERAL FUNCTIONS AND DESCRIPTION**

- 4.1 The cables shall be suitable for continuous and reliable operation at maximum conductor temperature of 90⁰ C. Voltage for instrumentation cable shall be up to and including 300 V for core to earth and 500 V for core to core. For control power cable the voltage shall be upto and including 650V for core to earth and 1100V for core to core.

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4.2 Environment conditions

- (a) Ambient Temperature .. 4°C - 45 degree C.
(b) Relative Humidity .. 100% max.

5.0 DESIGN REQUIREMENTS

All materials used shall be first class and of standard conforming to the requirements of this specification.

5.1 Conductor

Conductor shall be of annealed bare solid circular copper conductor in accordance with BS-6360 or IS-8130. Joints of any kind in the conductor are not allowed.

5.2 Insulation

Insulation shall be 90°C, Ethylene-Propylene Rubber (EPR) (Type IE-2 of IS-6380) and shall be meeting physical requirement of this standard. Grade of insulation shall be 500 V for instrumentation cables and 1100V for control power cable. No joints of any kind in the insulation are permitted. Insulation shall be applied by extrusion process. The colour of insulation shall be as per Annexure-A of this specification for each type of cable.

5.3 Core Identification

Numbering method used to identify the pairs of cables shall be as per clause 1.1, Annexure-'A' of this specification. The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is single numeral a dash shall be placed underneath it. If the number consists of two numerals they shall be printed one below the other and a dash placed below the lower numeral. The numbers shall be printed on both the wires of pair at an interval of not more than 150mm.

5.4 Shielding

Over the assembled pairs shall be applied non-metallic binder such as polyester. In intimate contact with binder shall be applied polyester backed aluminum tape with minimum 25% overlap such that polyester surface comes to the top. The thickness of aluminium shall be 0.025mm. A tinned solid copper drain wire of 0.75 sq.mm shall run in contact with and below the aluminium tape through out the length of the cable for grounding purpose.

Control power cables shall be unshielded.

5.5 Sheath

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Sheath material shall be Low Halogen Low Smoke (LHLS) Type SE 3 meeting physical requirements as specified in IS-6380 with termite/rodent proof. The oxygen index shall not be less than 29 and temperature index shall not be less than 250°C as per ASTM-D-2863 or IS-10810-58 and smoke density shall not be more than 20% when tested as per ASTM-D-2843. Smoke density test may be conducted as per IS-10810-63. Supplier to indicate the acceptance criteria which is equivalent to 20% smoke density rating as per ASTM-D-2843. **Test shall be conducted for 12 minutes instead of 4 minutes as specified by the standard.** HCL emission shall not exceed 2% when tested as per IEC-754-1 or IS-10810-59. Toxicity Index shall not exceed 5 when tested as per NES 713. It should be possible to strip the Jacket without damaging the insulation. Jacket shall be of black colour.

6.0 Construction Details of Cables

6.1 0.75 Sq.mm 5 Pair Overall Shielded Cable (Typical)

Each conductor shall be 0.75 sq.mm annealed bare solid copper conductor insulated with silicone rubber based elastomeric compound of 0.65 mm (nominal) $\pm 10\%$ wall thickness by extrusion process. Such two cores shall be twisted together (min. 12 lays per meter), overall shielded as per clause 5.4 of this specification. Then it is covered with LHLS Type SE 3 of IS-6380 compound sheath as mentioned in clause 6.5 of this specification. The wall thickness of sheath shall be 1.2mm (Nom) $\pm 20\%$ by pressure extrusion process. A rip cord shall be provided below the sheath for easy stripping of the sheath. Lay of pairs shall be staggered. Overall diameter shall not exceed 15mm.

Type of Cable	Sheath Thickness in mm	Overall cable diameter in mm
0.75 Sq.mm 25 Pair Overall Shielded Cable	1.7 mm $\pm 20\%$.	28
0.75 Sq.mm 10 Pair Overall Shielded Cable	1.3 mm $\pm 20\%$.	20
0.5 sq.mm 25Pair Overall Shielded Cable	1.3 mm $\pm 20\%$	18.5
0.5 sq.mm 10 Pair Overall Shielded Cable	1.2 mm $\pm 20\%$	11.5
0.5 sq.mm 5 Pair Overall Shielded Cable	1.2mm $\pm 20\%$	8.7
0.5 sq.mm 3 Pair Overall Shielded Cable	1.2 mm $\pm 20\%$	8
2C, 300sq.mm Unshielded cable		26

6.2 Cable Identification :

Durable Identification marking shall be provided with following details throughout the length of cable at a span of 1 meter for all types of Cables.

- (a) Name of manufacturer
- (b) Year of manufacture
- (c) LHLS Cable

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- (d) Voltage grade: 500 Vrms and 1100 Vrms
- (e) Running Meter

6.3 Coil Lengths:

The cables of each type shall be supplied in coil lengths of 500 m $\pm$ 10%. Coil lengths of 100 m to 449 m are considered as non-standard lengths. Non standard lengths of only 10% of ordered quantity are acceptable. Lengths less than 100 m are not acceptable.

7.0 INSPECTION, TESTS & REPORTS

The supplier shall be responsible for and shall perform all the tests and inspection as mentioned in this specification and any other tests which may be necessary to assess the required performance of the cable. The characteristic and performance of the cable shall conform to this specification on completion of tests.

The purchaser (NPCIL) or his representative shall have right to access to manufacturer's premises at all reasonable times for following up the manufacturing activities and validation of testing procedures to ensure that quality of performance meets this specification.

The purchaser shall have right to conduct at their own expenses any additional inspection and testing deemed necessary by him.

Quality surveillance relating to all aspects of manufacture shall be carried out by the purchaser. The supplier shall provide all the testing and inspection services and facilities satisfactorily as required. Inspection shall be carried out in satisfactory manner and shall be subjected to approval by the purchaser. Quality Assurance Plan (QAP) has been enclosed with the specification. The supplier shall prepare an inspection plan based on enclosed QAP and submit to NPCIL for approval.

Three copies of test reports and certificates of compliance stating the material is in accordance with the requirement specified in the specification shall be furnished by the supplier.

8.0 SHOP TESTS

<u>8.1 Type Tests</u>	<u>Applicable Standard</u>
8.1.1 Elongation test for Copper	BS-6360 /IS-8130
8.1.2 Conductor resistance test	BS-6360 /IS-8130
8.1.3 Measurement of diameter of Conductor	BS-6360

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- | | |
|---|---|
| 8.1.4 Measurement of thickness of Insulation and sheaths | IS-9968 Part I
but minimum values of thickness of insulation & sheath and tolerance shall be as per clause 6.6 of this spec. |
| 8.1.5 Tensile test on Insulation and sheaths | IS-6380 |
| 8.1.6 Elongation test on Insulation and Sheath | IS-6380 |
| 8.1.7 Hot set test on Insulation and Sheath | IS-6380 |
| 8.1.8 Accelerated ageing test on Insulation and Sheath | IS-6380 |
| 8.1.9 Swedish chimney flame test (Swedish Svensk Standard) | SS-424-14-75 (F3)/IS-10810-61 |
| 8.1.10 High Voltage test | at 1.5 KV as per IS-9968 part-I |
| 8.1.11 Insulation Resistance Test | IS-6380 |
| 8.1.12 Measurement of overall diameter | -- |
| 8.1.13 Test for continuity of tin coating | BS-6360 |
| 8.1.14 Oxygen index test and temp. index test on Sheath | ASTM-D-2863/IS-10810-58 |
| 8.1.15 HCL emission test on Sheath | IEC-754-1/IS-10810-59 |
| 8.1.16 Smoke density rating test on Sheath | ASTM-D-2843/IS-10810-63 with test duration as per clause no. 6.5 of specification.
(Supplier to indicate the acceptance criteria which is equivalent to ASTM-D-2843 as per clause no.6.5 of the spec.if test is done as per IS-10810-63) |
| 8.1.17 Measurement of capacitance between conductor of pairs and between conductor and shield | BS-5308 / IS-5608 or equivalent |

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- 8.1.18 Toxicity Index test on Sheath NES 713
- 8.1.19 Termite/Rodent proof test on Sheath As per supplier's specification.

8.2 Acceptance Tests

The following acceptance tests shall be carried out on samples taken from the lot of each type of cable. The total number of drums of each type of cable shall be treated as a lot size. The sample size for the acceptance test shall be as per Appendix-A of IS-5608-Part-I.

- 8.2.1 Elongation test for Copper BS-6360 /IS-8130
- 8.2.2 Conductor Resistance Test BS-6360 /IS-8130
- 8.2.3 Measurement of thickness of Insulation and Sheath IS-9968 Part I
but minimum values of thickness of insulation & sheath and tolerance shall be as per clause 6.6 of this spec.
- 8.2.4 Insulation Resistance Test IS-6380
- 8.2.5 High Voltage Test at 1.5 KV as per IS-9968 part-1
- 8.2.6 Oxygen Index Test and Temp. Index tests on Sheath ASTM-D-2863/IS-10810-58
- 8.2.7 Smoke Density rating test on Sheath ASTM-D-2843/IS-10810-63 with test duration as per clause no. 6.5 of specification.
(Supplier to indicate the acceptance criteria which is equivalent to ASTM-D-2843 as per clause no.6.5 of the spec.if test is done as per IS-10810-63)
- 8.2.8 HCL emission test on Sheath IEC-754-1 / IS-10810-59
- 8.2.9 Swedish Chimney flame test SS-424-14-75(F3)/IS-10810-61
- 8.2.10 Toxicity Index test on Sheath NES 713
- 8.2.11 Termite/Rodent proof test on Sheath As per supplier's specification.

NUCLEAR POWER CORPORATION OF INDIA LIMITED		
KAKRAPARA ATOMIC POWER PROJECT UNIT-3,4		
KAPP-3.4/40000/ PROCUREMENT SPECIFICATION-MS-1 January-2009 Revision-R0	VOLUME-II- Section-C PART-2 C-2: SPECIFIC TECHNICAL REQUIREMENTS TECHNICAL SPECIFICATIONS OF C&I CABLES	SECTION-C-2-4-9-1 SHEET 8 OF 22

8.2.12 Measurement Of overall diameter --

8.3 Routine Tests

- 8.3.1 Conductor Resistance Test BS-6360 /IS-8130
- 8.3.2 Insulation Resistance Test IS-6380
- 8.3.3 High Voltage Test at 1.5 KV as per
IS-9968 part-I

9.0 PACKING AND SHIPMENT:

The cables shall be so packed as not to suffer deterioration, damage or breakage during shipment. The ends of the cables shall be sealed to prevent ingress of moisture. Packing should be such that the ingress of moisture, dirt and other foreign material can be avoided. Packing method shall be adequate to withstand a period in transit for more than two months and storage at site under a tropical climate for minimum period of one year without suffering any damage or deterioration. Each package shall be properly labeled to indicate the type and quantity of material it contains, purchase order number, dimensions, weight, and any other necessary data to identify the equipment and relate it to the contract.

NUCLEAR POWER CORPORATION OF INDIA LIMITED		
KAKRAPARA ATOMIC POWER PROJECT UNIT-3,4		
KAPP-3,4 /40000/ PROCUREMENT SPECIFICATION-MS-1 January-2009 Revision-R0	VOLUME-II- Section-C PART-2 C-2: SPECIFIC TECHNICAL REQUIREMENTS TECHNICAL SPECIFICATIONS OF C&I CABLES	SECTION-C-2-4-9-1 SHEET 9 OF 22

ANNEXURE-A

COLOUR AND NUMBERING SCHEME OF THE CABLES:

Overall Shielded Cables

The colour of insulation of one conductor in a pair shall be Red and that of other conductor shall be Yellow. Colour of Sheath shall be black. The pairs shall be numbered as given in the example for 5 pair cable:

RED-1
YELLOW-1
RED-2
YELLOW-2
RED-3
YELLOW-3
RED-4
YELLOW-4
RED-5
YELLOW-5

Unshielded Cables

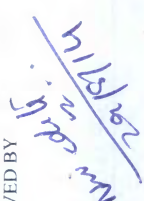
2C, 300sq.mm. (Assuming 720A Full Load Current)
WITHOUT NUMBER, RED & BLACK.

MANUFACTURER'S NAME AND ADDRESS				STANDARD QUALITY PLAN					TO BE FILLED BY BHEL				TO BE FILLED BY BHEL			
BHEL	VENDOR'S NAME		ITEM	GROUP CABLES: EPR insulated & LILIS sheathed unarmoured overall shielded 500V grade		QP NO.	QA/BE/QP/311/KAPP									
					DATED	29 August 2014										
			ADDENDUM NO.		418101B6007 Rev01											
			SPEC.		ST51012/ ST51022											
			REV	Rev 0		Page 2 of 7										
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY		REMARKS				
1	2	3	4	5	6	7	8	9	D	M	B	N	11			

4.3	TEAR RESISTANCE	MAJOR	THERMAL	Sample as per IS:10810	IS:10810 Part 176	IS: 6380	TC	✓	P	V	-	
4.4	TEEMITE AND RODENT PROOFNESS	MAJOR	PHYSICAL	One sample/lot	BHEL SPECN AND ITS ADDENDUM	BHEL SPECN AND ITS ADDENDUM	TC	✓	P	V	-	
4.5	OXYGEN INDEX	CR	THERMAL	Sample as per ASTM D-2863	ASTMD-2863	MIN 29	TC	✓	P	V	-	
4.6	TEMPERATURE INDEX	CR	THERMAL	Sample as per ASTM D-2863	ASTMD-2863	MIN 250°C	TC	✓	P	V	-	
4.7	SMOKE GENERATION	CR	THERMAL	Sample as per ASTM D-2863	ASTMD-2863	MAX 60%	TC	✓	P	V	-	
4.8	ACID GAS EMISSION	CR	THERMAL	Sample as per IEC/IS: 10810	IEC-754-1/IS: 10810 Part 59	BHEL SPECN & ITS ADDENDUM/ DATASHEET	TC	✓	P	V	-	
4.9	TOXICITY INDEX	CR	THERMAL	Sample as per NES 713	NES 713	LESS THAN 5	TC	✓	P	V	-	
4.10	COLOR	MAJOR	VISUAL	100%	BHEL SPECN AND ITS ADDENDUM	BHEL SPECN AND ITS ADDENDUM	IR	✓	P	V	-	

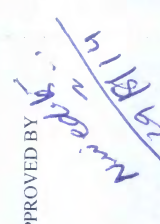
B) IN-PROCESS INSPECTION

1.1	WIRE DRAWING, ANNEALING & TINNING	MAJOR	MEASUREMENT	100%	BHEL SPECN	APPD DATA SHEET	IR	✓	P	V	-	
1.2	PERSULPHATE TEST	MAJOR	CHEMICAL	Sample as per IS:10810 /lot/size	IS:10810 (part 1)	IS 8130	TC	✓	P	V	-	For timed conductor only including drain wire
1.3	ELONGATION BEFORE STRANDING	MAJOR	PHYSICAL	Sample as per IS:10810 /lot/size	IS:10810 (part 4)	IS 8130	TC	✓	P	V	-	
1.4	CONDUCTIVITY/ RESISTIVITY	MAJOR	ELECTRICAL	One sample/lot/ size	BHEL SPECN.	IS 8130	TC	✓	P	V	-	
1.5	SURFACE FINISH	MAJOR	VISUAL	100%	VENDOR'S STD.	VENDOR'S STD.	IR	-	P	-	-	
2.1	NO. OF WIRE & DIA OF WIRE	MAJOR	MEASUREMENT	100%	BHEL SPECN	APPD DATA SHEET	IR	-	P	-	-	NOTE 1
2.2	RESISTANCE MEASUREMENT	MAJOR	ELECTRICAL	100%	BHEL SPECN	APPD DATA SHEET	IR	-	P	-	-	
2.3	SURFACE FINISH	MAJOR	VISUAL	100%	VENDOR'S STD.	VENDOR'S STD.	IR	-	P	-	-	
3.1	CORE DIA	MAJOR	MEASUREMENT	100%	BHEL SPECN	APPD DATA SHEET	IR	-	P	-	-	
3.2	RADIAL THICKNESS (MIN & MAX)	MAJOR	MEASUREMENT	100%	BHEL SPECN & ITS ADDENDUM	BHEL SPECN & ITS ADDENDUM	IR	✓	P	V	-	
3.3	COLOR CODING	MAJOR	VISUAL	100%	BHEL SPECN & ITS ADDENDUM	BHEL SPECN & ITS ADDENDUM	IR	-	P	-	-	

MANUFACTURER/SUBCONTRACTOR	LEGEND: ! RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY N: CUSTOMER INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER	FOR CUSTOMER USE	APPROVED BY 
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MANUFACTURER'S NAME AND ADDRESS				STANDARD QUALITY PLAN				TO BE FILLED BY BH&L				TO BE FILLED BY BH&L			
BH&L	VENDOR'S NAME		ITEM	GROUP,CABLES: EPR insulated & LHLS sheathed unarmoured overall shielded 500V grade		QP NO	QA/BE/QP/311/KAPP								
					DATED	29 August 2014									
			ADDENDUM NO.		418101B6007 Rev01										
			SPEC.		ST51012/ ST51022										
		REV	Rev 0		Page 3 of 7										
S/L NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS			AGENCY		REMARKS		
1	2	3	4	5	6	7	8	9	D	M	B	N	11		

3.4	CORE IDENTIFICATION / RING MARKING	MAJOR	VISUAL	100%	ANNEXURE A & cl 5.3 TO ADDENDUM	ANNEXURE A & cl 5.3 TO ADDENDUM	IR	✓	P	V	
3.5	SPARK TESTING	MAJOR	ELECTRICAL	100%	BHEL SPECN & ITS ADDENDUM	BHEL SPECN & ITS ADDENDUM	IR	-	P	-	
3.6	VOLUME RESISTIVITY	MAJOR	ELECTRICAL	100%	BHEL SPECN & ITS ADDENDUM	BHEL SPECN & ITS ADDENDUM	IR	-	P	-	
3.7	ABRASION RESISTANCE	MAJOR	PHYSICAL	100%	BHEL SPECN & ITS ADDENDUM	BHEL SPECN & ITS ADDENDUM	IR	-	P	-	
3.8	SURFACE FINISH	MAJOR	VISUAL	100%	VENDOR'S STD.	VENDOR'S STD.	IR	-	P	-	NOTE 1
4.0	SEQUENCE OF TWISTING	MAJOR	VISUAL	100%	VENDOR'S STD.	VENDOR'S STD.	IR	-	P	-	
4.1	DIRECTION AND LAY LENGTH	MAJOR	VISUAL	100%	BHEL SPECN & ITS ADDENDUM	BHEL SPECN & ITS ADDENDUM	IR	✓	P	V	
4.2	THICKNESS OF AL MYLAR TAPE	MAJOR	MEASUREMENT	100%	BHEL SPECN & ITS ADDENDUM	BHEL SPECN & ITS ADDENDUM	IR	✓	P	V	
4.3	COVERAGE & % OF OVERLAP	MAJOR	VISUAL	100%	BHEL SPECN & ITS ADDENDUM	BHEL SPECN & ITS ADDENDUM	IR	✓	P	V	
5.1	DRAIN WIRE APPLICATION FOR INDIVIDUAL PAIR SHIELDING	MAJOR	MEASUREMENT ELECTRICAL	100%	BHEL SPECN	APPD DATA SHEET	IR	-	P	-	
5.2	CONTINUITY	MAJOR	ELECTRICAL	100%	VENDOR'S STD.	VENDOR'S STD.	IR	-	P	-	
6.1	SEQUENCE OF TWISTING	MAJOR	VISUAL	100%	VENDOR'S STD.	VENDOR'S STD.	IR	-	P	-	
6.2	DIRECTION AND LAY LENGTH	MAJOR	VISUAL	100%	BHEL SPECN & ITS ADDENDUM	BHEL SPECN & ITS ADDENDUM	IR	✓	P	V	
7.1	THICKNESS OF AL MYLAR TAPE	MAJOR	MEASUREMENT	100%	BHEL SPECN & ITS ADDENDUM	BHEL SPECN & ITS ADDENDUM	IR	✓	P	V	
7.2	COVERAGE / % OF OVERLAP	MAJOR	VISUAL	100%	BHEL SPECN & ITS ADDENDUM	BHEL SPECN & ITS ADDENDUM	IR	✓	P	V	
8.1	DIA OF DRAIN WIRE	MAJOR	MEASUREMENT	100%	BHEL SPECN	APPD DATA SHEET	IR	-	P	-	
8.2	CONTINUITY	MAJOR	ELECTRICAL	100%	VENDOR'S STD.	VENDOR'S STD.	IR	-	P	-	
9.1	RADIAL THICKNESS	MAJOR	MEASUREMENT	100%	BHEL SPECN & ITS ADDENDUM	BHEL SPECN & ITS ADDENDUM	IR	✓	P	V	ENSURE ADDITION OF RIP CORD AS PER ADDENDUM CI 6.1
9.2	COLOUR	MAJOR	VISUAL	100%	BHEL SPECN	APPD DATA SHEET	IR	-	P	-	
9.3	SURFACE FINISH	MAJOR	VISUAL	100%	VENDOR'S STD.	VENDOR'S STD.	IR	-	P	-	
FINAL INSPECTION (ON FINISHED CABLE)											
1.1	ROUTINE TESTS	CR	ELECTRICAL	Sample as per IS 5608 Part1 Annexure A	IS 10810 part1	IS: 8130	TC	✓	P	V	

MANUFACTURER/SUBCONTRACTOR	LEGEND: 1 RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION M: MANUFACTURER / SUBCONTRACTOR B: BH&L/ NOM. INSPECTION AGENCY N: CUSTOMER INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHIP' OF CUSTOMER						FOR CUSTOMER USE		APPROVED BY	
									 29/11/2014	

MANUFACTURER'S NAME AND ADDRESS		STANDARD QUALITY PLAN				TO BE FILLED BY BHEL				TO BE FILLED BY BHEL			
VENDOR'S NAME		ITEM.	GROUP CABLES: EPR insulated & LHLs sheathed unarmoured overall shielded 500V grade		Q.P. NO.	QA/BE/QP/311/KAPP DATED							
BHEL		ADDENDUM NO.	418101B6007 Rev01			29 August 2014							
		SPEC.	ST51012/ ST51022										
		REV	Rev 0										
COMPONENT & OPERATIONS		CHARACTERISTICS		CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY		REMARKS
SL NO.	2	3	4	5	6	7	8	9	D	M	B	N	11

1.2		INSULATION RESISTANCE	CR	ELECTRICAL	Sample as per IS 5608 Part1 Annexure A	IS:10810 Part 43	IS: 6380	TC	✓	P	V	-	
1.3		HIGH VOLTAGE AT 1.5KV	CR	ELECTRICAL	Sample as per IS 5608 Part1 Annexure A	IS: 9968 Part-1	IS: 9968 Part-1	TC	✓	P	V	-	
2.1	TYPE TESTS	CONDUCTOR RESISTANCE	CR	ELECTRICAL	One sample/ lot/ type	IS:613	IS:613	TC	✓	P	V	-	
2.2		ELONGATION TEST OF COPPER	CR	PHYSICAL	One sample/ lot/ type	IS 10810 part1	IS: 8130	TC	✓	P	V	-	
2.3		DIAMETER OF CONDUCTOR	CR	MEASUREMENT	One sample/ lot/ type	BHEL APPD SPEC & ITS ADDENDUM/ APPD DATASHEET	BHEL SPECN & ITS ADDENDUM/ APPD DATASHEET	IR	✓	P	V	-	
2.4		THICKNESS OF INSULATION AND SHEATH	CR	MEASUREMENT	One sample/ lot/ type	IS: 9968 Part1	BHEL SPECN & ITS ADDENDUM	TC	✓	P	V	-	
2.5		TENSILE TEST ON INSULATION AND SHEATH	CR	PHYSICAL	One sample/ lot/ type	IS:10810	IS:6380	TC	✓	P	V	-	
2.6		ELONGATION TEST ON INSULATION AND SHEATH	CR	PHYSICAL	One sample/ lot/ type	IS:10810	IS:6380	TC	✓	P	V	-	
2.7		HOT SET TEST ON INSULATION	CR	THERMAL	One sample/ lot/ type	IS:10810 part 30	IS:6380	TC	✓	P	V	-	
2.8		ACCELERATED AGEING ON INSULATION AND SHEATH	CR	THERMAL	One sample/ lot/ type	IS:10810	IS:6380	TC	✓	P	V	-	
2.9		SWEDISH CHIMNEY FLAME TEST	CR	THERMAL	One sample/ lot/ type	SS-424-14-75 (F3)/ IS: 10810-61	BHEL SPECN & ITS ADDENDUM/ DATASHEET	TC	✓	P	V	-	
2.10		HIGH VOLTAGE TEST	CR	ELECTRICAL	One sample/ lot/ type	IS: 9968 Part-1	IS: 9968 Part-1	TC	✓	P	V	-	
2.11		INSULATION RESISTANCE TEST	CR	ELECTRICAL	One sample/ lot/ type	IS:10810 part 43	IS:6380	TC	✓	P	V	-	
2.12		OVERALL DIA	CR	MEASUREMENT	One sample/ lot/ type	BHEL SPECN & ITS ADDENDUM/ APPD DATASHEET	BHEL SPECN & ITS ADDENDUM/ APPD DATASHEET	IR	✓	P	V	-	
2.13		CONTINUITY OF TINNED CONDUCTOR	CR	THERMAL	One sample/ lot/ type	BS:6360	BS:6360	TC	✓	P	V	-	
2.14		OXYGEN INDEX ON SHEATH	CR	THERMAL	One sample/ lot/ type	ASTMD-2863/IS:10810 Part 63	ASTMD-2863/IS:10810 Part 63	TC	✓	P	V	-	

MANUFACTURER/SUBCONTRACTOR	FOR CUSTOMER USE	APPROVED BY
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MANUFACTURER'S NAME AND ADDRESS				STANDARD QUALITY PLAN				TO BE FILLED BY BHEL				TO BE FILLED BY BHEL			
VENDOR'S NAME		ITEM	GROUP CABLES: EPR insulated & LHS sheathed unarmoured overall shielded 500V grade	Q.P. NO.	QA/BE/QP/311/KAPP										
BHEL		ADDENDUM NO.	418101B6007 Rev01	DATED	29 August 2014										
		SPEC.	ST51012/ ST51022												
		REV	Rev 0												
COMPONENT & OPERATIONS		CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY		REMARKS				
SL. NO.	2	3	4	5	6	7	8	9	D	M	B	N			
1												11			

2.16	TEMPERATURE INDEX ON SHEATH	CR	THERMAL	One sample/ lot/ type	ASTMD-2863/IS:10810 Part 63	ASTMD-2863/IS:10810 Part 63	TC	✓	P	V	-	
2.17	ACID GAS EMISSION ON SHEATH	CR	THERMAL	One sample/ lot/ type	IEC-754-1/ IS: 10810 Part 59	BHEL SPECN & ITS ADDENDUM/ DATASHEET	TC	✓	P	V	-	
2.18	SMOKE DENSITY ON SHEATH	CR	THERMAL	One sample/ lot/ type	ASTMD-2863/IS:10810 Part 63	BHEL SPECN & ITS ADDENDUM/ DATASHEET	TC	✓	P	V	-	
2.19	CAPACITANCE BETWEEN CONDUCTORS OF PAIRS AND CONDUCTOR AND SHIELD	CR	THERMAL	One sample/ lot/ type	BS: 5308/ IS: 5608	BHEL SPECN & ITS ADDENDUM/ DATASHEET	TC	✓	P	V	-	
2.20	TOXICITY INDEX ON SHEATH	CR	THERMAL	One sample/ lot/ type	NES 713	NES 713	TC	✓	P	V	-	
2.21	TERMITE/ RODENT PROOFNESS ON SHEATH	CR	PHYSICAL	One sample/ lot/ type	VENDOR'S STANDARD	VENDOR'S STANDARD	TC	✓	P	V	-	
3.1	CONDUCTOR RESISTANCE OF THE LOOP	CR	ELECTRICAL	Sample as per IS 5608 Part1 Annexure A	IS 10810 part5	IS: 8130	TC	??	P	W	-	
3.2	ELONGATION TEST OF COPPER	CR	PHYSICAL	Sample as per IS 5608 Part1 Annexure	IS 10810 part1	IS: 8130	TC	✓	P	W	-	
3.3	THICKNESS OF INSULATION AND SHEATH	CR	MEASUREMNT	Sample as per IS 5608 Part1 Annexure	IS: 9968 Part1	BHEL SPECN & ITS ADDENDUM	TC	✓	P	W	-	
3.4	INSULATION RESISTANCE	CR	ELECTRICAL	Sample as per IS 5608 Part1 Annexure A	IS:10810 Part 43	IS: 6380	TC	✓	P	W	-	
3.5	HIGH VOLTAGE AT 1.5KV	CR	ELECTRICAL	Sample as per IS 5608 Part1 Annexure A	IS: 9968 Part-1	IS: 9968 Part-1	TC	✓	P	W	-	
3.6	OXYGEN INDEX ON SHEATH	CR	THERMAL	Sample as per IS 5608 Part1 Annexure A	ASTMD-2863/IS:10810 Part 63	ASTMD-2863/IS:10810 Part 63	TC	✓	P	W	-	

MANUFACTURER/SUBCONTRACTOR	LEGEND:	FOR CUSTOMER USE	APPROVED BY
	RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. 'M': MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY 'N': CUSTOMER INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER		h/18/150 h/18/150

MANUFACTURER'S NAME AND ADDRESS				STANDARD QUALITY PLAN				TO BE FILLED BY BHEL				TO BE FILLED BY BHEL			
VENDOR'S NAME		ITEM		GROUP CABLES: EPR insulated & LHLs sheathed unarmoured overall shielded 500V grade		QP NO.	QA/BE/QP/311/KAPP	ACCEPTANCE NORMS		FORMAT OF RECORDS		AGENCY		REMARKS	
BHEL		ADDENDUM NO.		418101B6007 Rev01		DATED	29 August 2014	8		9		10		11	
SPEC.		REV		ST51012/ ST51022		Rev 0		7		D		M		N	
SL. NO.		COMPONENT & OPERATIONS		CHARACTERISTICS		CLASS		TYPE OF CHECK		QUANTUM OF CHECK		REFERENCE DOCUMENT		Page 6 of 7	
1		2		3		4		5		6		7		8	

3.7	TEMPERATURE INDEX ON SHEATH	CR	THERMAL	Sample as per IS 5608 Part1 Annexure A	ASTMD-2863/IS:10810 Part 63	TC	✓	P	W	-	ASTMD-2863/IS:10810 Part 63	TC	✓	P	W	-	
3.8	SMOKE DENSITY ON SHEATH	CR	THERMAL	Sample as per IS 5608 Part1 Annexure A	ASTMD-2863/IS:10810 Part 63	TC	✓	P	W	-	BHEL SPECN & ITS ADDENDUM/ DATASHEET	TC	✓	P	W	-	Duration of test to be 12 minutes instead of 4 minutes
3.9	ACID GAS EMISSION	CR	THERMAL	Sample as per IS 5608 Part1 Annexure A	IEC-754-1/ IS: 10810 Part 59	TC	✓	P	W	-	BHEL SPECN & ITS ADDENDUM/ DATASHEET	TC	✓	P	W	-	
3.10	SWEDISH CHIMNEY FLAME TEST	CR	THERMAL	Sample as per IS 5608 Part1 Annexure A	SS-424-14-75 (F3)/ IS: 10810-61	TC	✓	P	W	-	BHEL SPECN & ITS ADDENDUM/ DATASHEET	TC	✓	P	W	-	
3.11	TOXITY INDEX OF SHEATH	CR	THERMAL	Sample as per IS 5608 Part1 Annexure A	NES 713	TC	✓	P	W	-	NES 713	TC	✓	P	W	-	
3.12	TERMITE AND RODENT PROOFNESS	CR	PHYSICAL	Sample as per IS 5608 Part1 Annexure A	VENDOR'S STANDARD	TC	✓	P	W	-	VENDOR'S STANDARD	TC	✓	P	W	-	
3.13	OVERALL DIMENSIONS OF CABLE INCLUDING CONDUCTOR DIA, CONDUCTOR CROSS SECTIONAL AREA, SHEATH THICKNESS, DIA OF DRAIN WIRE, OVERALL DIAMETER OF CABLE	MAJOR	MEASUREMENT	Sample as per IS 5608 Part1 Annexure A	BHEL SPECN & ITS ADDENDUM	TC	✓	P	W	-	BHEL SPECN & ITS ADDENDUM/ APPD DATASHEET	TC	✓	P	W	-	
3.14	COLOR OF JACKET	MAJOR	VISUAL	100%	ANNEXURE A TO ADDENDUM	TC	✓	P	W	-	ANNEXURE A TO ADDENDUM	TC	✓	P	W	-	CHECK FOR STRIPPING OF JACKET WITHOUT DAMAGE TO INSULATION
3.15	EMBOSSED / IDENTIFICATION MARKING OF CABLE	MAJOR	VISUAL	100%	BHEL SPECN	TC	✓	P	W	-	BHEL SPECN / APPD DATA SHEET	TC	✓	P	W	-	
3.16	THICKNESS OF AL MYLAR TAPE & % OVERLAP	MAJOR	MEASUREMENT	100%	BHEL SPECN	TC	✓	P	W	-	BHEL SPECN / APPD DATA SHEET	TC	✓	P	W	-	
3.17	CORE IDENTIFICATION / RING MARKING	MAJOR	VISUAL	100%	ANNEXURE A & cl 5.3 TO ADDENDUM	IR	✓	P	W	-	ANNEXURE A & cl 5.3 TO ADDENDUM	IR	✓	P	W	-	

MANUFACTURER/SUBCONTRACTOR		LEGEND:		FOR CUSTOMER USE		APPROVED BY	
RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION		M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM INSPECTION AGENCY N: CUSTOMER INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION		ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER		