

TD-201 Rev No. 00	Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD		PY 56286 REV 03 Page 1 of 15																
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company. SPECIFICATION for SIGNAL Cables 1. SCOPE This technical specification covers the Design, Manufacturing, testing at vendor works, inspection by purchaser, packing and transportation to site of SIGNAL cables. 2. SCOPE of SUPPLY – As per enquiry 3. INSTRUCTIONS TO BIDDERS 3.1 Bidders are advised to contact BHEL for essential technical queries in writing within one week of issue of Enquiry. Offers with incomplete information will not be considered for evaluation, and are likely to be rejected outright without any further interaction with the Bidder. 3.2 Any technical features [over & above BHEL enquiry specification requirements] proposed by Bidder will not be given preference for the purpose of evaluation. 3.3 In the event of any conflict between these specifications, data sheets, related standards, codes etc. the vendor shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture of the items in question. 3.4 Bidder shall mandatorily quote all the items against each material code of enquiry. No deviation is acceptable. If any deviation taken on this aspect, then offer will be rejected without any intimation. Hence bidder shall offer all the items. 4. CODES and STANDARDS The cable shall conform to the latest editions of various standards mentioned in the specification. In case of conflict between any standard and these specifications the matter shall be referred to the Purchaser before proceeding with the manufacturing of the cables. <table border="0"> <tr> <td>IS-7098 (Part 1)</td> <td>XLPE insulated (heavy duty) electric cables (Part-1 for working voltage up to and including 1100V).</td> </tr> <tr> <td>IS-2633</td> <td>Method for testing uniformity of coating on zinc coated articles.</td> </tr> <tr> <td>IS-3975</td> <td>Mild steel wires, formed wires and tapes for armouring of cables.</td> </tr> <tr> <td>IS-5831</td> <td>PVC insulation and sheath of electric cable.</td> </tr> <tr> <td>BS-5308 (Part 2)</td> <td>Instrumentation Cable</td> </tr> <tr> <td>ASTM D-2863</td> <td>Test method for measuring the minimum oxygen concentration to support cable like combustion of plastics (oxygen index)</td> </tr> <tr> <td>DIN-50049</td> <td>Document on material testing</td> </tr> <tr> <td>IEC-332-3 (Part 3)</td> <td>Tests on bunched wires and cables</td> </tr> </table>						IS-7098 (Part 1)	XLPE insulated (heavy duty) electric cables (Part-1 for working voltage up to and including 1100V).	IS-2633	Method for testing uniformity of coating on zinc coated articles.	IS-3975	Mild steel wires, formed wires and tapes for armouring of cables.	IS-5831	PVC insulation and sheath of electric cable.	BS-5308 (Part 2)	Instrumentation Cable	ASTM D-2863	Test method for measuring the minimum oxygen concentration to support cable like combustion of plastics (oxygen index)	DIN-50049	Document on material testing	IEC-332-3 (Part 3)	Tests on bunched wires and cables
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Ref. Doc	Revision :00 Refer Record of Revisions	Revised :  VINEET	Approved :  SUJATHA	Date : 24.07.2018																	

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5. CHECK LIST (To be filled by BIDDER and submitted along with Technical offer)

Vendor shall submit the following documents mandatorily as part of COMPLTE technical offer.

Enquiry No. / Date :

Name of the Bidder :

Project Name :

Item Description :

S. No	Document	Supplier confirmation (Yes/No)	Remarks
1	Technical offer complies with the specifications in Toto and there are no technical deviations; Signed copy of specifications attached.		
2	In case of deviation, vendor to confirm that these are technically not feasible deviations and same are submitted in BHEL format . In case technically feasible deviations are proposed by the bidder and subsequently withdrawn, <u>no commercial implications can be claimed by the bidder</u>		
3	All items are manufactured confirming to latest version of material grade standard and manufacturing standard mentioned in this specifications		
4	Material packing is confirmed as per this specification.		
5	Inspection & testing requirements are compiled as per this specifications.		
6	Unpriced Price schedule material code wise is submitted.		
7	<i>For addition/reduction of quantity, unit rate quoted in the present offer shall be considered during ordering and shall be valid up to execution of the contract to the extent of ± 10% of order Value.</i>		
8	Drum length for each type of cable shall be 1000 meters minimum & cable length < 1000 meters shall be in single length. Tolerance over the total ordered length shall be as follows: ± 5% for total length less than 5 km, ± 2% for total length more than 5 km.		
9	<u>Valid type test Certificate not older than five years (as on date of enquiry for all types of cables) is furnished along with offer for cables similar to those being offered.</u> (OR) <u>If Type tests certificates are not available for any size of cable, same shall be conducted by vendor at his own cost. There shall not be any delivery and commercial implications on account of this.</u>		

Ref. Doc

(Bidder's Signature and stamp with date)

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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 directly or indirectly in any way detrimental to the interest of the company.	6.TECHNICAL REQUIREMENTS		
	(1)	Type of cable	: Shielded, armored, single/multi pair signal/Triad cables.
	(2)	Quantity of cable	: As per enquiry
	(3)	Voltage grade [Uo/U]	: 600 / 1100 V
	(4)	No. of Pairs / Triads	: As per enquiry
	(5)	Applicable standards	: IS-7098 part-1, IS-5831, IS-3975, BS-5308 (Part 2), ASTM D-2863, DIN-50049 and IEC-332-3 (Part 3)
	(6)	CONDUCTOR	
	6.1	Material	: Annealed tinned electrolytic grade stranded copper conductor as per IS-8130
	6.2	Nominal area of conductor	: As per enquiry
	6.3	No. of strands	: 7 for 1.5 mm2 16 for 0.5 mm2 7 for 2.5 mm2 R03
	6.4	Dia of each Strand (Before Stranding) as per IS-8130	: 0.2 mm for 0.5 mm2 0.53 mm for 1.5 mm2 0.67mm for 2.5 mm2 R03
	6.5	Conductor Screening	Mica glass Tape shall be applied before insulation for fire retardant & Fire resistant cables and Fire survival cables only. R03
	(7)	INSULATION	
	7.1	Material	: Extruded, XLPE compound as per IS 7098-I for Non-IS cables; LDPE as per IS-6474 for IS (Intrinsic Safe) cables Extruded, LSZH compound for Fire retardant & Fire resistant cables and Fire survival cables only. R03
	7.2	Minimum Thickness	: For 1.5 mm2 : 0.8 mm for 2.5 mm2 : 0.9 mm Negative tolerance on insulation thickness is not acceptable R03
	7.3	Color	Pair: black and white Triad: Red, white and black (subject to change during drawing approval)
	(8)	No. of Twists for each pair / Triad per meter	: Positive and negative conductors of Pairs cable and every three core of Triads shall be twisted together to form a pair/triad with no. of twists per meter > 13
	(9)	PAIR / TRIAD Screening	
	9.1	Material	: Aluminum Mylar tape for XLPE and LDPE insulated cables Mica glass tape for LSZH insulated cables
	9.2	Nominal Thickness	: 0.05 mm
	9.3	Drain wire Size & material	: 0.5 mm2 & Annealed tinned multi stranded copper
	9.4	Drain wire [No. of strands x diameter]	: 7 x 0.3 mm
	9.5	Overlapping / Coverage	: 25 % / 100 %, Helically applied with either
	(10)	Cable Bundling	
	10.1	Binding material	: Mylar / polyester tape
	10.2	No. of twists/meter	: 4 to 6
	10.3	Tape thickness	: 0.025 mm
	10.4	Communication Cable	
	10.5	Conductor material	: Annealed tinned multi stranded copper wire
	10.6	Size	: 0.5 mm2 ((7x0.3 mm)
	10.7	Insulation material	: XLPE as per IS-7098-I
	10.8	Insulation thickness	: 0.4 mm
10.9	Colors of cores of communication cable	: Green & Red (subject to change during drawing approval)	
(11)	Overall Screening		
11.1	Material	: Aluminum Mylar tape for XLPE and LDPE insulated cables Mica glass tape for LSZH insulated cables	
11.2	Minimum Thickness	: 0.075	
11.3	Drain wire Size & material	: 0.5 mm2 & Annealed tinned multi stranded copper, drain wire and shall be in continuous contact with the Aluminum side of the overall shield.	
11.4	Drain wire [No. of strands x diameter]	: 7 x 0.3 mm	

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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 directly or indirectly in any way detrimental to the interest of the company.	11.5	Overlapping / Coverage	:	25 % / 100 %, Helically applied with either
	11.6	Fire protection on overall screening	:	A Layer of Mica glass tape (For Fire retardant & Fire resistant cables and Fire survival cables only) R03
	(12)	INNER SHEATH		
	12.1	Material	:	As per material code in enquiry [Extruded FRLS PVC or Fire Retardant (FR) Extruded PVC, 90°C, type- ST2] & Properties as per IS-5831 And Extruded halogen free low smoke compound as per IS 6380 (For Fire retardant & Fire resistant cables and Fire Survival cables only) R03
	12.2	Minimum Thickness	:	As per IS-7098 Part-1 R03
	12.3	Approx. Dia of cable over Inner Sheath	:	Vendor to specify
	12.4	non-metallic rip cord	:	Required
	12.5	Colour	:	Black (subject to change during drawing approval)
	(13)	ARMOUR		
	13.1	Material	:	Galvanized steel
	13.2	Type	:	Round wire/Strip
	13.3	Round Wire diameter / Strip	:	As per IS 7098, Part-1
	13.4	Approx. Dia of cable over Armour	:	Vendor to specify
	(14)	OUTER SHEATH		
	14.1	Material	:	As per material code in enquiry [Extruded FRLS HR PVC or Extruded FR PVC, 90° C, type- ST2, anti-rodent & Termite Properties] as per IS-5831 And Extruded halogen free low smoke compound as per IS 6380 (For Fire retardant & Fire resistant cables and Fire Survival cables only) R03
	14.2	Minimum Thickness	:	As per IS-7098 Part-1
	14.3	Approx. Dia of cable over Outer Sheath	:	Vendor to specify
	14.4	Color	:	BLACK for Non-IS cables; subject to change during drawing approval. Light BLUE for IS (Intrinsic Safe) cables; subject to change during drawing approval.
	(15)	ELECTRICAL CHARACTERISTICS		
	15.1	Conductor DC resistance at 20°C	:	≤39.7Ω/km for 0.5 mm2 conductors, and ≤18.2Ω/km for 1mm2 conductors, ≤12.2Ω/km for 1.5mm2 conductors, ≤7.56 Ω/km for 2.5mm2 conductors, R03
	15.2	Inductance	:	≤ 1.0 mH / Km between conductor of each pair and all other at 1000Hz.(NIS cables) ≤ 0.9 mH / Km between conductor of each pair and all other at 1000Hz(IS Cables) R03
	15.3	Mutual Capacitance	:	≤ 0.2 μ F/Km between adjacent cores in a pair at 1000Hz.(NIS cables) ≤ 0.1 μ F/Km between adjacent cores in a pair at 1000Hz.(IS cables) R03
	15.4	L /R ratio for adjacent cores	:	≤ 25 μ H / Ω (For 0.5 mm2), ≤ 40 μ H / Ω (For 1.0 mm2), and ≤ 40 μ H / Ω (For 1.5 mm2) ≤ 70 μ H / Ω (For 2.5 mm2). R03
	15.5	Drain wire + Shield Resistance	:	≤ 30 Ω/ Km
	15.6	Capacitance between any core or between any screen	:	≤ 0.4 μF/Km at 1000Hz.
	15.7	Electrostatic noise rejection ratio	:	Over 76dB
	15.8	Attenuation	:	≤ 1.2 dB / Km
	15.9	Insulation resistance	:	100 MΩ/Km@20°C R03
	15.10	CHARACTERISTICS OF FR / FRLS PVC		
	15.11	Oxygen index	:	Over 30% at room temperature
	15.12	Temperature index	:	Over 250°C
	15.13	HCL gas emission	:	20% (max.)
	15.14	Smoke density	:	60% (max.)
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15.15 Pair Identification

Pairs/Triad shall be identified by printing pair numbers by black indelible ink on the white core at interval not more than 250 mm. Conductor insulation shall be black and white for each Pair (subject to change during datasheet approval).

7. INSPECTION AND TESTING

(A)	<u>Type Tests</u>	:	Requirement	Remarks
7.1	Type tests shall be as per IS-7098-I part-1;	:	Certificate Review during technical evaluation	<u>Vendor to confirm as per cl. 5.(9) of this specification;</u> Offers without confirmation to the above will be rejected without any intimation to bidder.
7.2	Flame retardant test As per IEC 332-3 Part 3 Cat-A	:	Certificate Review during technical evaluation	
(B)	<u>Routine Tests</u> Vendor shall carry out these tests during various stages of manufacturing.			
7.3	Insulation and sheaths: All tests as per IS-5831 shall be conducted as part of routine tests, except for insulation resistance, voltage and spark test	:	Certificate Review	
7.4	Insulation resistance, voltage and spark test shall be as per BS-5308 part-2	:	Certificate Review	
7.5	Armour test as per IS –3975	:	Certificate Review	
7.6	Conductor resistance test as per IS 8130.		Certificate Review	
7.7	Electrical test including cable capacitance (core-core) and (core-screen).	:	Certificate Review	
7.8	Spark test as per BS 5308 Part 2.	:	Certificate Review	
(C)	<u>Acceptance Tests</u>			
7.9	Insulation resistance as per BS 5308 Part 2.	:	100% Witness	The sampling plan is as per IS-7098-I for each material code.
7.10	High Voltage test as per BS 5308 Part 2.	:	100% Witness	
7.11	Conductor resistance test as per IS 8130.	:	100% Witness	
7.12	Inductance between 2 adjacent cores at 1 kHz frequency.	:	100% Witness	
7.13	Mutual capacitance between 2 adjacent cores and core - screen at 1 kHz frequency.	:	100% Witness	
7.14	L/ R ratio at 1 kHz frequency.	:	100% Witness	
7.15	Drain wire resistance as per IS 8130.	:	100% Witness	
7.16	Continuity test.	:	100% Witness	
7.17	Oxygen & temp. Index test as per ASTM – D 2863	:	100% Witness	
7.18	Acid gas generation test as per IEC – 754. (For FRLS)	:	100% Witness	
7.19	Smoke density test as per ASTM –D 2843. (For FRLS)	:	100% Witness	
7.20	Flame Retardant test as per IEEE 383/ IEC – 332.3, Part 3, Category-A.	:	100% Witness	
7.21	Dimensional checks overall diameter, under armour and over armour diameter. Overall diameter shall be with in $\pm$ 2 mm over offered value.	:	100% Witness	
7.22	Checks for uniformity of galvanization of armour wire as per IS-2633.	:	100% Witness	
7.23	Checks for armour wire size as per IS-7098, part-1.	:	100% Witness	
7.24	Armour test as per IS-3975.	:	100% Witness	
7.25	Electrostatic noise rejection test, type wise for each lot.	:	100% Witness	

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	8. DOCUMENTATION 8.1 Information to be included with offer Vendor shall make the offer in detail, with respect to every item of the Purchaser’s specifications. Any offer not conforming to this shall be summarily rejected. a) Signed and stamped copy of enquiry technical specification, b) Unpriced price schedule (To be submitted compulsorily without fail) c) Deviation list, if any (as per “No deviation format” given in this specification). Data sheets shall not be submitted during technical offer; <u>even if it is submitted only signed technical specification will be considered for evaluation</u> 8.2 Documentation submission within 2 weeks of placement of LOI (for approval by BHEL and / or BHEL’s customer in 4 sets) a) Data sheets of each and every Cable. b) Comprehensive Quality Assurance plan (QAP). 8.3 Documents to be submitted <u>after Inspection</u> (Note: submission of these documents are commercially linked) a) Final Data sheets b) All test certificates including material test certificates, inspection reports shall be furnished within 1 week of completion of Inspection by BHEL and / or BHEL’s Third Party. 2 sets of CD-ROM – containing Test certificates and Engineering documents (1 set to be included with item dispatch and balance to BHEL purchase department).		
	9. NAME PLATE Each cable drum shall be marked with the following information at a visible place a) Manufacturer’s name and emblem. b) Type of cable and voltage grade Length of the Cable c) Gross Weight d) Direction of rotation of drum by means of an arrow for unwinding e) Purchase order number f) BHEL Material Code g) BHEL Part no. (Printed on Purchase Order copy) h) Reference to applicable standard i) Nominal cross sectional area of conductor. j) Cable Code k) Length of cable in drum l) Gross weight m) Country of Manufacture n) Year of manufacture o) Order No. p) Manufacturing batch no.		
Ref. Doc	10. SHIPPING 10.1 Cables shall be dispatched in steel drums, securely battened with takeoff end fully protected against damage. 10.2 The ends of the cable shall be sealed with suitable PVC/rubber caps to prevent ingress of moisture. 10.3 <i>The total length of the cable against each material code to be supplied by vendor as per BHEL enquiry. Further if any additional length required for conducting tests as per BHEL specification shall be considered by vendor over and above the length mentioned in the BHEL enquiry.</i> 10.4 <i>Mandatory Spare parts shall be packaged separately and clearly marked as ‘Mandatory Spares’.</i> 10.5 <i>Mandatory spare cables shall be sent in pre-decided lots in drums distinctly marked in Red color with boldly written "S" mark on each face of the drums.</i> 10.6 In case of imported/exported items, seaworthy packing shall be done as per specification no: AA00490004 (latest revision) and the type of packing applicable for cable is “CP”. This specification shall be obtained by vendor on request from BHEL.		
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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 directly or indirectly in any way detrimental to the interest of the company.	<u>THERMOCOUPLE EXTENSION CABLES FOR HPCL VIZAG PROJECT</u>																											
	1. SCOPE This specification covers the technical & quality requirements for design, manufacture, testing of thermocouple extension cables at manufacturer works, packing in non-returnable wooden drum and delivery to site. <u>Applicable for following Material codes of HPCL VIZAG:</u> PY9756286199-6P X 16AWG (IS)SHLD ANSI MC96 PY9756286202-12P X 16AWG(IS)SHLD ANSI MC96 2. SCOPE of SUPPLY – As per enquiry 3. INSTRUCTIONS TO BIDDERS 15.1 Bidders are advised to contact BHEL for essential technical queries in writing within one week of issue of Enquiry. Offers with incomplete information will not be considered for evaluation, and are likely to be rejected outright without any further interaction with the Bidder. 15.2 Any technical features [over & above BHEL enquiry specification requirements] proposed by Bidder will not be given preference for the purpose of evaluation. 15.3 In the event of any conflict between these specifications, data sheets, related standards, codes etc. the vendor shall refer the matter to the purchaser for clarifications and only after obtaining the same shall proceed with the manufacture of the items in question. 15.4 Bidder shall mandatorily quote all the items against each material code of enquiry. No deviation is acceptable. If any deviation taken on this aspect, then offer will be rejected without any intimation. Hence bidder shall offer all the items. 4. CODES and STANDARDS The cable shall conform to the latest editions of various standards mentioned in the specification. In case of conflict between any standard and these specifications the matter shall be referred to the Purchaser before proceeding with the manufacturing of the cables. <table><tr><td>IS-1554 (Part 1)</td><td>PVC insulated (heavy duty) electric cables (Part-1 for working voltage up to and including 1100V).</td></tr><tr><td>IS-2633</td><td>Method for testing uniformity of coating on zinc coated articles.</td></tr><tr><td>IS-3975</td><td>Mild steel wires, formed wires and tapes for armouring of cables.</td></tr><tr><td>IS-5831</td><td>PVC insulation and sheath of electric cable.</td></tr><tr><td>IS 8784</td><td>Thermocouple compensating cables</td></tr><tr><td>BS-5308 (Part 2)</td><td>Specification for PVC insulated cables - HV, spark & insulation resistance test.</td></tr><tr><td>ASTM D-2863</td><td>Test method for measuring the minimum oxygen concentration to support cable like combustion of plastics (oxygen index)</td></tr><tr><td>ANSI M.C. 96.1</td><td>Thermocouple color identification and calibration tolerance</td></tr><tr><td>DIN-50049</td><td>Document on material testing</td></tr><tr><td>IEC-332-3 (Part 3) Cat-A</td><td>Tests on bunched wires and cables</td></tr><tr><td>IEC 584-2</td><td>Thermocouple Tolerance Classes</td></tr><tr><td>IEC 584-3, Part 3</td><td>Extension & compensating cables – color identification system.</td></tr><tr><td>IEC 754</td><td>Acid gas generation test.</td></tr></table>			IS-1554 (Part 1)	PVC insulated (heavy duty) electric cables (Part-1 for working voltage up to and including 1100V).	IS-2633	Method for testing uniformity of coating on zinc coated articles.	IS-3975	Mild steel wires, formed wires and tapes for armouring of cables.	IS-5831	PVC insulation and sheath of electric cable.	IS 8784	Thermocouple compensating cables	BS-5308 (Part 2)	Specification for PVC insulated cables - HV, spark & insulation resistance test.	ASTM D-2863	Test method for measuring the minimum oxygen concentration to support cable like combustion of plastics (oxygen index)	ANSI M.C. 96.1	Thermocouple color identification and calibration tolerance	DIN-50049	Document on material testing	IEC-332-3 (Part 3) Cat-A	Tests on bunched wires and cables	IEC 584-2	Thermocouple Tolerance Classes	IEC 584-3, Part 3	Extension & compensating cables – color identification system.	IEC 754
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5. CHECK LIST (To be filled by BIDDER and submitted along with Technical offer)

Vendor shall submit the following documents mandatorily as part of COMPLTE technical offer.

Enquiry No. / Date : _____

Name of the Bidder : _____

Project Name : _____

Item Description : _____

S. No	Document	Supplier confirmation (Yes/No)	Remarks
1	Technical offer complies with the specifications in Toto and there are no technical deviations; Signed copy of specifications attached.		
2	In case of deviation, vendor to confirm that these are technically not feasible deviations and same are submitted in BHEL format . In case technically feasible deviations are proposed by the bidder and subsequently withdrawn, <u>no commercial implications can be claimed by the bidder</u>		
3	All items are manufactured confirming to latest version of material grade standard and manufacturing standard mentioned in this specifications		
4	Material packing is confirmed as per this specification.		
5	Inspection & testing requirements are compiled as per this specifications.		
6	Unpriced Price schedule material code wise is submitted.		
7	<i>For addition/reduction of quantity, unit rate quoted in the present offer shall be considered during ordering and shall be valid up to execution of the contract to the extent of ± 10% of order Value.</i>		
8	Drum length for each type of cable shall be 1000 meters minimum & cable length < 1000 meters shall be in single length. Tolerance over the total ordered length shall be as follows: ± 5% for total length less than 5 km, ± 2% for total length more than 5 km.		
9	<u>Valid type test Certificate not older than five years (as on date of enquiry for all types of cables) is furnished along with offer for cables similar to those being offered.</u> (OR) <u>If Type tests certificates are not available for any size of cable, same shall be conducted by vendor at his own cost. There shall not be any delivery and commercial implications on account of this.</u>		

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(Bidder's Signature and stamp with date)

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6. TECHNICAL REQUIREMENTS

(1)	Type of cable	:	Thermocouple extension cable with individual & overall shielding.(K-Type)
(2)	Quantity of cable	:	As per enquiry
(3)	Voltage grade [Uo/U]	:	600 / 1100 V
(4)	No. of Pairs / Triads	:	As per enquiry
(5)	Applicable standards	:	IS-1554 part-1,IS-2633,IS-3975, IS-8784 IS-5831, IS-3975, BS-5308 (Part 2), ASTM D-2863,ANSI M.C.96.1 DIN-50049 and IEC-332-3 (Part 3) Cat-A, IEC584-2, IEC584-3 part-3 & IEC754
(6)	CONDUCTOR		
18.1	Material	:	Solid thermocouple conductor as per IS-8784. / IEC 584.
18.2	Dia. of conductor	:	16 AWG or 20 AWG as per enquiry
18.3	Conductor accuracy	:	For IEC 584- 2 : class-1 or for ANSI M.C. 96.1: class- Special as per variant table
(7)	INSULATION		
19.1	Material	:	Extruded, type C, 85° C, HR PVC compound as per IS 5831 <i>for Non-IS cables</i> ; LDPE as per IS-6474 <i>for IS (Intrinsic Safe) cables</i>
19.2	Minimum Thickness	:	For 20 AWG : 0.5 mm For 16 AWG: 0.8mm Negative tolerance on insulation thickness is not acceptable
19.3	Core identification	:	For IEC 584 cables - Color of core insulation shall be as per IS 8784. For ANSI M.C. 96.1 cables - Color of core insulation shall be as per ANSI M.C. 96.1.It is subject to change during datasheet approval.
19.4	Pair Identification (For multi pair cables)	:	By number printing on both cores of each pair at an interval of not more than 200 mm.
(8)	No. of Twists for each pair per meter	:	Positive and negative conductors of Pairs cable shall be twisted together to form a pair with no. of twists per meter > 13 for Pair cables
(9)	PAIR / TRIAD Screening		
21.1	Material	:	Aluminum Mylar tape
21.2	Nominal Thickness	:	0.05 mm
21.3	Drain wire Size & material	:	0.5 mm2 & Annealed tinned multi stranded copper
21.4	Drain wire [No. of strands x diameter]	:	7 x 0.3 mm
21.5	Overlapping / Coverage	:	25 % / 100 %, Helically applied with either direction
(10)	Cable Bundling		
22.1	Binding material	:	Mylar / polyester tape
22.2	No. of twists/meter	:	4 to 6
22.3	Tape thickness	:	0.025 mm
22.4	Communication Cable		
22.5	Conductor material	:	Annealed tinned multi stranded copper wire
22.6	Size	:	0.5 mm2 ((7x0.3 mm)
22.7	Insulation material	:	Type-C, HR PVC
22.8	Insulation thickness	:	0.4 mm
22.9	Colors of cores of communication cable	:	Green & Red, subject to change during data sheet approval.
(11)	Overall Screening		
23.1	Material	:	Aluminum Mylar tape
23.2	Minimum Thickness	:	0.075
23.3	Drain wire Size & material	:	0.5 mm2 & Annealed tinned multi stranded copper, drain wire and shall be in continuous contact with the Aluminum side of the overall shield.
23.4	Drain wire [No. of strands x diameter]	:	7 x 0.3 mm
23.5	Overlapping / Coverage	:	25 % / 100 %, Helically applied with either direction
(12)	INNER SHEATH		

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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 directly or indirectly in any way detrimental to the interest of the company.	24.1	Material	:	As per material code in enquiry [Extruded FRLS HR PVC or Fire Retardant (FR) Extruded PVC, 90°C, type- ST2] & Properties as per IS-5831	
	24.2	Minimum Thickness	:	0.3 mm	
	24.3	Approx. Dia of cable over Inner Sheath	:	Vendor to specify	
	24.4	non-metallic rip cord	:	Required	
	24.5	Colour	:	Black (subject to change during drawing approval)	
	(13)	ARMOUR			
	25.1	Material	:	Galvanized steel	
	25.2	Type	:	Wire 1.4 mm Dia. as per IS 1554 part-I, IS 3975 and IS-8784.	
	25.3	Wire diameter	:	As per IS 1554, Part-1	
	25.4	Approx. Dia of cable over Armour	:	Vendor to specify	
	(14)	OUTER SHEATH			
	26.1	Material	:	As per material code in enquiry [Extruded FRLS HR PVC or Extruded FR PVC, 90° C, type- ST2, anti-rodent & Termite Properties] as per IS-5831	
	26.2	Minimum Thickness	:	1.24 mm	
	26.3	Approx. Dia of cable over Outer Sheath	:	Vendor to specify	
	26.4	Colour	:	BLACK for Non-IS cables; subject to change during drawing approval. BLUE for IS (Intrinsic Safe) cables; subject to change during drawing approval.	
	15	ELECTRICAL CHARACTERISTICS			
	27.1	Themo EMF accuracy & calibration tolerance		For IEC 584- 2 : class-1 For ANSI M.C. 96.1: class- Special	
	27.2	Conductor DC resistance at 20°C	:	≤39.7Ω/km for 0.5 mm2 conductors, and ≤18.2Ω/km for 1mm2 conductors, ≤12.2Ω/km for 1.5mm2 conductors,	
	27.3	Inductance	:	≤ 4.0 mH / Km between conductor of each pair and all other at 1000Hz.	
	27.4	Mutual Capacitance	:	≤ 0.18 μ F/Km between adjacent cores in a pair at 1000Hz.	
	27.5	L/R ratio for adjacent cores	:	≤ 25 μ H / Ω (For 20 AWG), ≤ 40 μ H / Ω (For 16AWG mm2)	
	27.6	Drain wire + Shield Resistance	:	≤ 30 Ω/ Km	
	27.7	Capacitance between any core or between any screen	:	≤ 0.4 μF/Km at 1000Hz.	
	27.8	Electrostatic noise rejection ratio	:	Over 76dB	
	27.9	Attenuation	:	≤ 1.2 dB / Km	
	27.10	Insulation resistance	:	100 MΩ/Km	
	27.11	CHARACTERISTICS OF FR / FRLS PVC			
	27.12	Oxygen index	:	Over 30% at room temperature	
27.13	Temperature index	:	Over 250°C		
27.14	HCL gas emission	:	20% (max.)		
27.15	Smoke density	:	60% (max.)		
Ref. Doc	7. COLOR CODE REFERENCE:				
	Ref. standard	Cable Type	Positive		Outer sheath
			Negative		
		ANSI MC 96.1	Kx	Yellow	Yellow
				Red	
			Ex	Purple	Purple
				Red	
	Jx	White	Black		
		Red			
	IS 8784	Kx	Red	Green	
			Green		
		Ex	Red	Violet	
Violet					
Jx		Red	Blue		
		Blue			

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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 directly or indirectly in any way detrimental to the interest of the company.	9. DOCUMENTATION 9.1 Information to be included with offer Vendor shall make the offer in detail, with respect to every item of the Purchaser’s specifications. Any offer not conforming to this shall be summarily rejected. a) Signed and stamped copy of enquiry technical specification, b) Unpriced price schedule (To be submitted compulsorily without fail) c) Deviation list, if any (as per “No deviation format” given in this specification). Data sheets shall not be submitted during technical offer; <u>even if it is submitted only signed technical specification will be considered for evaluation</u> 9.2 Documentation submission within 2 weeks of placement of LOI (for approval by BHEL and / or BHEL’s customer in 4 sets) a) Data sheets of each and every Cable. b) Comprehensive Quality Assurance plan (QAP). 9.3 Documents to be submitted <u>after Inspection</u> (Note: submission of these documents are commercially linked) a) Final Data sheets b) All test certificates including material test certificates, inspection reports shall be furnished within 1 week of completion of Inspection by BHEL and / or BHEL’s Third Party. 2 sets of CD-ROM – containing Test certificates and Engineering documents (1 set to be included with item dispatch and balance to BHEL purchase department). 10. NAME PLATE Each cable drum shall be marked with the following information at a visible place a) Manufacturer’s name and emblem. b) Type of cable and voltage grade Length of the Cable c) Gross Weight d) Direction of rotation of drum by means of an arrow for unwinding e) Purchase order number f) BHEL Material Code g) BHEL Part no. (Printed on Purchase Order copy) h) Reference to applicable standard i) Nominal cross sectional area of conductor. j) Cable Code k) Length of cable in drum l) Gross weight m) Country of Manufacture n) Year of manufacture o) Order No. p) Manufacturing batch no. 11. SHIPPING 11.1 Cables shall be dispatched in Steel drums, securely battened with takeoff end fully protected against damage. 11.2 The ends of the cable shall be sealed with suitable PVC/rubber caps to prevent ingress of moisture. 11.3 <i>The total length of the cable against each material code to be supplied by vendor as per BHEL enquiry. Further if any additional length required for conducting tests as per BHEL specification shall be considered by vendor over and above the length mentioned in the BHEL enquiry.</i> 11.4 <i>Mandatory Spare parts shall be packaged separately and clearly marked as ‘Mandatory Spares’.</i> 11.5 <i>Mandatory spare cables shall be sent in pre-decided lots in drums distinctly marked in Red color with boldly written "S" mark on each face of the drums.</i> 11.6 In case of imported/exported items, seaworthy packing shall be done as per specification no: AA00490004 (latest revision) and the type of packing applicable for cable is “CP”. This specification shall be obtained by vendor on request from BHEL.		
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12.DEVIATION FORMAT FOR THERMOCOUPLE CABLES FOR HPCL VZIAG PROJECT Enquiry No.: Item: Name of Bidder: Offer Ref. No.: <table><thead><tr><th>Sl. No.</th><th>Clause no. & Spec. no.</th><th>Description as per Specification</th><th>Deviation taken</th><th>Nature of Deviation</th><th>Remarks</th></tr></thead><tbody><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></tbody></table> NOTES: 1. Deviations, if any, shall be clearly brought out only in this format. Deviations mentioned / taken elsewhere or in any other format will be ignored. 2. Additional sheets in the same format can be attached by the vendor, if necessary. 3. Nature of Deviations shall only be of Design / Manufacturing constraints and non-availability of items / components / makes in market. 4. No price implications shall be entertained for deviations withdrawn during the technical scrutiny. If any deviations are accepted by BHEL during technical scrutiny then also there will be no price implication. Hence, in no case there will be consideration of Price implications. 5. Reasons for the deviations shall be specified in the Remarks column. 6. If there are no deviations from the specifications, bidder still has to submit the signed copy of this format by writing “NO Deviations” on this format. 7. If the “Deviation Schedule” is not submitted along with the offer, the bidder’s offer is likely to be rejected without any further interaction with the bidder. Only the accepted deviations in conjunction with the original tender shall constitute the contract document for the award of job to the bidder SIGNATURE OF THE BIDDER_____ NAME_____ DESIGNATION_____ DATE_____ COMPANY SEAL				Sl. No.	Clause no. & Spec. no.	Description as per Specification	Deviation taken	Nature of Deviation	Remarks																								
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	Rev. No.	Date	Revision Details	Revised By	Approved By
	00	24.07.2018	Original issue	-----	SUJATHA <i>Sujatha</i>
	01	10.04.2019	Updated variants 17 to 22	SWATHI GOLI	SUJATHA <i>Sujatha</i>
	02	11.06.2019	Updated technical details of Thermocouple Cables	SWATHI GOLI	SRIKANTH K
	03	18.06.2019	Changes updated as R03	SWATHI GOLI	SRIKANTH K
	Ref. Doc.				