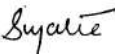


TD-201 Rev No. 00	Form No.  HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD		PY 56297 REV 01 Page 1 of 9																
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company. <u>SPECIFICATION for Loop Cables</u> 1. SCOPE This technical specification covers the Design, Manufacturing, testing at vendor works, inspection by purchaser, packing and transportation to site of Loop 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" style="width: 100%;"> <tr> <td style="width: 40%;">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>BS-5308 (Part 2)</td> <td>Instrumentation Cables : Specification for PVC insulated cables</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-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.	BS-5308 (Part 2)	Instrumentation Cables : Specification for PVC insulated cables	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 : 03.08.2018																

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	PY 56297
			REV. 01
			Page 2 of 9

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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.		

(Bidder's Signature and stamp with date)

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Ref. Doc

Form No.	बी एच ई लि BHEL HYDERABAD	PRODUCT STANDARD	PY 56297
		PROJECT ENGINEERING & SYSTEMS DIVISION	REV. 01
		HYDERABAD	Page 3 of 9
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-1554 part-1, IS-5831, IS-3975, BS-5308 (Part 2), ASTM D-2863, DIN-50049 and IEC-332-3 (Part 3), IPCEA-S-61-402. ASTM-B-33 and IS 10810.
(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 and 7 for 2.5 mm2
6.4	Dia of each Strand (Before Stranding) as per IS-8130	:	0.53 mm for 1.5 mm2 0.67 mm for 2.5 mm2
(7)	INSULATION	:	
7.1	Material	:	Extruded, type C, 85° C, HR PVC compound as per IS 5831
7.2	Minimum Thickness	:	For 1.5 mm2 : 0.8mm For 2.5 mm2 : 0.9 mm Negative tolerance on insulation thickness is not acceptable
7.3	Color	:	Pair: Blue and Red (subject to change during drawing approval).
(8)	No. of Twists for each pair / Triad per meter	:	Positive and negative conductors of Pairs cable shall be twisted together to form a pair with no. of twists per meter > 17.
(9)	Pair Identification	:	Pairs 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
(10)	PAIR Screening	:	Applicable for Multi pair cables
10.1	Material	:	Aluminum Mylar tape
10.2	Nominal Thickness	:	0.05 mm
10.3	Over the individual pair screening	:	Two laps of 0.05 mm thick (min.) polyester tape shall be applied with minimum overlap of 25%.
10.4	Drain wire Size & material	:	0.5 mm2 & Annealed tinned multi stranded copper
10.5	Drain wire [No. of strands x diameter]	:	7 x 0.3 mm
10.6	Overlapping / Coverage	:	25 % / 100 %, Helically applied with either side
(11)	Cable Bundling	:	Applicable for Multi Pair cables, Not applicable for Single Pair cables
11.1	Binding material	:	Mylar / polyester tape
11.2	No. of twists/meter	:	4 to 6
11.3	Tape thickness	:	0.025 mm
11.4	Communication Cable	:	
11.5	Conductor material	:	Annealed tinned multi stranded copper wire
11.6	Size	:	0.5 mm2 ((7x0.3 mm)
11.7	Insulation material	:	Type-C, HR PVC
11.8	Insulation thickness	:	0.4 mm
11.9	Colors of cores of communication cable	:	Green & Red
(12)	Overall Screening	:	Applicable for Multi Pair cables as well as for Single Pair cable
12.1	Material	:	Aluminum Mylar tape
12.2	Minimum Thickness	:	0.075
12.3	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.
12.4	Drain wire [No. of strands x diameter]	:	7 x 0.3 mm
12.5	Overlapping / Coverage	:	25 % / 100 %, Helically applied with either
(13)	INNER SHEATH	:	
13.1	Material	:	As per material code in enquiry [Extruded FRLS PVC, anti-rodent, anti termite & moisture resistant properties, 90°C, type- ST2] as per IS-5831
13.2	Minimum Thickness	:	0.4 mm

Form No.	बी एस ई एल  HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD		PY 56297
				REV. 01
				Page 4 of 9

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13.3	Approx. Dia of cable over Inner Sheath	:	Vendor to specify
13.4	Non-metallic rip cord	:	Required
13.5	Colour	:	Black (subject to change during drawing approval)
(14)	ARMOUR		
14.1	Material	:	Galvanized steel
14.2	Type	:	Wire 1.4 mm Dia. as per IS 1554 part I and IS 3975.
14.3	Wire diameter	:	As per IS 1554, Part-1
14.4	Approx. Dia of cable over Armour	:	Vendor to specify
(15)	OUTER SHEATH		
15.1	Material	:	As per material code in enquiry [Extruded FRLS PVC, anti-rodent, anti termite & moisture resistant properties, 90°C, type- ST2] as per IS-5831
15.2	Minimum Thickness	:	As per IS-1554 Part-1
15.3	Approx. Dia of cable over Outer Sheath	:	Vendor to specify
15.4	Colour	:	RED for Non-IS cables; subject to change during drawing approval.
15.5	Filler	:	Non hygroscopic with FRLS property.
(16)	ELECTRICAL CHARACTERISTICS		
16.1	Conductor DC resistance at 20°C	:	≤39.7Ω/km for 0.5 mm2 conductors, ≤18.2Ω/km for 1mm2 conductors, ≤12.2Ω/km for 1.5mm2 conductors, ≤7.56Ω/km for 2.5mm2 conductors,
16.2	Inductance	:	≤ 1.0 mH / Km between conductor of each pair and all other at 1000Hz.
16.3	Mutual Capacitance	:	≤ 0.120 μ F/Km between adjacent cores in a pair at 800Hz.
16.4	L / R ratio for adjacent cores	:	≤ 25 μ H / Ω (For 0.5 mm2), ≤ 40 μ H / Ω (For 1.0 mm2), ≤ 40 μ H / Ω (For 1.5 mm2) and ≤ 70 μ H / Ω (For 1.5 mm2).
16.5	Drain wire + Shield Resistance	:	≤ 30 Ω/ Km
16.6	Capacitance between any core or between any screen	:	≤ 0.4 μF/Km at 1000Hz.
16.7	Electrostatic noise rejection ratio	:	Over 76dB
16.8	Attenuation	:	≤ 1.2 dB / Km
16.9	Insulation resistance	:	100 MΩ/Km
16.10	Cross Talk	:	60 dB
17	FRLS Tests		Following FRLS tests on each size shall be conducted on one drum out of every 10 drums of cable
17.1	Oxygen index	:	Over 29% at room temperature (ASTM-D-2863)
17.2	Temperature index	:	Over 250°C. (ASTM-D-2863)
17.3	HCL gas emission	:	20% (max.) by weight as per IEC 754 Part-I.
17.4	Smoke density	:	60% (max.) (ASTM-D-2843)
17.5	Pair Identification		Pairs 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)
17.6	Swedish Chimney		As per Test-SS-424-1475 F3.
17.7	Insulation Resistance		100 M Ohm / Km Min.
17.8	High voltage test		1) Core to core- 1.5 kV for 1 min. 2) Core to screen- 1.0 kV for 1 min.
17.9	Rodent & Termite repulsion test		Presence of lead shall be confirmed
17.10	Cable shall satisfy requirements		of Article 760 NFPA 70
17.11	Color Coding		The wires of pairs shall be coded by base colors on insulation which are repeated in every unit as per VDE 0815
17.12	Marking		Progressive automatic on-line sequential length marking in meters to be provided on outer sheath at every one meter.
17.13	Marking to read 'FRLS'		To be provided at every 5 meters on outer sheath
17.14	Allowable Tolerance on overall diameter		+/- 2 mm (maximum) over the declared value in data sheet
17.15	Variation in diameter		Not more than 1.0 mm throughout the length of cable.
17.16	Ovality at any cross- section		Not more than 1.0 mm

Ref. Doc

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD		PY 56297
				REV. 01
				Page 5 of 9
7. INSPECTION AND TESTING				
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	7.1 Type test on each type and size of cable, inclusive of measurement of armor DC resistance as per IS 1554-I, IS 5831, approved data sheet and QAP (as applicable) shall be conducted on one drum out of every 10 drums of cable in the presence of BHEL's representative. The Test reports shall be annexed to the Inspection Report.	:	Certificate review	
	7.2 Flame retardant test As per IEC 332 Part 1, IEC 332 Part 3 Cat-A, This test shall be conducted on each size (on one drum out of every 10 drums) of cable.	:	Certificate review	
	(B) Routine Tests Vendor shall carry out these tests during various stages of manufacturing. (100 % of drums)			
	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.	:	100% Witness	The sampling plan is as per IS-1554-I for each material code
	(C) Acceptance Tests			
	7.9 Insulation resistance as per BS 5308 Part 2.	:	100% Witness	
	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-1554, 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		
Ref. Doc				

Form No.		बी एच ई एल  HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD		PY 56297	
					REV. 01	
					Page 6 of 9	
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.						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. 10. SHIPPING 10.1 Cables shall be dispatched in wooden 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 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. 10.4 Mandatory Spare parts shall be packaged separately and clearly marked as 'Mandatory Spares'. 10.5 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. 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.
						Ref. Doc

Ref. Doc	Form No.	बी एच ई एल  HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD		PY 56297														
					REV. 01														
					Page 7 of 9														
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. VARIANT TABLE <table><tr><th>Var. No</th><th>Material Code</th><th>Description</th></tr><tr><td>0</td><td>PY9756297000</td><td>1PX1.5MM2,CU,PVC/FRLS PVC LOOP CABLE</td></tr><tr><td>1</td><td>PY9756297018</td><td>1PX2.5MM2,CU,PVC/FRLS PVC POWER CABLE</td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table>					Var. No	Material Code	Description	0	PY9756297000	1PX1.5MM2,CU,PVC/FRLS PVC LOOP CABLE	1	PY9756297018	1PX2.5MM2,CU,PVC/FRLS PVC POWER CABLE						
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PRODUCT STANDARD
PROJECT ENGINEERING & SYSTEMS DIVISION
HYDERABAD

PY 56297

REV. 01

Page 8 of 9

Form No.

12.DEVIATION FORMAT

Enquiry No.:

Item:

Name of Bidder:

Offer Ref. No.:

Sl. No.	Clause no. & Spec. no.	Description as per Specification	Deviation taken	Nature of Deviation	Remarks

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

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