

	PURCHASE SPECIFICATION FOR Supply of 1-core x 300 sq-mm aluminium, 1.1 kV XLPE insulated, armoured cable	PS-439-1068
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Technical specification

For Supply of 1 core x 300 sq-mm aluminium, XLPE insulated, armoured cable

Revision details :	Prepared	Approved	Date
Rev01 td 10-12-16:			
Cl.1.1.11 (d) and (e) revised <i>V. Radhakrishnan</i> 10-12-16.	SP <i>A. VandeK... ..</i>	<i>V. Radhakrishnan</i> V Radhakrishnan	27 th Oct 2016

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1.0 Introduction:

This technical specification provides BHEL requirements for supply of 1-core x 300 sq-mm, stranded aluminium conductor, XLPE insulation, armoured, PVC outer sheathed, FRLS, voltage grade 1100V for solar photovoltaic application.

Offer shall be submitted by vendor with clause-wise acceptance as shown below with signature and seal on every page.

In case of conflict between this specification and those (IS Codes, standards) referred to herein, the former shall prevail. If the vendors acceptance is 'NO' against any of the clauses mentioned herein, the offer is liable for rejection on technical grounds. Vendor to record deviations if any, in the column meant for vendor compliance.

1.1 Technical specification:

#	Particular	BHEL specification	Vendor acceptance (Yes / No)
1.1.1	Item description	Cable 1-corex300mm ² , stranded and compacted, aluminium conductor, XLPE insulated, armoured PVC outer sheathed, FRLS, voltage grade 1100V	
1.1.2	Application	Cable shall be suitable for continuous use under sunlight and for direct burial.	
1.1.3	Applicable standards	IS: 7098 (part-1) 1988	
1.1.4	Voltage grade	1100V	
1.1.5	Conductor	As per IS: 8130-1984	
a)	Material	Class 2 plain aluminium conductor (grade H4)	
b)	Cross sectional area	300 sq-mm minimum	
c)	Maximum DC conductor resistance at 20°C	0.100 Ohm per Km	
d)	No of strands (minimum)	as per IS: 8130-1984	
1.1.6	Insulation	as per IS: 7098 (part-1) 1988	
a)	Material	Cross linked polyethylene (XLPE)	
b)	Nominal insulation thickness	2.1 mm	
c)	Tolerance on thickness	As per IS: 7098 (part-1) 1988	

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d)	Volume resistivity at 27°C	1x 10 ¹⁴ Ohm-cm (Min)	
e)	Volume resistivity at 70°C	1x 10 ¹² Ohm-cm (Min)	
f)	Max. conductor temperature	90°C – Normal continuous operation 250°C – Short circuit condition	
g)	Insulation colour for identification	Black/ Red. Quantity as per BHEL tender requirement	
1.1.7	Armouring details	As per IS:7098 (part-1)	
a)	Armour material	H4 grade Aluminium wire	
b)	Armour wire dia (Nominal)	As per IS:7098 (part-1)	
c)	The gap between armour wires shall not exceed one armour wire space and there shall be no cross-over / over-riding of armour wire. The minimum area of coverage of the armour wire shall be 90%. The breaking load of armour joint shall not be less than 95% of that of the armour wire.		
1.1.8	Outer sheath	As per IS: 5831- 1984	
a)	Material	Extruded PVC Type ST2 with FRLS properties	
b)	Thickness of outer sheath	As per IS: 7098 (part-1)	
c)	Colour of outer sheath	Black	
d)	Overall diameter of cable	Vendor shall indicate dimension. Allowable tolerance shall be +/- 2 mm over declared value.	
1.1.9	Ovality	Ovality at any cross section shall be kept minimum so as to have circular cross section of cable	
1.1.10	Minimum bending radius	15 D as per IS: 1255-1983	
1.1.11	FRLS properties		
a)	Oxygen index	as per IS 10810 Part 58	
b)	FR properties	as per IS 10810 Part 61, 62	
c)	Specific optical density of smoke	as per relevant standard	
d)	Smoke density	Not more than 60% as per ASTM-D-2843 or as per IS 10810 Part 63	
e)	Halogen acid gas evolution	Max 20 % as per IEC-60754 Part-1 or as per IS 10810 Part 59	
f)	Temperature index	As per IS 10810 Part 64	

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1.1.12: Type Tests

Type tests shall be carried out in presence of BHEL's and BHEL customer's representative for which minimum 15 days prior intimation shall be given by the vendor. The vendor shall obtain BHEL's customer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, accepted norms, recording of different parameters, and interval of recording etc. for the tests to be carried out. Copy of type test certificates and reports shall be submitted to BHEL/BHEL customer for approval. Charges for these tests to be conducted shall be deemed to be included in the price of the cables ordered.

Vendor acceptance (Yes / No)

#	Particulars	BHEL specification	Vendor acceptance (Yes / No)
a)	Tensile test	As per IS 7098 part-1: 1988 FRLS properties tests shall be as per relevant IS/IEC	
b)	Wrapping test		
c)	Conductor resistance test		
d)	Test on thickness of insulation and sheath		
e)	Tests on armour wire as per IS:3975:1979		
f)	Physical tests for thickness of insulation and outer sheath		
g)	Insulation resistance test		
h)	HV test		
i)	Oxygen index		
j)	FR-LSH properties		
k)	FR test on single and bunched cables		
l)	Specific optical density of smoke		
m)	Smoke density		
n)	Halogen acid gas evolution		
o)	Temperature index		
p)	Flammability		

1.1.13 Routine tests:

#	Particular	BHEL specification	Vendor acceptance (Yes / No)
a)	Conductor resistance test	As per IS: 7098 part 1 - 1988	
b)	High voltage test		

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1.1.14 Acceptance tests:

#	Particular	BHEL specification	Vendor acceptance (Yes / No)
a)	Tensile test	As per IS: 7098 part 1 – 1988 FRLS properties tests shall be as per relevant IS/IEC	
b)	Wrapping test		
c)	Conductor resistance test		
d)	Test for thickness of insulation and sheath (inner & outer)		
e)	Hot set test for insulation		
f)	Tensile strength and elongation at break of insulation and sheath(inner & outer)		
g)	Ageing test on insulation and sheath (inner and outer)		
h)	Thermal stability test for sheath (inner & outer) as per IS 5831-1984		
i)	Tests on armour wire as per IS:3975-1979		
	i) Measurement of dimensions		
	ii) Tensile test		
	iii) Elongation test		
	iv) Torsion test		
	v) Wrapping test		
	vi) Resistance test		
	vii) Zinc coating test (mass & uniformity)		
	viii) Adhesion test		
	ix) Freedom from defects		
j)	Insulation resistance test (Volume resistivity test)		
k)	HV test		
l)	Flammability (IEC 60332)		
m)	FRLS properties test		
	(i) Oxygen index		
	(ii) Temperature index		
	(iii) FR test on single cable		
	(iv) Smoke density		

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	(v) Halogen acid gas evolution	
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1.1.15	Test certificate	Three copies of test certificate shall be supplied with BHEL PO number and date, BHEL specification number, Cable description, Manufacturer name, Part number, Size & Length of the cable, Batch / Lot number. Test certificate shall contain test description, measured values of dimensions and cable properties, and acceptance limits.	
1.1.16	Cable identification	The printing/ embossing shall be progressive, automatic, in line and marking shall be legible and indelible. Printing/embossing shall be on outer sheath with following information throughout the length of the cable at an interval of every 5 m: Manufacturer name, brand name or trade mark, BHEL, IS symbol, IS 7098 Part 1: 1988, Cable size, Voltage grade, FRLS, Cable code, lot number, year of manufacture. Embossing/ printing shall be done for sequential marking of the length of cable at an interval of every 1 m.	
1.1.17	Pre-dispatch inspection	Inspection shall be witnessed by BHEL and/or BHEL CUSTOMER. Prior to dispatch of the item, vendor shall provide inspection call to BHEL to witness the tests as detailed in Clause 1.1.12, 1.1.13, 1.1.14 and accordingly inspection reports, test certificates/reports and packing list shall be submitted to BHEL/BHEL customer.	

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1.1.18	Packing and Marking	The cable shall be supplied in non-returnable wooden or steel drum of heavy construction. The surface of the drum and the outermost cable layer shall be covered with water proof cover. Both the ends of the cable shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply IS: 10418-1982. Each drum shall be marked with following information: BHEL PO number and date, Cable description, Manufacturer name, Part number, Size & Length of the cable, Cable code, Voltage grade, Approximate gross mass, Year of manufacture on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.	
1.1.19	Drum length	1000 meter +/- 5%	

1.2 Documents to be submitted along with offer

1. Technical datasheet of the offered cable with cable cross section sketch.
2. Type Test Certificate and reports of cable with similar construction.
3. Filled in values/details wherever the same is asked for in BHEL technical specifications
4. Vendor has to enclose the deviation sheet clause wise separately in case any deviations are sought by the vendor. Absence of any deviation sheet shall be taken as compliance of BHEL specification in total without any deviation.

1.3 Documents to be submitted within 1 week after receipt of Purchase order

1. Technical datasheet of the cable with cable cross section sketch shall be submitted to BHEL/BHEL customer for approval.
2. Manufacturing Quality Plan (MQP) indicating all tests/checks regarding raw material, in-process and final product as per relevant IS/IEC standards, as called in this document and any other relevant standards shall be submitted to BHEL/BHEL customer for approval.