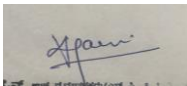

	<b>Purchase specification; Group: Photovoltaics</b> <b>33kV (E) grade, 1Cx300 sq-mm Aluminium, XLPE, Armoured Power Cable</b>		PS-439-1197																																																																		
					REV No. 01																																																																		
					PAGE 1 OF 3																																																																		
		<b>A. Item Description</b> Cable, Voltage grade 33 kV (E), 1 Core x 300 sq-mm, stranded, compacted Aluminium conductor, XLPE insulated, Aluminium wire armoured, FRLS PVC outer sheathed.																																																																					
COPY RIGHT AND CONFIDENTIAL  The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in anyway detrimental to the interest to the company		<b>B. Technical specification</b>																																																																					
		<table border="1"> <thead> <tr> <th>#</th> <th>Particular</th> <th>BHEL specification</th> </tr> </thead> <tbody> <tr> <td>1.0</td> <td>Item description</td> <td>33kV(E) grade cable, 1 Core X 300 sq-mm, stranded, compacted Aluminium conductor, Extruded semi-conducting compound screen, Extruded XLPE insulated, Extruded semi conducting compound screen, Aluminium wire armoured, Extruded FRLS PVC (Type ST2) outer sheathed confirming to IS 7098 part 2-2011 or latest edition.</td> </tr> <tr> <td>2.0</td> <td>Application</td> <td>Suitable for use in outdoor application in solar PV plants</td> </tr> <tr> <td>3.0</td> <td>Applicable standards</td> <td>IS: 7098 (part-2) 2011/latest edition</td> </tr> <tr> <td>4.0</td> <td>Voltage grade</td> <td>33 kV –Earthed grade (E)</td> </tr> <tr> <td>5.0</td> <td>Cable code</td> <td>A2XWaY</td> </tr> <tr> <td>6.0</td> <td><b>Conductor</b></td> <td>As per IS: 8130-1984/ latest edition</td> </tr> <tr> <td>a)</td> <td>Material</td> <td>Class-2 multi-stranded compacted Aluminium conductor (grade H4)</td> </tr> <tr> <td>b)</td> <td>Cross sectional area</td> <td>300 sq.mm</td> </tr> <tr> <td>c)</td> <td>Maximum conductor resistance at 20°C</td> <td>0.1 Ohm/km</td> </tr> <tr> <td>d)</td> <td>No of strands (minimum)</td> <td>30 wires</td> </tr> <tr> <td>e)</td> <td>Approx dia of each strand</td> <td>Dia of each strand shall be such as to meet the DC Resistance of conductor specified in IS:8130-1984</td> </tr> <tr> <td>7.0</td> <td><b>Conductor screening</b></td> <td>Extruded semi-conducting compound</td> </tr> <tr> <td>8.0</td> <td><b>Insulation</b></td> <td>As per IS: 7098 (part-2) 2011/latest edition</td> </tr> <tr> <td>a)</td> <td>Material</td> <td>Cross-linked polyethylene (XLPE)</td> </tr> <tr> <td>b)</td> <td>Nominal insulation thickness</td> <td>8.8 mm</td> </tr> <tr> <td>c)</td> <td>Tolerance on thickness in mm</td> <td>0.1 + 0.1*t where t is the nominal thickness</td> </tr> <tr> <td>d)</td> <td>Volume resistivity at 27°C</td> <td>1x 1014 Ohm-cm (Min)</td> </tr> <tr> <td>e)</td> <td>Volume resistivity at 90°C</td> <td>1x 1012 Ohm-cm (Min)</td> </tr> <tr> <td>f)</td> <td>Max. conductor temperature</td> <td>90°C – Normal continuous operation 250°C – Short circuit condition</td> </tr> <tr> <td>g)</td> <td>Core identification (insulation colour)</td> <td>Natural</td> </tr> <tr> <td>9.0</td> <td><b>Insulation screening</b></td> <td>Extruded semi-conducting compound</td> </tr> </tbody> </table>	#	Particular	BHEL specification	1.0	Item description	33kV(E) grade cable, 1 Core X 300 sq-mm, stranded, compacted Aluminium conductor, Extruded semi-conducting compound screen, Extruded XLPE insulated, Extruded semi conducting compound screen, Aluminium wire armoured, Extruded FRLS PVC (Type ST2) outer sheathed confirming to IS 7098 part 2-2011 or latest edition.	2.0	Application	Suitable for use in outdoor application in solar PV plants	3.0	Applicable standards	IS: 7098 (part-2) 2011/latest edition	4.0	Voltage grade	33 kV –Earthed grade (E)	5.0	Cable code	A2XWaY	6.0	<b>Conductor</b>	As per IS: 8130-1984/ latest edition	a)	Material	Class-2 multi-stranded compacted Aluminium conductor (grade H4)	b)	Cross sectional area	300 sq.mm	c)	Maximum conductor resistance at 20°C	0.1 Ohm/km	d)	No of strands (minimum)	30 wires	e)	Approx dia of each strand	Dia of each strand shall be such as to meet the DC Resistance of conductor specified in IS:8130-1984	7.0	<b>Conductor screening</b>	Extruded semi-conducting compound	8.0	<b>Insulation</b>	As per IS: 7098 (part-2) 2011/latest edition	a)	Material	Cross-linked polyethylene (XLPE)	b)	Nominal insulation thickness	8.8 mm	c)	Tolerance on thickness in mm	0.1 + 0.1*t where t is the nominal thickness	d)	Volume resistivity at 27°C	1x 1014 Ohm-cm (Min)	e)	Volume resistivity at 90°C	1x 1012 Ohm-cm (Min)	f)	Max. conductor temperature	90°C – Normal continuous operation 250°C – Short circuit condition	g)	Core identification (insulation colour)	Natural	9.0	<b>Insulation screening</b>	Extruded semi-conducting compound			
#	Particular	BHEL specification																																																																					
1.0	Item description	33kV(E) grade cable, 1 Core X 300 sq-mm, stranded, compacted Aluminium conductor, Extruded semi-conducting compound screen, Extruded XLPE insulated, Extruded semi conducting compound screen, Aluminium wire armoured, Extruded FRLS PVC (Type ST2) outer sheathed confirming to IS 7098 part 2-2011 or latest edition.																																																																					
2.0	Application	Suitable for use in outdoor application in solar PV plants																																																																					
3.0	Applicable standards	IS: 7098 (part-2) 2011/latest edition																																																																					
4.0	Voltage grade	33 kV –Earthed grade (E)																																																																					
5.0	Cable code	A2XWaY																																																																					
6.0	<b>Conductor</b>	As per IS: 8130-1984/ latest edition																																																																					
a)	Material	Class-2 multi-stranded compacted Aluminium conductor (grade H4)																																																																					
b)	Cross sectional area	300 sq.mm																																																																					
c)	Maximum conductor resistance at 20°C	0.1 Ohm/km																																																																					
d)	No of strands (minimum)	30 wires																																																																					
e)	Approx dia of each strand	Dia of each strand shall be such as to meet the DC Resistance of conductor specified in IS:8130-1984																																																																					
7.0	<b>Conductor screening</b>	Extruded semi-conducting compound																																																																					
8.0	<b>Insulation</b>	As per IS: 7098 (part-2) 2011/latest edition																																																																					
a)	Material	Cross-linked polyethylene (XLPE)																																																																					
b)	Nominal insulation thickness	8.8 mm																																																																					
c)	Tolerance on thickness in mm	0.1 + 0.1*t where t is the nominal thickness																																																																					
d)	Volume resistivity at 27°C	1x 1014 Ohm-cm (Min)																																																																					
e)	Volume resistivity at 90°C	1x 1012 Ohm-cm (Min)																																																																					
f)	Max. conductor temperature	90°C – Normal continuous operation 250°C – Short circuit condition																																																																					
g)	Core identification (insulation colour)	Natural																																																																					
9.0	<b>Insulation screening</b>	Extruded semi-conducting compound																																																																					
		REVISION : 01	PREPARED  Varun Jain	APPROVED  Prachi Rao V	DATE  26-07-2019																																																																		



**Purchase specification; Group: Photovoltaics**  
**33kV (E) grade, 1Cx300 sq-mm Aluminium, XLPE, Armoured Power Cable**

PS-439-1197


REV No. 01

PAGE 2 OF 3

COPY RIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in anyway detrimental to the interest to the company

10.0	Armouring	As per IS: 3975- 1979/latest edition	
a)	Armour material and shape	Aluminium round wire armour H4 Grade as per IS:8130	
b)	Armour wire diameter (Nominal)	As per IS: 7098 (part-2)	
c)	Max. resistivity of armour at 20 °C	As per IS: 7098 (part-2)	
d)	Size and type of armour	Size and type of armour selected shall meet the minimum requirement of Short-circuit capability as per Cl. 15 (b). Vendor shall submit detailed calculation for the same along with offer.	
e)	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 armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire.		
11.0	Outer sheath	As per IS: 5831-1984 and ASTM stds	
a)	Material	Extruded PVC Type ST2 with FRLS properties	
b)	Thickness of outer sheath	As per IS: 7098 (part-2)	
c)	Colour of outer sheath	Black	
d)	Overall diameter of cable	Vendor shall indicate dimension. Allowable tolerance shall be +/- 2 mm over declared value.	
12.0	Continuous current carrying capacity of cable (Amps) – To be mentioned by vendor	a) in Ground at 30°C	
		b) in Duct at 30°C	
		c) In Air at 40°C	
13.0	Ovality at any cross section shall be as per requirements of IS 7098 Part2 and shall be kept minimum so as to have circular cross section of cable.		
14.0	Minimum bending radius	As per IS: 1255	
15.0	Short-circuit withstand capacity and duration	25kA / 1 sec (min)	
a)	Conductor (kAmps) for 1sec	25kA / 1 sec (min)	
b)	Armour (kAmps) for 1 sec	25kA / 1 sec (min)	
	Calculation for (a) and (b) enclosed along with offer. Confirm YES/NO		
16.0	FRLS properties		
a)	Minimum Oxygen index	29 % as per IS 10810 Part-58/ ASTM-D-2863	
b)	Minimum Temperature index	250°C as per IS 10810 Part-64/ ASTM D-2863	
c)	Flammability	As per IEC-60332 Part-3 (Cat-B)	
d)	Halogen acid gas evolution by weight	Max. 20 % as per IEC-60754 Part-1	
e)	Smoke density	Max. 60% as per ASTM-D-2843	
e)	Fire Resistance requirement	As per IEEE-383	
17.0	Routine tests	To be conducted the vendor on each drum of finished cables. Test report shall be submitted to BHEL along with inspection call for acceptance tests.	
a)	Conductor resistance test		
b)	HV test		
18.0	Acceptance Tests		
	All applicable acceptance tests shall be carried out on manufactured cable as per IS-7098 (Part-2) 2011 or latest edition. Vendor shall issue inspection call to BHEL/BHEL Customer for witness of tests prior to dispatch of cables.		



**Purchase specification; Group: Photovoltaics**  
**33kV (E) grade, 1Cx300 sq-mm Aluminium, XLPE,**  
**Armoured Power Cable**

**PS-439-1197**  
**REV No. 01**  
**PAGE 3 OF 3**

**19.0**

**Type Tests**

During detailed engineering, vendor shall submit the reports of all valid type tests as per IS-7098 (Part-2) 2011 or latest edition conducted within last 5 years.

These reports should be for the tests conducted on the cables similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

However if the vendor is not able to submit valid type test reports, the vendor shall conduct all such tests under this contract at no additional cost to BHEL either at third party lab or in presence of BHEL /customer representative and submit the reports for approval.

**20.0**

**Cable Identification /marking**

a) The printing/ embossing shall be progressive, automatic, in line and marking shall be legible and indelible.

b) Identification scheme / printing on the cable.

Embossing on outer sheath at an interval of 1 meter:  
 (a) BHEL, Customer Name  
 (b) Voltage grade  
 (c) Cable size  
 (d) Word 'FRLS'  
 (e) Year of manufacture  
 (f) Manufacturer name, brand name or trade mark,  
 (g) ISI mark and IS standard  
 (h) Sequential marking of length of the cable in meters.

**21.0**

**Packing and marking**

a) 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.

b) Drum length

1000 meters. +/- 5%

c) Marking on the drum

Each drum shall be marked with following information:  
 BHEL PO number and date, BHEL specification number, Cable description, Manufacturer name, Address and contact number, Part number, Size & Length of the cable, Cable code, Voltage grade, Approx. gross mass, Year of manufacture, ISI mark and IS standard, Number of lengths on the drum (if more than one) etc. stenciled 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.

**22.0**

**Documents to be submitted along with offer**

1. Filled in values/details wherever the same is asked for in BHEL technical specifications

2. 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.

**23.0**

**Documents to be submitted for BHEL/BHEL customer approval within 1 week after receipt of Purchase order**

1. Technical datasheet of the cable with cable cross section sketch.

2. Manufacturing Quality Plan (MQP) indicating all tests/checks regarding raw material, in-process and final product as per relevant IS/IEC standards.

3. Type Test Certificates and reports of cable with similar construction.

COPY RIGHT AND CONFIDENTIAL  
 The information on this document is the property of Bharat Heavy Electricals Limited.  
 It must not be used directly or indirectly in anyway detrimental to the interest to the company