

POWERING THE FUEL OF TOMORROW.

Solar DC Cables for PV Modules



POLYCAB SOLAR DC CABLE 1C X 6 Sq.mm as per TUV-2 Pf g 1169/08.2007



COMPANY PROFILE

POLYCAB is the industry leader in the manufacturing of Electric Wires & Cables in India.

We are a customer focused company, and always keen to develop wires & cables to meet the specific market segment. During financial year ending March 2012 Polycab has achieved a Sales turnover of Rs. 42500 millions (USD\$ 775 million). We are committed to interacting with our customers to deliver innovative cable solutions that increase productivity and safety. Polycab is also a ISO 9001:2008, ISO 14001:2004, OHSAS 18001:2007 certified cable manufacturer headquartered in Mumbai with plants in Daman (UT) & Halol (Gujarat).

POLYCAB announces the launch of Solar Cables to support Renewable Energy initiative of the world.

Solar Cables are designed to meet the growing needs of the solar industry. Our solar cables is just the beginning of our plans to develop and launch green technology in wires & cables. Solar Cables are flexible and are resistant to abrasion & moisture. Regardless of your panel-to-grid needs, we have the cables to meet your requirements.

Applications

These cables are designed for connecting photovoltaic power supply systems. These cables can be used indoor & outdoor for flexible and fixed installations with high mechanical strength in extreme weather conditions.

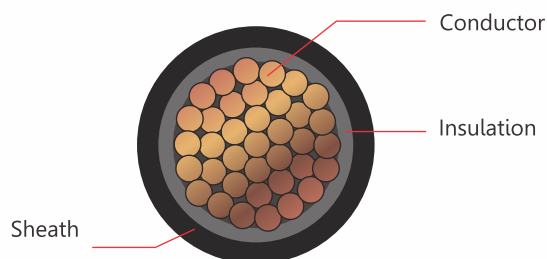
Standards

2 Pfg 1169/08.2007.

Electrical Characteristics

- Rated Voltage: 0.6/1 kV AC
- Rated DC Voltage: 1.5 kV
- Maximum Permitted DC Voltage: 1.8 kV (conductor/ conductor, non earthed system, circuit not under load)
- Maximum Permitted AC Voltage: 0.7/1.2 kV
- Working Voltage: DC 1000 V
- Insulation Resistance: 1000M Ω - km
- Spark Test: 6000 Vac (8400 Vdc)
- Voltage Withstand: 6500 V as per EN50395 for 5 min
- Ampacity: According to requirements for cables for PV systems

Construction Characteristics



Conductor	Electrolytic Multi Stranded tinned copper conductor flexible as per IEC 60228 Class 5.
Insulation	Crosslinked Halogen Free & Flame Retardant Insulation
Sheath	Sheath Crosslinked Halogen Free & Flame Retardant Sheath in Black/Blue/Red Colour

Thermal Characteristics

- Ambient Temperature: -40°C ~ +90°C
- Maximum Temperature at Conductor: 120°C (20000h)
- Short Circuit Temperature: 200°C (at conductor max. 5sec)
- Thermal Endurance Test: According to EN 60216-2 (temperature index +120°C)
- High Temperature Pressure: Test according to EN 60811-3-1
- Damp – Heat Test: According to EN 60068-2-78 1000 hrs. at 90°C with 85% humidity

Mechanical Characteristics

- Minimum Bending Radius: 5 x OD (fixed), 15 x OD (occasional flexing)
- Dynamic Penetration: According to requirement of Cables for PV systems 2 Pfg 1169/08.2007 Annex F
- Notch Propagation: According to 2 Pfg 1169/08.2007 Annex G
- Tensile Strength: 6.5 N/mm² for insulation and 8 N/mm² for sheathing – according to EN60811
- Elongation of Insulation and sheathing: 125% – according to EN60811
- Anticipated Period of Use: 25 years
- Shrinkage: 2% at 120°C according to EN60811-1-3

EU Directives

- The cables are RoHS (Restriction of certain Hazardous Substances) compliant as per EU Directives 2002/95/EC



Chemical Characteristics

- Mineral Oil Resistance: according to EN 60811-2-1
- Ozone Resistance: according to EN 50396 part 8.1.3 Method B
- Weathering-UV Resistance: according to HD 605/A1 or DIN 53367
- Ammonia resistant : 30 days in saturated ammonia atmosphere (internal testing)
- Very good resistance to oil and chemicals
- High wear and robust, abrasion resistant
- Acid & Alkaline Resistance: According to EN 60811-2-1 (Oxal acid and sodium hydroxide)

Fire Performance

- Flame retardant according to IEC 60332-1-2
- Low smoke emission < 20% as per ASTM D-2843
- Halogen free according to EN 50267-2-1/-2, IEC 60754-2
- Acid gas emission not more than 0.5% as per IEC 60754-1 pH minimum 4.3 as per IEC 60754-2 conductivity maximum 10 as per IEC 60754-2
- Toxicity according to EN 50305, ITC- index<3

Specifications

As per TÜV Rheinland specification: 2 Pfg 1169/08.2007.

Solar Cables used in Solar Farm installations are mainly categorized as given below:

A. PV module to PV module and PV modules to Array Junction Box

These cables though not exposed to direct sunlight are throughout the day time exposed to diffused/indirect sunlight and atmospheric temperatures in open air.

TYPE 1

DC Solar Cables are Single core Copper cables each for +ve and -ve. They are insulated and sheathed with Cross Linkable LSOH which has UV as well as Ozone protection properties. These cables confirm to TUV specificationst.

TYPE 2

DC Solar Cables are Single core Copper cables each for +ve and -ve. They are insulated with HR 105°C PVC compound and sheathed with UV stabilized HR 105°C PVC compound.

TYPE 3

DC Solar Cables are Single core Copper cables each for +ve and -ve. They are insulated with XLPE compound and and sheathed with UV stabilized PVC ST2 compound.

B. Array Junction Box to Main Junction Box and Main Junction Box to Inverter

These Solar DC cables which are not exposed to sunlight and are always routed through PVC Pipes which are laid underground. Choice of cables can be done from any one of the options given. Generally Option 3 is chosen for this route.

C. Inverter to Transformer Primary

The Three Phase AC output from the Inverters is connected to the Transformer Primary through Underground Armoured Cables. These cables are Copper or Aluminium XLPE insulated, GI armoured, UV stabilised PVC ST2.

D. Transformer Secondary to RMU/Switchyard

The Three Phase AC output from the Tranformer Secondary is connected to the RMU/Switchyard through Armoured Cables. These cables are Copper or Aluminium XLPE insulated, GI armoured, UV stabilised PVC ST2.

E. RMU to Switchyard

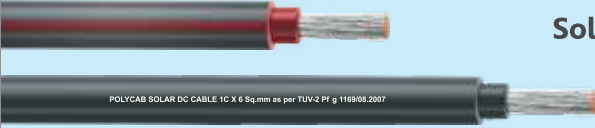
Three Phase AC connection from the RMU is connected to the Switchyard through Armoured Cables. These cables are Copper or Aluminium XLPE insulated, GI armoured, UV stabilised PVC ST2.

Note:

All Solar cables used with XLPE insulation armoured or unarmoured are specially manufactured with UV stabilised PVC ST2 outer sheathing which are specially formulated compounds to sustain the Direct / Diffused / Indirect Sunlight in case of exposed cables at any stage of installation.



Solar DC Cables



TYPE 1 – Dimensions

Solar DC Cables from PV Module to Array Junction Box (as per TUV Specifications-2 Pfg 1169/08.2007)				
Single Core Size in sq. mm	Max. Conductor Diameter	XL-LSOH Insulation Thickness-Nominal in mm	XL-LSOH Sheathing Thickness-Nominal in mm	Overall Dia. Nominal in mm
1.5	0.26	0.5	0.5	4.10 +/-0.5
2.5	0.26	0.5	0.5	4.5 +/-0.5
4	0.31	0.5	0.5	5.1 +/-0.5
6	0.31	0.5	0.5	6.1 +/-0.5
Solar DC Cables from Array Junction Box to Main Junction Box & MJB to Inverter (as per TUV Specifications-2 Pfg 1169/08.2007)				
10	0.41	0.5	0.5	6.6 +/-0.5
16	0.41	0.5	0.5	7.7 +/-0.5
25	0.41	0.9	1.0	10.5 +/-0.7
35	0.41	0.9	1.1	12.0 +/-0.7
50	0.41	1.0	1.2	14.0 +/-0.7
70	0.51	1.1	1.3	16.0 +/-1.0
95	0.51	1.1	1.5	18.5 +/-1.0
120	0.51	1.2	1.6	20.0 +/-1.0
150	0.51	1.4	1.7	22.5 +/-1.0
185	0.51	1.6	1.9	25.0 +/-1.0
240	0.51	1.7	2.1	28.0 +/-1.0

TYPE 2 – Dimensions

Solar DC Cables from PV Module to Array Junction Box (as per IS 694 & IS 1554 Part I guidelines)				
Single Core Size in sq. mm	Max. Conductor Diameter	HR 105°C PVC Insulation Thickness-Nominal in mm	UV HR 105°C PVC Sheathing Thickness-Nominal in mm	Overall Dia. Nominal in mm
1.5	0.26	0.6	0.9	5.0 +/-0.5
2.5	0.26	0.7	0.9	5.5 +/-0.5
4	0.31	0.8	0.9	6.5 +/-0.5
6	0.31	0.8	0.9	7.0 +/-0.5
Solar DC Cables from Array Junction Box to Main Junction Box & MJB to Inverter (as per IS 694 & IS 1554 Part I guidelines))				
10	0.41	1.0	0.9	8.5 +/-0.5
16	0.41	1.0	0.9	9.5 +/-0.5
25	0.41	1.2	1.0	11.0 +/-0.7
35	0.41	1.2	1.1	12.5 +/-0.7
50	0.41	1.4	1.3	15.0 +/-0.7
70	0.51	1.4	1.4	17.0 +/-1.0
95	0.51	1.6	1.5	19.5 +/-1.0
120	0.51	1.6	1.6	21.0 +/-1.0
150	0.51	1.8	1.8	23.5 +/-1.0
185	0.51	2.0	1.9	25.5 +/-1.0
240	0.51	2.2	2.2	29.5 +/-1.0

Solar DC Cables



TYPE 3 – Dimensions

Solar DC Cables from PV Module to Array Junction Box (as per IS 7098 Part I guidelines)

Single Core Size in sq. mm	Max. Conductor Diameter	XLPE Insulation Thickness-Nominal in mm	UV-PVC-ST2 Sheathing Thickness-Nominal in mm	Overall Dia. Nominal in mm
1.5	0.26	0.7	0.9	5.0 +/-0.5
2.5	0.26	0.7	0.9	5.5 +/-0.5
4	0.31	0.7	0.9	6.0 +/-0.5
6	0.31	0.7	0.9	6.5 +/-0.5

Solar DC Cables from Array Junction Box to Main Junction Box & MJB to Inverter (as per IS 7098 Part I guidelines)

10	0.41	0.7	0.9	7.5 +/-0.5
16	0.41	0.7	0.9	8.5 +/-0.5
25	0.41	0.9	1.0	10.5 +/-0.7
35	0.41	0.9	1.1	12.0 +/-0.7
50	0.41	1.0	1.2	14.0 +/-0.7
70	0.51	1.1	1.3	16.0 +/-1.0
95	0.51	1.1	1.5	18.5 +/-1.0
120	0.51	1.2	1.6	20.0 +/-1.0
150	0.51	1.4	1.7	22.5 +/-1.0
185	0.51	1.6	1.9	25.0 +/-1.0
240	0.51	1.7	2.1	28.0 +/-1.0

TYPE 1 – Current Carrying Capacity

Solar DC Cables as per TUV Specifications-2 Pfg 1169/08.2007

Single Core Size in Sq.mm	Tinned Copper Maximum Resistance @20°C Ohms-Ω/Km	Current Carrying Capacity of DC Solar Cable with XL-LSOH Insulation and XL-LSOH Sheathing at 60°C		
		Single Cable in Air in Amps-A	Single Cable on Surface in Amps-A	2 Adjacent Cables on Surface in Amps-A
1.5	13.700	30	29	24
2.5	8.210	41	39	33
4	5.090	55	52	44
6	3.390	70	67	57
10	1.950	98	93	79
16	1.240	132	125	107
25	0.795	176	167	142
35	0.565	218	207	176
50	0.393	274	260	219
70	0.277	406	386	325
95	0.210	491	467	393
120	0.164	576	547	461
150	0.132	670	637	536
185	0.108	784	745	627
240	0.0817	944	897	755

TYPE 2 – Current Carrying Capacity

Solar DC Cables from Junction Box to Inverter as per IS 694 & IS 1554 Part I guidelines

Single Core Size in	Bare Copper Maximum Resistance @20°C	Current Carrying Capacity of DC Solar Cable with HR 105°C PVC Insulation and UV Stabilised HR 105°C PVC Sheathing at 40°C		
		Single Cable in Air	Single Cable on Surface	2 Adjacent Cables on Surface
Sq.mm	Ohms-Ω/Km	in Amps-A	in Amps-A	in Amps-A
1.5	13.3	28	26	22
2.5	7.98	39	37	31
4	4.95	50	48	40
6	3.30	64	61	51
10	1.910	89	84	71
16	1.210	119	113	95
25	0.780	150	143	120
35	0.554	191	182	153
50	0.386	253	240	202
70	0.272	374	355	299
95	0.206	451	429	361
120	0.161	530	504	424
150	0.129	618	587	494
185	0.106	721	685	577
240	0.0801	869	825	695

TYPE 3 – Current Carrying Capacity

Solar DC Cables from Junction Box to Inverter as per IS 7098 Part I guidelines

Single Core Size in	Bare Copper Maximum Resistance @20°C	Current Carrying Capacity of DC Solar Cable with XLPE Insulation and UV Stabilised PVC ST2 Sheathing at 40°C		
		Single Cable in Air	Single Cable on Surface	2 Adjacent Cables on Surface
Sq.mm	Ohms-Ω/Km	in Amps-A	in Amps-A	in Amps-A
1.5	13.3	25	24	20
2.5	7.98	35	33	28
4	4.95	45	43	36
6	3.30	58	55	46
10	1.910	80	76	64
16	1.210	106	101	85
25	0.780	135	128	108
35	0.554	173	164	138
50	0.386	226	215	181
70	0.272	336	319	269
95	0.206	406	386	325
120	0.161	476	452	381
150	0.129	555	527	444
185	0.106	649	616	519
240	0.0801	781	742	625



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