

# Cables for photovoltaic systems

 BRÖCKSKES · D-VIERSEN · **SAB**<sup>solar</sup> PV1-F 4,0 mm<sup>2</sup> · VDE-REG.-Nr. 8292



[www.sab-worldwide.com](http://www.sab-worldwide.com)





## DIN EN ISO 9001

Nearly 60 years of experience in temperature measurement and control technique as well as in cable production have made a one man business a company with more than 450 staff members. Our strength is not only the production of standard products but also the development and manufacturing of special products acc. to customers' specifications. Every year we manufacture more than 1500 special products on our customer's request. Every single product is a challenge for our technical team.

We at SAB Bröckskes see ourselves as manufacturer and service provider - in the sense of real partnership and customer oriented work. The quality of our products is known in more than 40 countries of the world. Our customers have tested our products intensively and confirm that they have a longer service life than others. In all product ranges we are certified according to DIN EN ISO 9001:2000. Besides we established an environmental management system for our company according to DIN EN ISO 14001:2005 als well as occupational health and safety management acc. to ILO and OHSAS 18001. And our future slogan is: **We go forward!**

### founded:

- 1947 by Peter Bröckskes sen.
- an independent, middle sized company

### CEO:

- Peter Bröckskes

### plant/location:

- in Viersen (lower Rhine) 110.000 m<sup>2</sup> company site
- manufacturing from copper conductor to outer sheath,
- own VDE proofed burnchamber and laboratory

### employees/workers:

- approx. 400 at the plant in Viersen, 450 worldwide

### yearly sales:

- approx. 55 Mio. € worldwide

### products:

- Special Cables
- Temperature Measurement
- Cable Harnessing

### certificates and approvals:

- DIN EN ISO 9001:2000 for every manufacturing field
- environmental management system acc. to DIN EN ISO 14001:2005
- occupational health and safety management acc. to ILO and OHSAS 18001



**MIL, VDE, HAR, IEC, GL, DNV, BV, KR,  
ABS, NK, RINA, LR, CE**

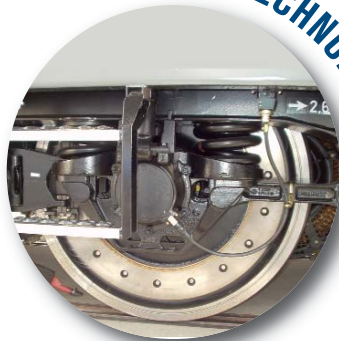
ROBOT INDUSTRY



AUTOMATION



RAILWAY TECHNOLOGY



MEDICAL TECHNOLOGY



AUTOMOBILE INDUSTRY



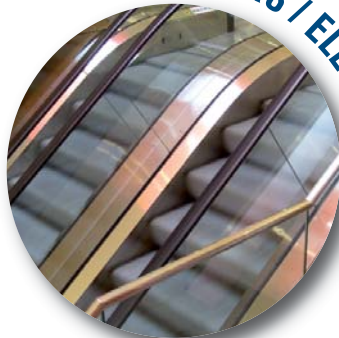
STEEL INDUSTRY



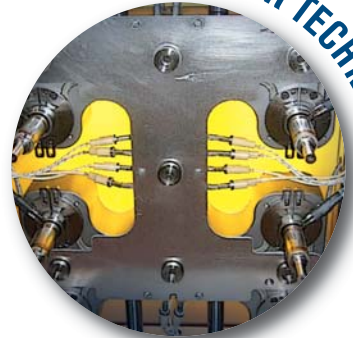
SOLAR TECHNOLOGY



ESCALATORS / ELEVATORS



HOT RUNNER TECHNIQUE



WIND POWER





# CABLES FOR PHOTOVOLTAIC SYSTEMS

**SAB**solar PV1-F halogen-free cable for photovoltaic systems

The requirements acc. to the DKE draft AK 411.2.3\* are fulfilled.



B 100561971004

VDE-REG. no. 8292

+120 °C

SABsolar PV1-F 4,0 mm<sup>2</sup> · VDE-REG.-Nr. 8292 · TÜV Süd-Bauart geprüft B 100561971004



Marking for SABsolar PV1-F 71913386:

SAB BRÖCKSKES · D-VIERSEN · SABsolar PV1-F 4,0 mm<sup>2</sup> · VDE-REG.-Nr. 8292 · TÜV Süd-Bauart geprüft B 100561971004 CE

## Construction:

<b>Conductor :</b>	tinned copper strands acc. to IEC 60228, EN 60228, VDE 0295, class 5
<b>Primary insulation:</b>	SABIX® solar
<b>Color code primary insulation:</b>	see table below
<b>Secondary insulation:</b>	SABIX® solar
<b>Color code secondary insulation:</b>	see table below

## Outstanding features:

- fulfills DKE draft AK 411.2.3\*
- halogen-free
- no flame propagation
- flame retardant and self-extinguishing
- up to +120 °C
- weather resistant
- sunlight resistance
- with improved fire performance
- expected service life: up to 25 years
- very good resistance against acids and alkaline solutions
- ammonia resistance
- absence of marten attractants

## Technical data:

<b>Nominal voltage U<sub>0</sub>/U:</b>	0,6/1 kV (AC)
<b>Testing voltage:</b>	6500 V (AC)
<b>Min. bending radius</b>	
Ø ≤ 12 mm:	3 x d
Ø > 12 mm:	4 x d
<b>Temperature range</b>	<b>VDE-REG.-no. 8292 as well as TÜV SÜD type tested B 100561971004:</b> up to +90 °C
<i>for ambient temperature:</i>	
<i>maximum temperature at the conductor:</i>	+120 °C
<i>for installation:</i>	-30/+120 °C
<i>fixed laying:</i>	-40/+120 °C
<i>short circuit:</i>	+250 °C
<b>Halogen-free :</b>	without hydrogen chloride acc. to EN 50267-2-1, without fluorine content acc. to EN 60684-2
<b>Corrosiveness of conflagration gases:</b>	in compliance with IEC 60754-2 + EN 50267-2-2 VDE + 0482 part 267-2-2 no development of corrosive conflagration gases
<b>Fire performance:</b>	flame retardant and self-extinguishing acc. to IEC 60332-1-2 +EN 60332-1-2
<b>Weather resistance:</b>	very good
<b>Ozone resistance:</b>	acc. to EN 50396
<b>Ammonia resistance:</b>	very good
<b>Absence of harmful substances:</b>	acc. to RoHS-guideline 2002/95/EG as well as GefStoffV appendix IV-no. 24

item no.	nominal cross-section mm <sup>2</sup>	outer-ø max. mm	copper figure kg/km	cable weight ≈ kg/km
7191 .. 82	1,50	5,0	14,4	39
7191 .. 84	2,50	5,4	24,0	50
7191 .. 86	4,00	5,6	38,4	67
7191 .. 87	6,00	6,2	57,6	95
7191 .. 88	10,0	8,9	96,0	162
7191 .. 89	16,0	10,3	153,6	234
7191 .. 90	25,0	12,5	240,0	353
7191 .. 91	35,0	13,9	236,0	463

Other dimensions are possible on request.

## Marking for primary insulation and secondary insulation

Primary insulation / secondary insulation	
33 black / black	38 black / red
32 black / blue	83 red / black
88 red / red	22 blue / blue
23 blue / black	Other colours are possible on request.

suitable for protecting class II





# CABLES FOR PHOTOVOLTAIC SYSTEMS

The requirements acc. to the DKE draft AK 411.2.3\* are fulfilled.



B 100561971004

## SAB<sup>solar</sup> PV1-F dual halogen-free twin cable for photovoltaic systems

VDE-REG. no. 8292

+120 °C



D-VIERSEN · SAB<sup>solar</sup> PV1-F 2x6,0 mm<sup>2</sup> · VDE-REG.-Nr. 8292 · TÜV<sup>Süd</sup>-Bauart geprüft B 1

Marking for SAB<sup>solar</sup> PV1-F dual 71918317:

SAB BRÖCKSKES · D-VIERSEN · SAB<sup>solar</sup> PV1-F 2x6,0 mm<sup>2</sup> · VDE-REG.-Nr. 8292 · TÜV<sup>Süd</sup>-Bauart geprüft B 100561971004 CE

### Construction:

Conductor :	tinned copper strands acc. to IEC 60228, EN 60228, VDE 0295, class 5
Primary insulation:	SABIX <sup>®</sup> solar
Color code primary insulation:	black / red or black / blue
Secondary insulation:	SABIX <sup>®</sup> solar
Color code secondary insulation:	black

### Outstanding features:

- fulfills DKE draft AK 411.2.3\*
- halogen-free
- no flame propagation
- flame retardant and self-extinguishing
- up to +120 °C
- weather resistant
- sunlight resistance
- with improved fire performance
- expected service life: up to 25 years
- very good resistance against acids and alkaline solutions
- ammonia resistance
- absence of marten attractants

### Technical data:

Nominal voltage U <sub>0</sub> /U:	0,6/1 kV (AC)
Testing voltage:	6500 V (AC)
Min. bending radius	
Ø ≤ 12 mm:	3 x d
Ø > 12 mm:	4 x d
Temperature range	VDE-REG.-no. 8292 as well as TÜV SÜD type tested B 100561971004: up to +90 °C
for ambient temperature: maximum temperature at the conductor:	+120 °C
for installation:	-30/+120 °C
fixed laying:	-40/+120 °C
short circuit:	+250 °C
Halogen-free :	without hydrogen chloride acc. to EN 50267-2-1, without fluorine content acc. to EN 60684-2
Corrosiveness of conflagration gases:	in compliance with IEC 60754-2 + EN 50267-2-2 VDE + 0482 part 267-2-2 no development of corrosive conflagration gases
Fire performance:	flame retardant and self-extinguishing acc. to IEC 60332-1-2 +EN 60332-1-2
Weather resistance:	very good
Ozone resistance:	acc. to EN 50396
Ammonia resistance:	very good
Absence of harmful substances:	acc. to RoHS-guideline 2002/95/EG as well as GefStoffV appendix IV-no. 24

item no.	no. of conductors	nominal cross-section mm <sup>2</sup>	outer-Ø approx. mm	copper figure kg/km	cable weight ≈ kg/km
7191 .. 16	2	4,00	6,0 x 11,9	76,8	140
7191 .. 17	2	6,00	6,9 x 13,8	115,2	190
7191 .. 18	2	10,0	8,7 x 17,4	192,0	323

Other dimensions are possible on request.

### Marking for primary insulation and secondary insulation

Primary insulation / secondary insulation

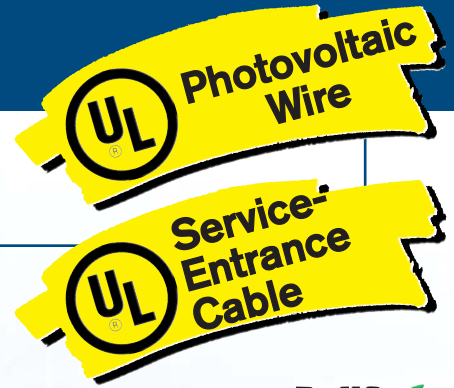
83 red / black	23 blue / black
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Other colours are possible on request.

suitable for protecting class II



**SAB**solar PV Wire halogen-free cable for photovoltaic systems



sunlight-resistant -40°C (UL) Service-Entrance Cable Type USE-2 600V Single Conductor CE



Marking for SAB solar PV Wire 71813386:

SAB BRÖCKSKES · D-VIERSEN · SAB solar 12 AWG (UL) · Photovoltaic Wire 600V 90°C dry 90°C wet sunlight-resistant -40°C

(UL) Service-Entrance Cable Type USE-2 600V Single Conductor CE

## Construction:

<b>Conductor :</b>	tinned copper strands acc. to IEC 60228, EN 60228, VDE 0295, class 5 and UL standard 758 table 5.1 + UL 1581 table 20.1
<b>Primary insulation:</b>	SABIX® 285
<b>Color code primary insulation:</b>	see table below
<b>Secondary insulation:</b>	SABIX® 285
<b>Color code secondary insulation:</b>	see table below

## Outstanding features:

- UL Subject 4703 PV Wire
- UL 854 USE-2
- halogen-free
- flame retardant and self-extinguishing
- weather resistant
- sunlight resistance
- very good resistance against acids and alkaline solutions
- connection cable for photovoltaic modules acc. to NEC Section 690.31 (A)
- ammonia resistance
- absence of marten attractants

## Technical data:

<b>Nominal voltage:</b>	600 V (AC)
<b>Testing voltage:</b>	3000 V (AC)
<b>Min. bending radius</b>	
Ø ≤ 12 mm:	3 x d
Ø > 12 mm:	4 x d
<b>Temperature range for ambient temperature:</b>	-40°C/+90 °C
<b>Halogen-free :</b>	without hydrogen chloride acc. to EN 50267-2-1, without fluorine content acc. to EN 60684-2
<b>Corrosiveness of conflagration gases:</b>	in compliance with IEC 60754-2 + EN 50267-2-2 VDE + 0482 part 267-2-2 no development of corrosive conflagration gases.
<b>Fire performance:</b>	flame retardant and self-extinguishing acc. to IEC 60332-1-2 +EN 60332-1-2 and (UL) FT1
<b>Sunlight resistance:</b>	yes
<b>Weather resistance:</b>	very good
<b>Ozone resistance:</b>	acc. to EN 50396
<b>Ammonia resistance:</b>	very good
<b>Absence of harmful substances:</b>	acc. to RoHS-guideline 2002/95/EG as well as GefStoffV appendix IV-no. 24

item no.	AWG	outer-ø max. mm	copper figure kg/km	cable weight ≈ kg/km
7181 .. 86	12	6,6	38,4	77
7181 .. 87	10	7,1	57,6	97
7181 .. 88	8	8,9	84,5	151

Other dimensions are possible on request.

## Marking for primary insulation and secondary insulation

Primary insulation / secondary insulation

33 black / black	23 blue / black
63 white / black	83 red / black

Other colours for the primary insulation possible on request.



# CABLES FOR PHOTOVOLTAIC SYSTEMS

**SAB solar PV1-F with UL** halogen-free cable for photovoltaic systems



B 100561971004



VDE-REG. no. 8292

The requirements acc. to the DKE draft AK 411.2.3\* are fulfilled.

90°C wet sunlight-resistant -40°C (UL) Service-Entrance Cable Type USE-2 600V Single Conductor

+120°C

Marking for SAB solar PV1-F with UL 71913346:

SAB BRÖCKSKES · D-VIERSEN · SAB solar PV1-F 4,0 mm<sup>2</sup> · VDE-REG.-Nr. 8292 · TÜV Süd-Bauart geprüft B 100561971004 AWG12 (UL) Photovoltaic Wire 600V 90°C dry 90°C wet sunlight-resistant -40°C (UL) Service-Entrance Cable Type USE-2 600V Single Conductor CE

## Construction:

<b>Conductor :</b>	tinned copper strands acc. to IEC 60228, EN 60228, VDE 0295, class 5 and UL standard 758 table 5.1 + UL 1581 table 20.1
<b>Primary insulation:</b>	SABIX® solar
<b>Color code primary insulation:</b>	see table below
<b>Secondary insulation:</b>	SABIX® solar
<b>Color code secondary insulation:</b>	see table below

## Outstanding features:

- fulfills DKE draft AK 411.2.3\*
- UL Subject 4703 PV Wire
- UL 854 USE-2
- halogen-free
- no flame propagation
- flame retardant and self-extinguishing
- up to +120 °C
- weather resistant
- sunlight resistance
- with improved fire performance
- expected service life: up to 25 years
- very good resistance against acids and alkaline solutions
- connection cable for photovoltaic modules acc. to NEC Section 690.31 (A)
- ammonia resistance
- absence of marten attractants

## Technical data:

<b>Nominal voltage U<sub>0</sub>/U:</b>	0,6/1 kV (AC)	(UL): 600 V (AC)
<b>Testing voltage:</b>	6500 V (AC)	(UL): 3000 V (AC)
<b>Min. bending radius</b>		
Ø ≤ 12 mm:	3 x d	
Ø > 12 mm:	4 x d	
<b>Temperature range</b>	VDE-REG.-no. 8292 as well as TÜV SÜD type tested B 100561971004:	
<i>for ambient temperature:</i>	up to +90 °C (UL): -40°C/+90°C	
<i>maximum temperature at the conductor:</i>	+120 °C	
<i>for installation:</i>	-30/+120 °C	
<i>fixed laying:</i>	-40/+120 °C	
<i>short circuit:</i>	+250 °C	
<b>Halogen-free :</b>	without hydrogen chloride acc. to EN 50267-2-1, without fluorine content acc. to EN 60684-2	
<b>Corrosiveness of conflagration gases:</b>	in compliance with IEC 60754-2 + EN 50267-2-2 VDE + 0482 part 267-2-2 no development of corrosive conflagration gases	
<b>Fire performance:</b>	flame retardant and self-extinguishing acc. to IEC 60332-1-2 +EN 60332-1-2 and (UL) FT1	
<b>Sunlight resistance (UL):</b>	yes	
<b>Weather resistance:</b>	very good	
<b>Ozone resistance:</b>	acc. to EN 50396	
<b>Ammonia resistance:</b>	very good	
<b>Absence of harmful substances:</b>	acc. to RoHS-guideline 2002/95/EG as well as GefStoffV appendix IV-no. 24	

item no.	nominal cross-section mm <sup>2</sup>	outer-ø mm	copper figure kg/km	cable weight ≈ kg/km
7191 .. 46	4,00	6,8	38,4	79
7191 .. 47	6,00	7,5	57,6	114

Other dimensions are possible on request.

## Marking for primary insulation and secondary insulation

Primary insulation / secondary insulation	
33 black / black	83 red / black
23 blue / black	63 white / black

Other colours are possible on request.

suitable for protecting class II

\*as at 12.02.2008



## FLEXIBLE CABLES

- Halogen-free cables ■ Cable track cables
- Servo motor cables ■ ETFE, FEP, PFA cables
  - Bus cables ■ Torsion cables
- Hybrid and special cables ■ Control and connection cables
  - Data cables ■ Besilen® (Silicone) cables
- Compensating and extension cables ■ Tray cables

## TEMPERATURE MEASUREMENT

- Protecting armatures and gauge slides
- Mineral insulated thermocouples and Mineral insulated resistance thermometers
- Temperature measurement in plastic processing industry/Hot runner technique
  - Diesel thermocouples ■ Probe with stainless steel sleeve
    - Temperature measurement in test vehicles
      - Measurement techniques

## CABLE HARNESSING

- Harnessed cables acc. to customer's specification
  - Harnessed cable track cables
  - Helix cables ■ Cable harnesses
- Harnessed motor and transmission cables for Siemens and Indramat drives