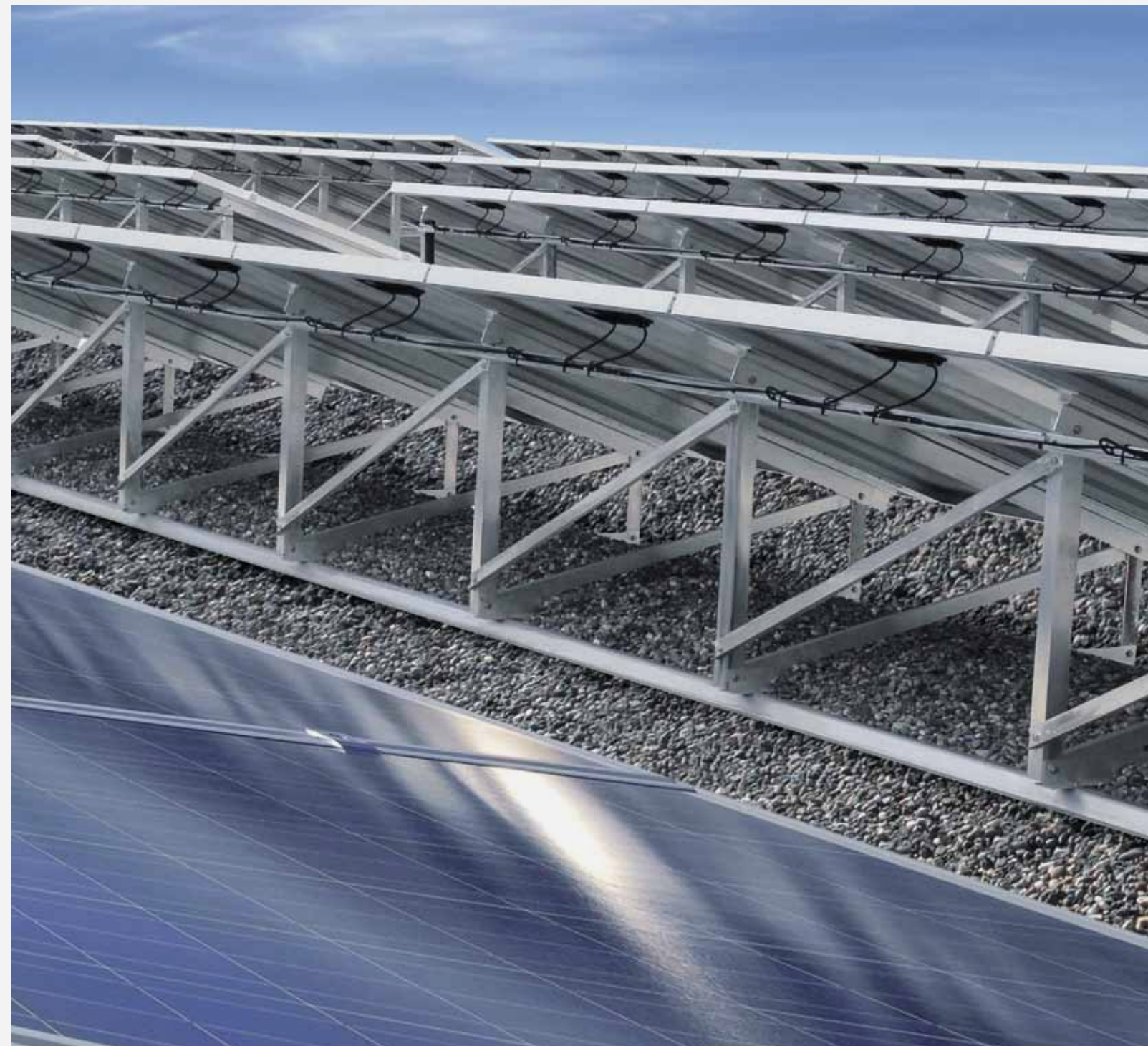


RADOX® SOLAR

Edition 2011



Be energised





Interdisciplinary knowledge

The HUBER+SUHNER Group is a leading international manufacturer of electrical and optical interconnectivity components and systems. Under one roof, we combine technological capabilities in the three core fields of Radio Frequency, Fiber Optics and Low Frequency.

HUBER +SUHNER understands its role as being a partner in the development of innovative solutions meeting specific customer needs and including both individual product solutions and applications using existing components. For this purpose, our engineers combine components into a solution in an expert manner so that the design requirements and all technical specifications are fulfilled.

Content

| | |
|-----------------------------|----|
| Introduction | 6 |
| RADOX® SOLAR junction boxes | 9 |
| Customized solutions | 21 |
| RADOX® SOLAR cables | 23 |
| RADOX® SOLAR connectors | 31 |
| Accessories and tools | 39 |
| Technical information | 49 |



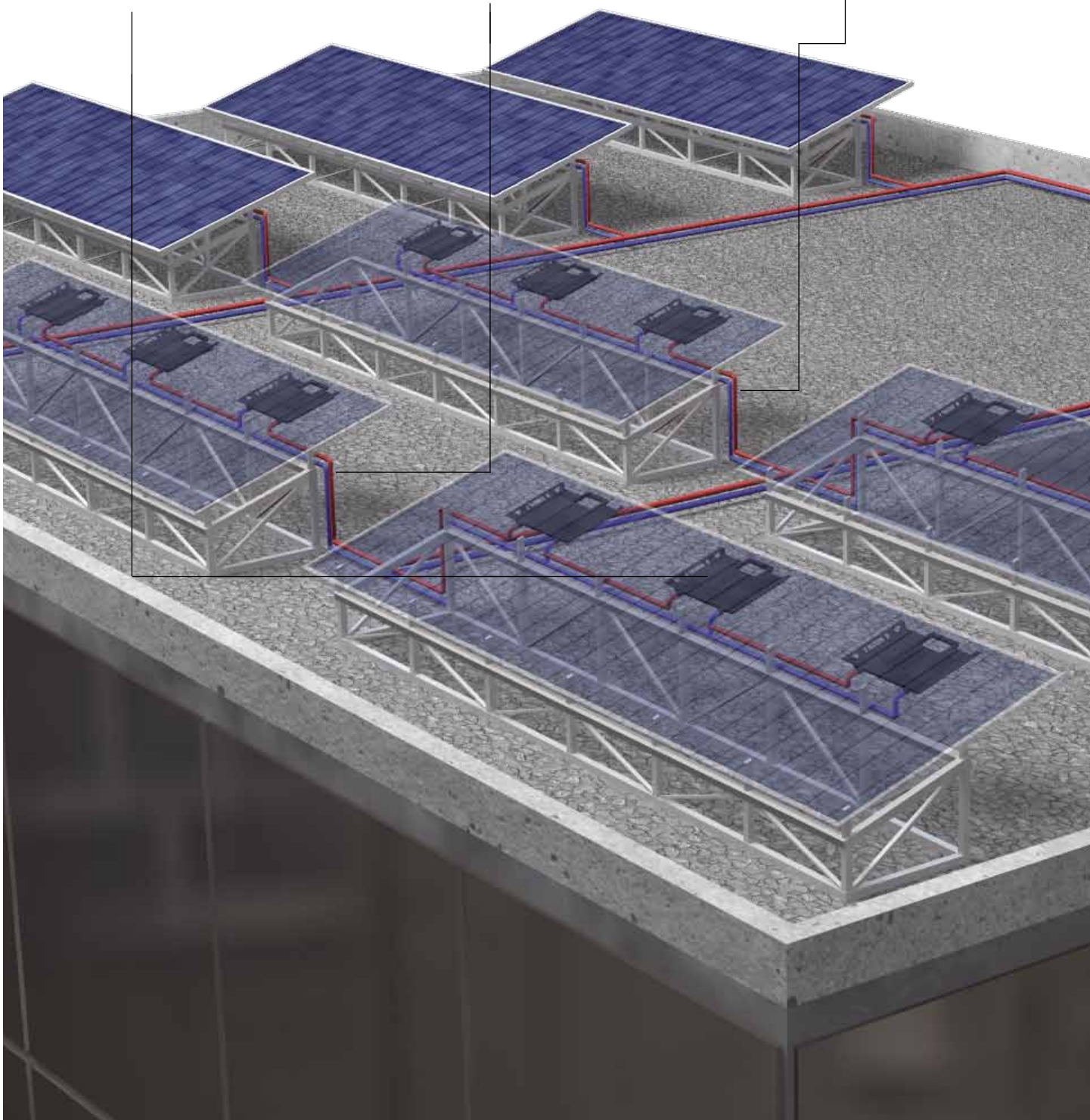
RADOX® SOLAR junction boxes,
page 9 ff



RADOX® SOLAR customized solutions,
page 21 ff



RADOX® SOLAR connectors,
page 31 ff



RADOX® SOLAR system solutions



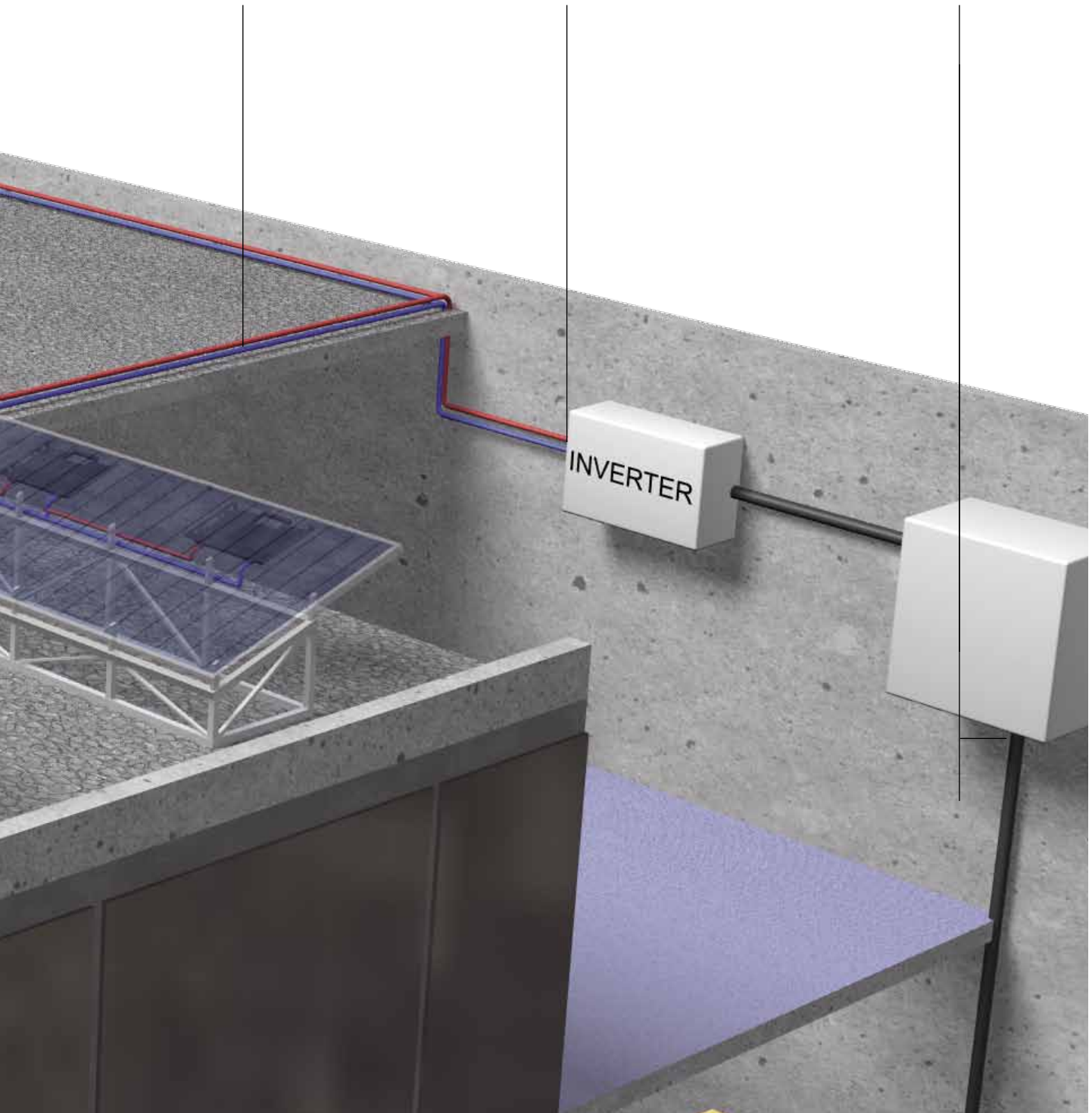
RADOX® SOLAR cables,
page 23 ff



RADOX® SOLAR accessories and tools,
page 39 ff



RADOX® wires and cables for
industrial applications, see
catalogue item no. 84047253





patented

All our PV junction boxes fully comply with the European directives 76/769/EWG, 2003/11/EG, 2000/53/EG, 2003/53/EG and 2002/95/EG (RoHS) and the requirements of REACH Nr. EC1907/2006.



RADOX® SOLAR junction Boxes

PV SOLAR junction boxes are important components in solar systems. They provide the electrical interconnections between the modules and protect the cells from damage. They contribute significantly to the high performance and long service life of such installations. High life expectancy, adverse environmental influences and wide temperature and humidity fluctuations place rigorous demands on the design, materials and workmanship of junction boxes.

We develop, produce and sell junction boxes designed for applications in the PV SOLAR industry. In our in-house chemical, mechanical and electrical laboratories, we test the influences of the materials for their suitability. Besides testing the mechanical, electrical and chemical resistance, we also especially subject the junction boxes to aging tests in order to ensure their reliable performance throughout their life cycle.

In cooperation with our customers, we continuously develop new, innovative solar boxes which are optimally tailored to customers' needs. The focus of our process-integrated solutions for processes allowing automation is especially on quick, easy and dependable installation at customers' sites, in addition to high quality and reliability.

General features

- Easy handling, quick assembly
- For manual assembling and fully automated assembly lines
- Reliable, flat design
- Excellent heat dissipation (away from the module)
- Designed according to the new IEC 61215 and 61730 requirements



| | |
|---------------------------|----|
| RADOX® SolarBox HA3 | 10 |
| RADOX® SolarBox RH3 | 12 |
| RADOX® SolarBox HF0 / HF1 | 14 |
| RADOX® SolarBox HO1 | 16 |
| RADOX® SolarBox NS3 | 18 |



RADOX® SolarBox HA3

Junction box for high performance modules



patented



Applications

- High performance crystalline PV modules.

Benefits

- Outstanding heat dissipation away from the module and thermal separation between box and module (patented)
- Low forward voltage drop through
 - large conductors cross section
 - excellent contacting (welding) of wires
 - connectors with lamella spring contact
- Reliable, flat design
- Defined glueing/sealing area for mounting on panel - distance pins and glue groove for controlled application and defined sealing gap
- Quick, clean potting by direct injection; suited for automation
- Reduction of handling and assembly time
- Maintenance free during the complete life cycle
- RADOX® - for highest quality



RADOX® SolarBox HA3

Junction box for high performance modules

Approvals

- DIN V VDE V 0126-5:2008-5 (TÜV Rheinland; certificate no. R 2210086)
- UL 1703 (CSA, certificate no. 2059270)

Ordering information

| Product description | Item no. |
|----------------------------------|----------|
| SolarBox HA3 (TÜV certified) | 12720100 |
| SolarBox HA3 (TÜV/CSA certified) | 12720126 |
| Cover for SolarBox HA3 | 12720205 |

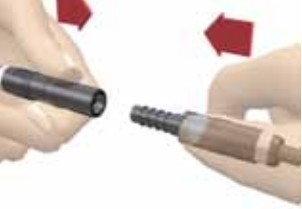
Technical data

| Electrical data | 12720100 | 12720126 |
|---------------------------------------|-------------|-------------|
| Rated voltage | 1000 V DC | 600 V DC |
| Max. blocking voltage per diode | ≤ 45 V DC | ≤ 45 V DC |
| Rated current (I _{sc}) | 14.0 A | 10.0 A |
| Test current (I _{sc} x 1.25) | 17.5 A | 12.5 A |
| Use of diode | bypass mode | bypass mode |

| Physical/mechanical data | |
|---|---|
| Overall dimensions (box only) | 201 x 141 x 19.7 mm (length x width x height) |
| Number of terminals | 4 |
| Dimensions of ribbons | 6 mm ± 1 mm |
| Distance between ribbons | 12 mm |
| Contact carrier of terminal | copper plate tin coated |
| Contact principle for copper ribbons | soldering |
| Cable 4 mm ² , 1000 mm length each | 2 x RADOX® SOLAR cable (TÜV) 2 x RADOX® SOLAR SMART (TÜV/UL) |
| Connectors | RADOX® SOLAR connectors 4 mm ² twist lock |

| Environmental data | |
|-----------------------|-------------------------|
| Temperature range | -40 °C to +85 °C |
| Chemical resistance | UV- and ozone resistant |
| Protective insulation | protection type II |
| Protection mode | IP 67 |

| Material data | |
|---------------|--|
| PPE + PS - HI | |



RADOX® SolarBox RH3

Junction box for high performance modules



patented



Applications

- High performance crystalline PV modules

Benefits

- Thermal separation between box and module ensures high performance over the whole lifetime (patented)
- Low forward voltage drop through:
 - large conductor cross section
 - excellent contacting (welding) of wires
 - connectors with lamella spring contact
- Typically 0.5 % more power output than other junction boxes
- Defined glueing/sealing area for mounting on panel - distance pins and glue groove for controlled application and defined sealing gap
- Quick, clean potting by direct injection; suited for automation
- Reduction of handling and assembly time
- Maintenance free during the complete life cycle
- RADOX® - for highest quality



RADOX® SolarBox RH3

Junction box for high performance modules

Approvals

- DIN V VDE V 0126-6/05.08 (TÜV Rheinland; certificate no. R 60024970)
- UL 1703 (UL; certificate no Q1102.E252114)

Ordering information

| Description | Item no. |
|---------------------------------|----------|
| SolarBox RH3 (TÜV certified) | 12720111 |
| SolarBox RH3 (TÜV/UL certified) | 12720119 |

Technical data

| Electrical data | 12720111 | 12720119 |
|---------------------------------------|-------------|-------------|
| Rated voltage | 1000 V DC | 600 V DC |
| Max. blocking voltage per diode | ≤ 45 V DC | ≤ 45 V DC |
| Rated current (I_{sc}) | 10.0 A | 10.0 A |
| Test current ($I_{sc} \times 1.25$) | 12.5 A | 12.5 A |
| Use of diode | bypass mode | bypass mode |

| Physical/mechanical data | |
|---|---|
| Overall dimensions (box only) | 129 x 94 x 16 mm (length x width x height) |
| Number of terminals | 4 |
| Dimensions of ribbons | 6 mm ± 1 mm |
| Distance between ribbons | 12 mm |
| Contact carrier of terminal | copper plate tin coated |
| Contact principle for copper ribbons | soldering |
| Cable 4 mm ² , 1000 mm length each | 2 x RADOX® SOLAR cable (TÜV) 2 x RADOX® SOLAR SMART (TÜV/UL) |
| Connectors | RADOX® SOLAR connectors 4 mm ² twist lock |

| Environmental data | |
|-----------------------|-------------------------|
| Temperature range | -40 °C to +85 °C |
| Chemical resistance | UV- and ozone resistant |
| Protective insulation | protection type II |
| Protection mode | IP 67 |

| Material data | |
|---------------|--|
| PPE + PS - HI | |



RADOX® SolarBox HF0 / HF1

Twin junction box for thin film PV modules



Applications

- Thin film PV modules
- Suitable for bypass or blocking mode

Benefits

- Low forward voltage drop through
 - excellent contacting (welding or soldering) of all components
 - connectors with lamella spring contact
 - balance of system
- Outstanding moisture barrier due to potting
- Quick, clean potting by direct injection
- Ready for automation
- Minimised handling and assembly time
- Increased life time due to complete sealing and improved heat dissipation
- Unique twin design for sophisticated module architecture
- RADOX® - for highest quality



RADOX® SolarBox HF0 / HF1

Twin junction box for thin film PV modules

Approvals

- Comply with: IEC 61730, IEC 61646
- Designed according to: DIN V VDE V 0126-5/05.08

Ordering information

| Description | Item no. |
|-------------------------|----------|
| With low voltage diode | 12720104 |
| With high voltage diode | 12720121 |

Technical data

| Electrical data | 12720104 | 12720121 |
|----------------------------|--------------------------|--------------------------|
| Rated voltage | 1000 V DC | 1000 V DC |
| Bypass voltage (typical) | < 150 V DC | < 1000 V DC |
| Blocking voltage (typical) | < 150 V DC | < 1000 V DC |
| Rated current (typical) | 6.0 A | 4.5 A |
| Test current (typical) | 8.5 A | 5.0 A |
| Diode HF0 | no | no |
| Diode HF1 | yes | yes |
| Use of diode | bypass or blocking mode* | bypass or blocking mode* |

*Please note: The design configurations between bypass and blocking mode are different

| Physical/mechanical data | |
|--|---|
| Overall dimensions (box only) | 68 x 54 x 11 mm (length x width x height) |
| Number of terminals | 2 each box |
| Dimensions of ribbons | < 6 mm |
| Distance between ribbons | 4 to 10 mm |
| Contact carrier of terminal | copper plate tin coated |
| Contact principle for copper ribbons | soldering or welding |
| Cable 2.5 mm ² , 300 mm length each | 2 x RADOX® SOLAR cable |
| Connectors | RADOX® SOLAR connectors 2.5 mm ² push-pull |

| Environmental data | |
|-----------------------|-------------------------|
| Temperature range | -40 °C to +85 °C |
| Chemical resistance | UV- and ozone resistant |
| Protective insulation | protection type II |
| Protection mode | IP 67 |

| Material data | |
|---------------|--|
| PPE + PS - HI | |



RADOX® SolarBox HO1

Junction box for thin film PV modules



Applications

- Thin film PV modules
- Low power crystalline PV modules

Benefits

- Low forward voltage drop through
 - excellent contacting (welding or soldering) of all components
 - connectors with lamella spring contact
- Outstanding moisture barrier due to potting
- Quick, clean potting by direct injection
- Ready for automation
- Minimised handling and assembly time
- Increased life time due to complete sealing and improved heat dissipation and thermal resistance
- Outstanding resistance to harsh environments
- Unique flat design for sophisticated module architecture
- RADOX® - for highest quality



RADOX® SolarBox HO1

Junction box for thin film PV modules

Approvals

- Comply with: IEC 61730, IEC 61646
- In process: DIN V VDE V 0126-5/05.08, UL1703

Ordering information

| Description | Item no. |
|-------------------------|----------|
| With low voltage diode | 12720108 |
| With high voltage diode | 84121410 |

Technical data

| Electrical data | 12720108 | 84121410 |
|---------------------------------------|-------------|-------------|
| Rated voltage | 1000 V DC | 1000 V DC |
| Bypass voltage (typical) | < 170 V DC | < 1000 V DC |
| Rated current (I_{sc}) | 10.0 A | 4.5 A |
| Test current ($I_{sc} \times 1.25$) | 12.5 A | 8.75 A |
| Use of diode | bypass mode | bypass mode |

Physical/mechanical data

| | |
|--|---|
| Overall dimensions (box only) | 50 x 48 x 11 mm (length x width x height) |
| Number of terminals | 2 |
| Dimensions of ribbons | < 6 mm |
| Distance between ribbons | 5 to 16 mm |
| Contact carrier of terminal | copper plate tin coated |
| Contact principle for copper ribbons | soldering or welding |
| Cable 2.5 mm ² , 800 mm length each | 2 x RADOX® SOLAR cable |
| Connectors | RADOX® SOLAR connectors 2.5 mm ² push-pull |

Environmental data

| | |
|-----------------------|-------------------------|
| Temperature range | -40 °C to +85 °C |
| Chemical resistance | UV- and ozone resistant |
| Protective insulation | protection type II |
| Protection mode | IP 67 |

Material data

| | |
|-----|--|
| PPS | |
|-----|--|



RADOX® SolarBox NS3

Junction box with integrated electronic



patented



Application

- The NS3 junction box is designed for high performance applications and it is constructed with the MPPT (maximum power point tracking) functionality of National Semiconductor's SolarMagic™ power optimizer built inside.

Benefits

- The junction box integrated power optimizer reclaims up to 75% of the energy lost due to environmental and system mismatch (e.g. trees, clouds, module aging, etc.)
- Outstanding heat dissipation away from the module and thermal separation between box and module (patent pending)
- Its compact form factor with thin profile easily integrate into modules with 25 mm frames
- Low forward voltage drop through
 - welding or soldering of all components
 - connectors with lamella spring contact
 - balance of system
- Outstanding moisture barrier due to potting
- Quick, clean potting by direct injection
- Ready for automation process
- Maintenance free throughout the complete life cycle
- RADOX® - for highest quality



RADOX® SolarBox NS3

Junction box with integrated electronic

Approvals

- DIN V VDE 0126-5:2008 (TÜV Rheinland PTL)
- UL1703 (TÜV Rheinland PTL)

Ordering information

| Description | Item no. |
|--------------|----------|
| SolarBox NS3 | 84103381 |

Technical data

| Electrical data | |
|--------------------------|--|
| Rated voltage | 600/1000 V DC |
| Voltage per string/diode | max. 35 V |
| Rated current | 11.0 A (according to IEC 61215 in bypass mode) |
| Test current | 12.5 A (according to IEC 61215) |

| Physical/mechanical data | |
|---|--|
| Overall dimensions (box only) | 260 x 129 x 22 mm (length x width x height) |
| Number of terminals | 4 |
| Dimensions of ribbons | 6 mm ± 1 mm |
| Distance between ribbons | 12 mm |
| Contact carrier of terminal | copper plate tin coated |
| Contact principle for copper ribbons | soldering |
| Cable 4 mm ² , 1000 mm length each | 2 x RADOX® SOLAR cable (TÜV) 2 x RADOX® SMART (TÜV/UL) 2 x RADOX® Solarlink (UL) |
| Connectors | RADOX® SOLAR connectors 4 mm ² twist lock |

| Environmental data | |
|-----------------------|-------------------------|
| Temperature range | -40 °C to +85 °C |
| Chemical resistance | UV- and ozone resistant |
| Protective insulation | protection type II |
| Protection mode | IP 67 |

| Material data | |
|---------------|--|
| PPE + PS - HI | |



RADOX® SOLAR example of a string-line



RADOX® SOLAR customized solutions

HUBER+SUHNER develops and produces customized solutions. From the module to the inverter we offer high performance connectivity solutions for the DC side of photovoltaic applications. Our products guarantee a durable energy transmission and low power losses during the entire life cycle.

High quality, reliability, quick assembly of the module and easy outdoor handling is standard for our products.

The optimized design ensures high safety in your manufacturing process and offers low cost of ownership. Your benefit is our worldwide support and logistic which suits the specific needs of our customers.

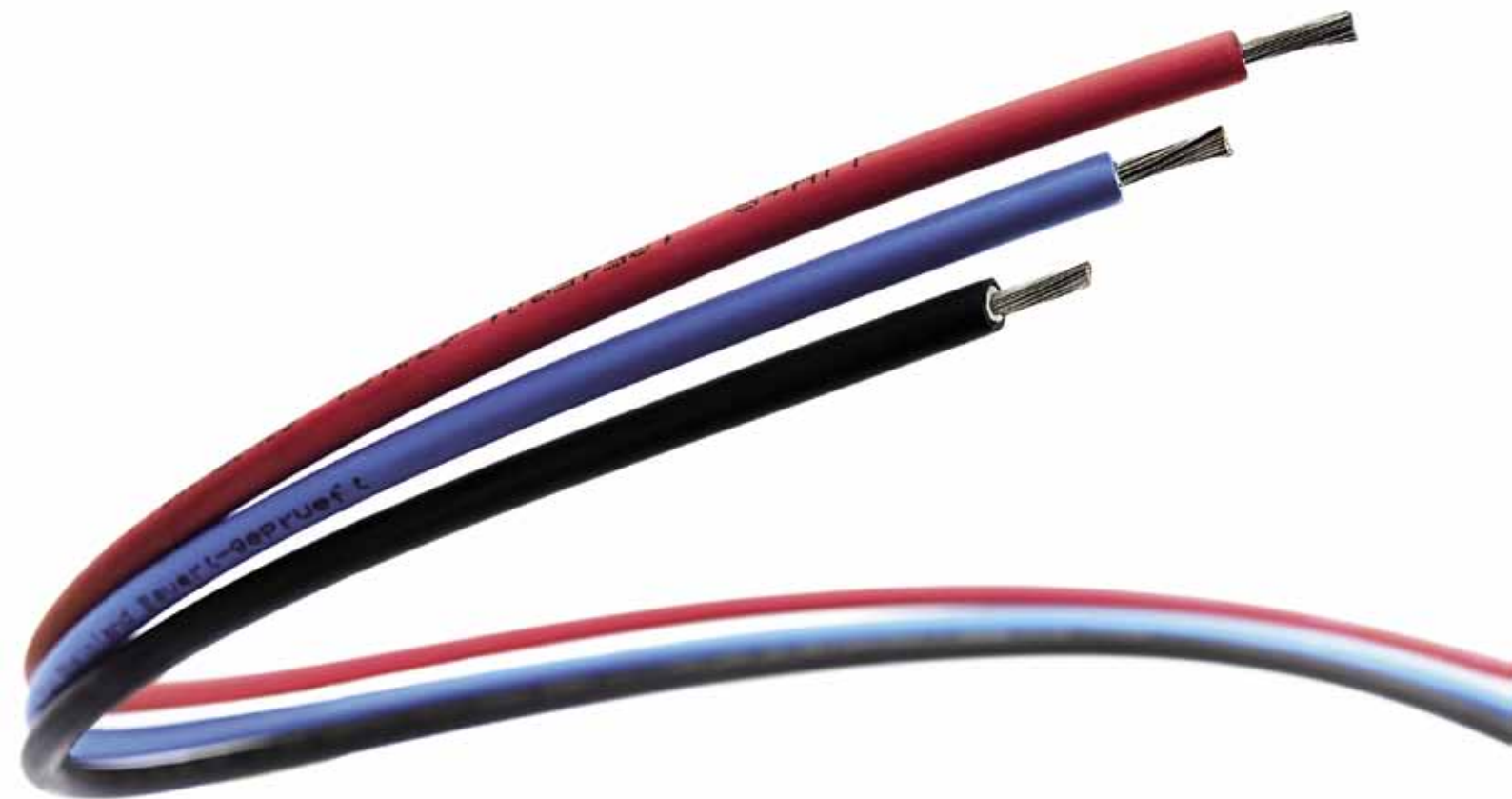
PV SOLAR junction boxes, cables and connectors are important components in a solar installation. They provide the electrical interconnections between the modules and the power inverters. They contribute significantly to the high performance and long service life of such installations. High life expectancy, adverse environmental influences and wide temperature and humidity fluctuations place rigorous demands on the design, materials, and workmanship of cable assemblies.

HUBER+SUHNER solar cables and connectors are carefully matched. They have been specially developed for use in PV installations and have proven their high worth during years of service.

HUBER+SUHNER produces cable assemblies to your specifications.

General features

- Reduction of handling and assembly time
- Fail safe
- Maintenance free during the complete life cycle
- Pre-assembled cables with connectors for installation
- Pre-assembled cable sets for interconnecting modules
- Pre-assembled adapter sets
- String coupling lines
- Pre-assembled cables with connectors for module production
- Pre-assembled cables, connectors and junction boxes for module production
- RADOX® - for highest quality



All our cables fully comply with the European directives 76/769/EWG, 2003/11/EG, 2000/53/EG, 2003/53/EG and 2002/95/EG (RoHS) and the requirements of REACH Nr. EC1907/2006.



RADOX® SOLAR Cables

RADOX® SOLAR cable means flexible single and multi-core cables specially designed for wiring solar plants.

RADOX® SOLAR cables are extremely robust and resist high mechanical load and abrasion. High temperature resistance and excellent weather-proofing characteristics provide a long service life. Due to RADOX® technology, these outstanding properties have been achieved with small cable diameters.

Tight production tolerances – specifically for automated processes – enable easy assembly of cables. This represents a special advantage for molding, casting or soldering with no shrinking or other changes in electron-beam cross-linked material. There is no cold flow with RADOX® cables which guarantees long-term, optimum tightness for connectors or transitions. In case of fire there is no occurrence of corrosive or toxic gases. Smoke production in case of fire is very low.

General features

- Temperature range for applications -40 °C to +120 °C
- RADOX® electron-beam cross-linked materials do not melt or flow, even at high temperatures
- High resistance against UV-, ozone- and hydrolyses
- Very high mechanical robustness and resistance against water, oil and chemicals
- Compact and flexible
- Years of approved applications worldwide
- TÜV und UL approval

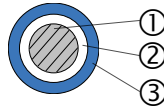
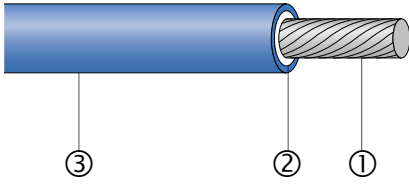


| | |
|--------------------------------|----|
| RADOX® SOLAR cable single core | 24 |
| RADOX® SMART | 26 |
| RADOX® SolarLink | 28 |



RADOX® SOLAR Cable

single core cable



- TÜV approval, PV1-F
- Double insulated construction (safety class II)
- Space saving outer diameter
- Long service life, extremely robust
- Electronbeam, cross-linked insulation and sheath
- High resistance against heat, cold, oil, abrasion, ozone, UV and weather
- Halogen free, flame retardant
- Flexible, easy to strip
- Meter marking - easy installation

Application

Specifically designed for connecting photovoltaic system components inside and outside of buildings and equipment with high mechanical requirements and extreme weather conditions. For permanent installations.

Composition of cable

| | |
|--------------|---|
| ① Conductor | stranded tin plated copper, fine wired, acc. to EN 60228, class 5 |
| ② Insulation | RADOX® 125 |
| ③ Sheat | RADOX® 125 |
| Colours | see table |

Technical data

Conductor resistance at 20 °C

TÜV:

| | |
|-------------------------------------|-----------------|
| see table | |
| voltage rating line to ground | U_o 600 V AC |
| voltage rating line to line | U 1000 V AC |
| maximum voltage line to ground | 720 V AC |
| maximum voltage line to line | U_m 1200 V AC |
| maximum voltage line to ground | V_o 900 V DC |
| maximum voltage line to line | 1800 V DC |
| test voltage AC | 6.5 kV |
| test voltage DC | 15 kV |
| lower ambient temperature | -40 °C |
| upper ambient temperature | +90 °C |
| max. conductor temperature 20'000 h | +120 °C |

Min. bending radius

4 x cable-Ø



RADOX® SOLAR Cable

single core cable

Complies with:

| | | |
|---------------------------------|------------------------|-----------------------------|
| Vertical flame spread | 50 < L ≤ 540 mm | EN 60332-1-2, IEC 60332-1-2 |
| Corrosivity of combustion gases | pH ≥ 4.3, σ ≤ 10 μS/mm | EN 50267-2-2, IEC 60754-2 |
| Amount of halogen acid gas | HCl + HBr ≤ 0.5% | EN 50267-2-1, IEC 60754-1 |
| Content of fluorine | HF ≤ 0.1 % | EN 60684-2, 45.2 |
| Acid and alkaline resistance | 168 h / 23 °C | EN 60811-2-1, 10 |
| Wheather resistance | 720 h | EN ISO 4892-2, Meth. A |
| RoHS Directive | fulfilled | 2002/95/EC |

Approvals

| | | |
|-----------------|--------------------------------------|---|
| * TÜV Rheinland | Wires for photovoltaic-systems PV1-F | 2 Pfg 1169/08.07, certificate no. R60024042 |
|-----------------|--------------------------------------|---|

Extract from our delivery programme

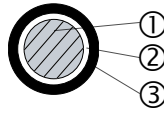
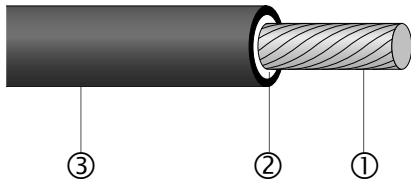
| Cross section mm ² | Conductor | | Cable diameter mm | Conductor resistance R ₂₀ max. Ω/km | Weight kg/100m | Colour | Item no. |
|----------------------------------|------------------------|--------------|----------------------|--|-------------------|--------|----------|
| | Construction n x mm | d mm | | | | | |
| 1.5 | 30 x 0.25 | 1.52 ± 0.05 | 4.3 ± 0.15 | 13.7 | 3.2 | black | 12558072 |
| 2.5* | 48 x 0.25 | 2.01 ± 0.05 | 5.2 ± 0.15 | 8.21 | 4.6 | red | 12529712 |
| 2.5* | 48 x 0.25 | 2.01 ± 0.05 | 5.2 ± 0.15 | 8.21 | 4.6 | blue | 12529713 |
| 2.5* | 48 x 0.25 | 2.01 ± 0.05 | 5.2 ± 0.15 | 8.21 | 4.6 | black | 12529714 |
| 4.0* | 56 x 0.30 | 2.54 ± 0.05 | 5.8 ± 0.15 | 5.09 | 6.6 | red | 12545801 |
| 4.0* | 56 x 0.30 | 2.54 ± 0.05 | 5.8 ± 0.15 | 5.09 | 6.6 | blue | 12537896 |
| 4.0* | 56 x 0.30 | 2.54 ± 0.05 | 5.8 ± 0.15 | 5.09 | 6.6 | black | 12545802 |
| 6.0* | 81 x 0.30 | 3.30 ± 0.10 | 6.9 ± 0.20 | 3.39 | 9.2 | red | 12568182 |
| 6.0* | 81 x 0.30 | 3.30 ± 0.10 | 6.9 ± 0.20 | 3.39 | 9.2 | blue | 12568183 |
| 6.0* | 81 x 0.30 | 3.30 ± 0.10 | 6.9 ± 0.20 | 3.39 | 9.2 | black | 12552756 |
| 10 | 78 x 0.40 | 4.30 ± 0.10 | 8.1 ± 0.15 | 1.95 | 14.4 | black | 12537897 |
| 16 | 119 x 0.40 | 5.30 ± 0.10 | 9.5 ± 0.20 | 1.24 | 21.0 | black | 12567377 |
| 25 | 182 x 0.40 | 6.60 ± 0.10 | 11.1 ± 0.20 | 0.779 | 29.6 | black | 12567378 |
| 35 | 266 x 0.40 | 7.80 ± 0.10 | 12.8 ± 0.25 | 0.565 | 41.7 | black | 12567379 |
| 50 | 378 x 0.40 | 9.30 ± 0.10 | 15.0 ± 0.25 | 0.393 | 60.2 | black | 12567380 |
| 70 | 348 x 0.50 | 11.40 ± 0.10 | 17.5 ± 0.30 | 0.277 | 80.8 | black | 12567381 |
| 95 | 444 x 0.50 | 12.80 ± 0.10 | 19.3 ± 0.30 | 0.210 | 103.1 | black | 12567382 |
| 120 | 551 x 0.50 | 14.60 ± 0.10 | 21.8 ± 0.30 | 0.164 | 126.0 | black | 12567383 |
| 150 | 722 x 0.50 | 16.80 ± 0.10 | 24.4 ± 0.30 | 0.132 | 161.7 | black | 12567384 |

Other cross sections and colours on request.



RADOX® SMART

single core cable



- With UL and TÜV approvals
- Double insulated construction (safety class II)
- For all climate zones
- For reliable and durable connections
- Halogen free, flame retardant
- Lean, powerful and flexible
- Of proven RADOX® quality
- Meter marking – easy installation

Composition of cable

- ① Conductor
- ② Inner insulation
- ③ Outer insulation
Colour

stranded tin plated copper, fine wired, acc. to EN 60228, class 5
 RADOX® FI
 RADOX® FS
 black

Technical data

| | | |
|------------------------|-------------------------------------|---|
| UL: | voltage rating | 600 V AC |
| | test voltage | 3.0 kV AC |
| | temperature rating | 90 °C wet or dry, sunlight resistant |
| TÜV: | voltage rating line to ground | U_o 600 V AC |
| | voltage rating line to line | U 1000 V AC |
| | maximum voltage line to ground | 720 V AC |
| | maximum voltage line to line | U_m 1200 V AC |
| | maximum voltage line to ground | V_o 900 V DC |
| | maximum voltage line to line | 1800 V DC |
| | test voltage AC | 6.5 kV |
| | test voltage DC | 15 kV |
| | lower ambient temperature | -40 °C |
| | upper ambient temperature | +90 °C |
| | max. conductor temperature 20'000 h | +120 °C |
| Minimum bending radius | 4 x cable-Ø | |

Application

United States:

- Type PV: Suitable for interconnection wiring of grounded and ungrounded photovoltaic power systems as described in section 690.31 (A) and other parts of the National Electrical Code (NEC), NFPA 70. For single conductor, double insulated wires installation without using a conduit is permitted according to section 690.35 (D) of the NEC.
- Type RHH oder RHW-2: Suitable for any of the wiring methods recognised in chapter 3 and as specified in their respective tables or as permitted elsewhere in the NEC.

Europe:

- Suitable for the installation methods reference no. 2, 3A, 4A, 5A, 11, 11A, 12, 13, 14, 15, 16, 21, 22A, 23A, 24A, 25, 31A, 32A, 33A, 41, 43, 51, 72, 73, 75 in table 52H of HD 384.5.52 (CH: SEV 1000 section 5.2; DE: DIN VDE 0100-520).



RADOX® SMART

single core cable

Complies with:

| | | |
|---------------------------------|--|-----------------------------|
| Vertical FT1 | $L \leq 250 \text{ mm}, T \leq 60 \text{ s}$ | UL 1581 # 1060 |
| Vertical flame spread | $50 < L \leq 540 \text{ mm}$ | EN 60332-1-2, IEC 60332-1-2 |
| Corrosivity of combustion gases | $\text{pH} \geq 4.3, \sigma \leq 10 \mu\text{S}/\text{mm}$ | EN 50267-2-2, IEC 60754-2 |
| Amount of halogen acid gas | $\text{HCl} + \text{HBr} \leq 0.5\%$ | EN 50267-2-1, IEC 60754-1 |
| Content of fluorine | $\text{HF} \leq 0.1 \%$ | EN 60684-2, 45.2 |
| Acid and alkaline resistance | 168 h / 23 °C | EN 60811-2-1, 10 |
| Wheather resistance | 720 h | EN ISO 4892-2, Meth. A |
| RoHS Directive | fulfilled | 2002/95/EC |

Approvals

| | | |
|---------------|--------------------------------------|---|
| UL | Photovoltaic Wire | Type PV, UL subject 4703, UL listed E305787 |
| UL | Thermoset-insulated Wires and Cables | Type RHH and RHW-2, UL 44, listed E310273 |
| TÜV Rheinland | Wires for photovoltaic-systems | 2 Pfg 1169/08.07, certificate R60026135 |

Extract from our delivery programme

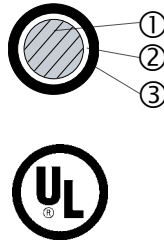
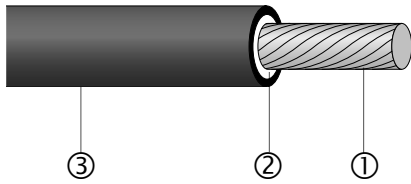
| Cross section | | Conductor | | Conductor resistance | Cable dia. | Weight | Item no. |
|---------------|-----------------|-------------------------|-------------------------|------------------------------|-------------|----------|----------|
| AWG | mm ² | Construction. n x mm | d _{nom.} mm | R ₂₀ max. Ω/km | mm | kg/100 m | |
| 14 | 2.5 | 48 x 0.26 | 2.0 | 8.21 | 5.35 ± 0.10 | 5.1 | 12583222 |
| 12 | 4.0 | 61 x 0.29 | 2.5 | 5.09 | 6.05 ± 0.15 | 7.1 | 12583780 |
| 10 | 6.0 | 82 x 0.30 | 3.2 | 3.39 | 7.15 ± 0.15 | 9.9 | 12583781 |

Other cross sections and colours on request.



RADOX® SolarLink

single core cable



- UL approval, TÜV tested
- Higher temperature rating as PV1-F
- Double insulated construction (safety class II) allows for installation without a conduit
- Smaller outer diameter
- Of proven RADOX® quality
- Very flexible
- Meter marking – easy installation

Composition of cable

- ① Conductor
- ② Inner insulation
- ③ Outer insulation
Colour

stranded tin plated copper, fine wired, acc. to EN 60228, class 5
 RADOX® 155
 RADOX® 155
 black

Technical data

| | | |
|------------------------|-------------------------------------|---|
| UL: | voltage rating | 600 V AC |
| | test voltage AC | 3.0 kV AC |
| | temperature rating | 90 °C wet or dry, sunlight resistant |
| TÜV: | voltage rating line to ground | U _o 600 V AC |
| | voltage rating line to line | U 1000 V AC |
| | maximum voltage line to ground | 720 V AC |
| | maximum voltage line to line | U _m 1200 V AC |
| | maximum voltage line to ground | V _o 900 V DC |
| | maximum voltage line to line | 1800 V DC |
| | test voltage AC | 6.5 kV |
| | test voltage DC | 15 kV |
| | lower ambient temperature | -40 °C |
| | upper ambient temperature | +90 °C |
| | max. conductor temperature 20'000 h | +130 °C |
| Minimum bending radius | 4 x cable-Ø | |

Application

United States:

- Type PV: suitable for interconnection wiring of grounded and ungrounded photovoltaic power systems as described in section 690.31 (A) and other parts of the National Electrical Code (NEC), NFPA 70.
For single conductor, double insulated wires installation without using a conduit is permitted according to section 690.35 (D) of the NEC.
- Type RHH or RHW-2: suitable for use in any of the wiring methods recognized in chapter 3 and as specified in their respective tables or as permitted elsewhere in the NEC.

Europe:

- suitable for the installation methods reference no. 2, 3A, 4A, 5A, 11, 11A, 12, 13, 14, 15, 16, 21, 22A, 23A, 24A, 25, 31A, 32A, 33A, 41, 43, 51, 72, 73, 75 given in table 52H of HD 384.5.52 (CH: SEV 1000 cl. 5.2; DE: DIN VDE 0100-520).



RADOX® SolarLink

single core cable

Complies with:

| | | |
|------------------------------|--|-----------------------------|
| Vertical FT1 | $L \leq 250 \text{ mm}, T \leq 60 \text{ s}$ | UL 1581 # 1060 |
| Vertical flame spread | $50 < L \leq 540 \text{ mm}$ | EN 60332-1-2, IEC 60332-1-2 |
| Acid and alkaline resistance | 168 h / 23 °C | EN 60811-2-1, 10 |
| Weather resistance | 720 h | EN ISO 4892-2, Meth. A |
| RoHS directive | fulfilled | 2002/95/EC |

Approvals and reports

| | | |
|---------------|--------------------------------------|--|
| UL | Photovoltaic Wire | Type PV, UL subject 4703, UL listed E305787 |
| UL | Thermoset-insulated wires and cables | Type RHH and RHW-2, UL 44, UL listed E310273 |
| TÜV Rheinland | Wires for photovoltaic-systems | Report no. 21139372-002F |

Extract from our delivery programme

| Cross section | | Conductor | | Conductor resistance | Cable | Weight | Item no. |
|---------------|-----------------|-------------------------|-------------------------|------------------------------|-------------|----------|----------|
| AWG | mm ² | Construction. n x mm | d _{nom.} mm | R ₂₀ max. Ω/km | dia. mm | kg/100 m | |
| 14 | 2.5 | 48 x 0.26 | 2.0 | 8.21 | 5.35 ± 0.10 | 5.1 | 12582664 |
| 12 | 4.0 | 56 x 0.30 | 2.5 | 5.09 | 6.05 ± 0.10 | 7.1 | 12582665 |
| 10 | 6.0 | 82 x 0.30 | 3.2 | 3.39 | 7.15 ± 0.15 | 9.9 | 12583784 |

Other cross sections and colours on request.



All our connectors and cables fully comply with the European directives 76/769/EWG, 2003/11/EG, 2000/53/EG, 2003/53/EG and 2002/95/EG (RoHS) and the requirements of REACH Nr. EC1907/2006



RADOX® SOLAR Connectors

RADOX® SOLAR connectors of HUBER+SUHNER consist of a housing and contact element. Lamella contacts made of high quality copper beryllium are responsible for the high current carrying capacity of the connectors.

Without a lamella contact these advantages cannot be achieved. The lamella contact as a flexible element provides mechanical compensation between socket and pin. The lamella produces a large contact surface between the elements and guarantees a low, constant transition resistance.

All RADOX® SOLAR connectors are intercompatible.

General features

- Small dimensions
- Corrosion resistance
- High contact security
- High mechanical endurance (impact resistance)
- Low, constant transition resistance
- High current carrying capacity



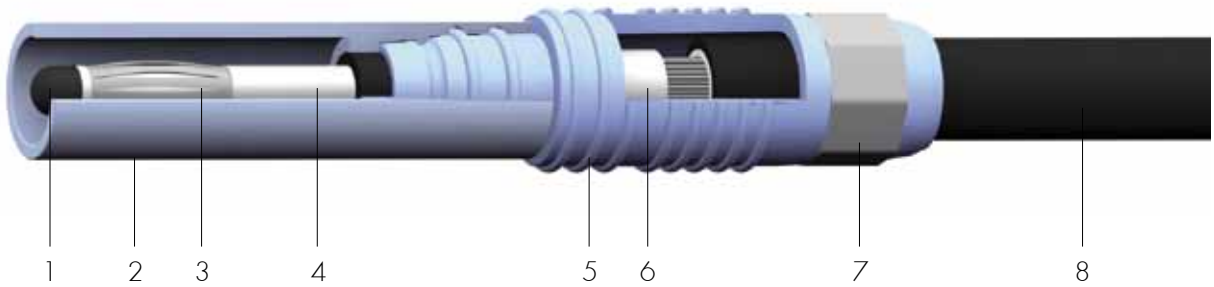
| | |
|---|----|
| Principle of the RADOX® SOLAR connectors | 32 |
| RADOX® SOLAR connector 2.5 mm ² push-pull | 33 |
| RADOX® SOLAR connector 4 mm ² push-pull | 34 |
| RADOX® SOLAR connector 4 mm ² with integrated twist lock | 35 |
| RADOX® SOLAR connector 6 mm ² with integrated twist lock | 36 |
| RADOX® SOLAR NEC-lock for twist lock connectors | 37 |



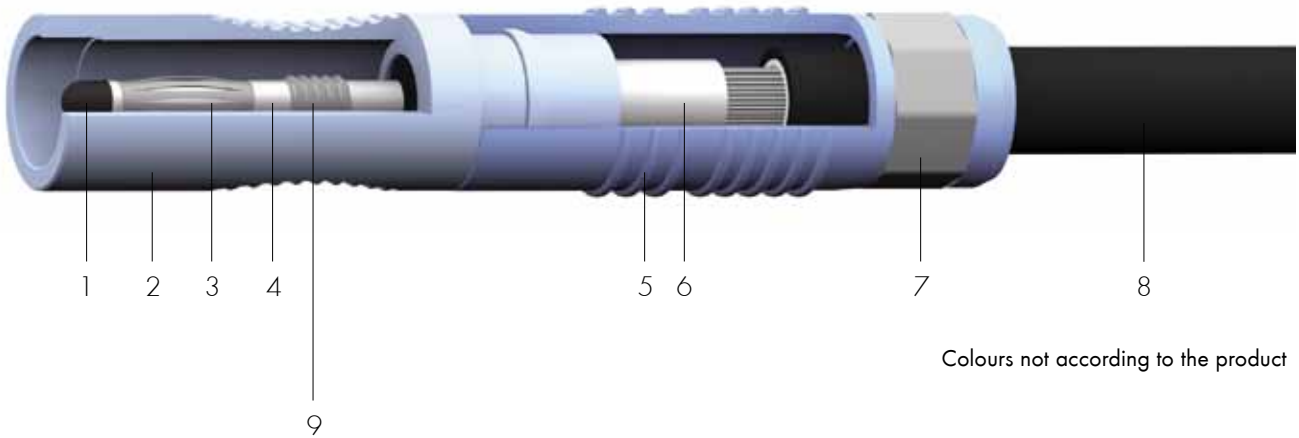
RADOX® SOLAR Connector

Presentation of the contact and construction principle

Connector push-pull



Connector with integrated twist lock



Colours not according to the product

- 1 Protection cap
- 2 Slim plastic connector housing
- 3 Lamella contact
- 4 Solid contact carrier
- 5 Grip hood
- 6 Solid crimp barrel
- 7 Crimp ring
- 8 Cable
- 9 Twist lock providing additional electrical connection



RADOX® SOLAR Connector push-pull 2.5 mm²



- Small profile
- High current carrying capacity
- Constant low transition resistance
- High mechanical resistance
- UV- and ozone-resistant
- Protection mode IP 67
- Easy assembly



Approvals

- EN 50521:2008 (TÜV Rheinland; certificate: R 60034855)

| Ordering information | Item no. set |
|---|----------------------------------|
| SOLAR connector push-pull 2.5 mm ² male (male plug + grip hood) | 12720820 (package unit 250 pcs.) |
| SOLAR connector push-pull 2.5mm ² female (female plug + grip hood) | 12720821 (package unit 250 pcs.) |

Technical data

| Electrical data | |
|---------------------------|--|
| Current carrying capacity | 28 A at +85 °C |
| Max. system voltage | 1000 V/DC |
| Transition resistance | 0.5 mΩ |
| Protection type | II |
| Protection mode | IP 67 (TÜV; mated condition) |
| Physical/mechanical data | |
| Contact carrier diameter | 4 mm |
| Contact carrier | brass tin-plated |
| Contact principle | copper beryllium lamella contact |
| Disengagement force | ~ 75 N |
| Fire resistance | UL 94 - HB (grip hood) / UL 94 - V0 (connector) |
| Compatible cables | 2.5 mm ² RADOX® SOLAR cable, RADOX® SMART, RADOX® SolarLink |
| Compatible connectors | All available RADOX® SOLAR connectors |
| Environmental data | |
| Temperature range | -40 °C to +85 °C |
| Weathering resistance | DIN ISO 4892-2 |
| RoHS and REACH | compliant |
| Material data | |
| Connector | PA6.6 |
| Grip hood | TPE |



RADOX® SOLAR Connector push-pull 4 mm²



- Small profile
- High current carrying capacity
- Constant low transition resistance
- High mechanical resistance
- UV- and ozone resistant
- Protection mode IP 67
- Easy assembly

Approvals

- EN 50521:2008 (TÜV Rheinland; certificate: R 60034855)

| Ordering information | Item no. set |
|--|----------------------------------|
| SOLAR connector push-pull 4 mm ² male (male plug + grip hood) | 24500070 (package unit 250 pcs.) |
| SOLAR connector push-pull 4 mm ² female (female plug + grip hood) | 24500072 (package unit 250 pcs.) |

Technical data

| Electrical data | |
|---------------------------|--|
| Current carrying capacity | 38 A at +85 °C |
| Max. system voltage | 1000 V/DC |
| Transition resistance | 0.5 mΩ |
| Protection type | II |
| Protection mode | IP 67 (TÜV; mated condition) |
| Physical/mechanical data | |
| Contact carrier diameter | 4 mm |
| Contact carrier | brass tin-plated |
| Contact principle | copper beryllium lamella contact |
| Disengagement force | ~ 75 N |
| Fire resistance | UL 94 - HB (grip hood) / UL 94 - V0 (connector) |
| Compatible cables | 4 mm ² RADOX® SOLAR cable, RADOX® SMART, RADOX® SolarLink |
| Compatible connectors | All available RADOX® SOLAR connectors |
| Environmental data | |
| Temperature range | -40 °C to +85 °C |
| Weathering resistance | DIN ISO 4892-2 |
| RoHS and REACH | compliant |
| Material data | |
| Connector | PA6.6 |
| Grip hood | TPE |



RADOX® SOLAR Connector with integrated twist lock 4 mm²



- Small profile
- Integrated twist locking
- High current carrying capacity
- Constant low transition resistance
- High mechanical resistance
- UV- and ozone-resistant
- Protection mode IP 68
- Easy assembly

Approvals

- EN 50521:2008 (TÜV Rheinland; certificate: R 60033367)
- UL 486A+B , UL1703 (CSA ; certificate: 2059270)

| Ordering information | Item no. set |
|---|----------------------------------|
| SOLAR connector 4 mm ² twist lock male (male plug + grip hood) | 24500094 (package unit 250 pcs.) |
| SOLAR connector 4 mm ² twist lock female (female plug + grip hood) | 24500095 (package unit 250 pcs.) |
| SOLAR connector 4 mm ² twist lock male CSA (male plug + grip hood) | 13720827 (package unit 250 pcs.) |
| SOLAR connector 4 mm ² twist lock female CSA (female plug + grip hood) | 13720828 (package unit 250 pcs.) |

Technical data

| Electrical data | |
|---------------------------|--|
| Current carrying capacity | 38 A at +85 °C TÜV |
| Max. system voltage | 1000 V/DC (TÜV); 600 V/DC (CSA) |
| Transition resistance | 0.5 mΩ |
| Protection type | II |
| Protection mode | IP 67 (TÜV; mated condition) IP 68, 1m/24h (H+S; mated condition) |
| Physical/mechanical data | |
| Contact carrier diameter | 4 mm |
| Contact carrier | brass tin-plated |
| Contact principle | copper beryllium lamella contact |
| Disengagement force | ~ 75 N |
| Fire resistance | UL 94 - HB (grip hood) / UL 94 - V0 (connector) |
| Compatible cables | 4 mm ² RADOX® SOLAR cable, RADOX® SOLAR SMART, RADOX® SolarLink |
| Compatible connectors | All available RADOX® SOLAR connectors |
| Environmental data | |
| Ambient temperature range | -40 °C to +85 °C |
| Weathering resistance | DIN ISO 4892-2 |
| RoHS and REACH | compliant |
| Material data | |
| Connector | PA6.6 / TPE |
| Grip hood | TPE |



RADOX® SOLAR Connector with integrated twist lock 6 mm²



- Small profile
- Integrated twist locking
- High current carrying capacity
- Constant low transition resistance
- High mechanical resistance
- UV- and ozone-resistant
- Protection mode IP 68
- Easy assembly

Approvals

- EN 50521:2008 (TÜV Rheinland; certificate: R 60033367)
- UL 486A+B , UL1703 (CSA ; certificate: 2059270)

| Ordering information | Item no. set |
|---|----------------------------------|
| SOLAR connector 6 mm ² twist lock male (male plug + grip hood) | 24500092 (package unit 250 pcs.) |
| SOLAR connector 6 mm ² twist lock female (female plug + grip hood) | 24500093 (package unit 250 pcs.) |
| SOLAR connector 6 mm ² twist lock male CSA (male plug + grip hood) | 13720832 (package unit 250 pcs.) |
| SOLAR connector 6 mm ² twist lock female CSA (female plug + grip hood) | 13720833 (package unit 250 pcs.) |

Technical data

| Electrical data | |
|---------------------------|---|
| Current carrying capacity | 38 A at +85 °C |
| Max. system voltage | 1000 V/DC |
| Transition resistance | 0.5 mΩ |
| Protection type | II |
| Protection mode | IP 67 (TÜV; mated condition) IP 68, 1 m/24h (H+S; mated condition) |

| Physical/mechanical data | |
|--------------------------|--|
| Contact carrier diameter | 4 mm |
| Contact carrier | brass tin-plated |
| Contact principle | copper beryllium lamella contact |
| Disengagement force | ~ 75 N |
| Fire resistance | UL 94 - HB (grip hood) / UL 94 - V0 (connector) |
| Compatible cables | 6 mm ² RADOX® SOLAR cable, RADOX® SOLAR SMART, RADOX® SolarLink |
| Compatible connectors | All available RADOX® SOLAR connectors |

| Environmental data | |
|-----------------------|------------------|
| Temperature range | -40 °C to +85 °C |
| Weathering resistance | DIN ISO 4892-2 |
| RoHS and REACH | compliant |

| Material data | |
|---------------|-------------|
| Connector | PA6.6 / TPE |
| Grip hood | TPE |



RADOX® SOLAR NEC-Lock for twist lock Connectors



- Easy assembly
- To be opened with tool only
- Provides additional mechanical protection
- UV- and ozone-resistant
- Leaves RADOX® SOLAR twist lock
- Connectors small-sized
- Fulfil NEC 2008/2010

| Ordering information | Item no. set |
|--|----------------------------------|
| SOLAR NEC-Lock 4 mm ² and 6 mm ² | 12720824 (package unit 250 pcs.) |

Technical data

| Technical data | |
|-----------------------|---|
| Applicable standards | NFPA 70: National Electrical Code 2008 standard (article no. 690.33) |
| Compatible cables | 4 mm ² and 6mm ² RADOX® SOLAR cable, RADOX® SMART, RADOX® SolarLink |
| Compatible connectors | 4 mm ² and 6mm ² RADOX® SOLAR twist lock connectors |

| Physical/environmental data | |
|---|----------------------------|
| Ambient temperature range | -40 °C to +85 °C |
| Outdoor suitability, UL 746C | f1 (UV and water exposure) |
| Flammability Classification UL94/ IEC 60695-11-10 | V-2 |
| RoHS and REACH | compliant |

| Material data | |
|---------------|------------|
| | PA66 black |





RADOX® SOLAR Accessories and Tools

The HUBER+SUHNER interconnection system has been specially developed with quick and easy installation in mind. All our connector types are plug-compatible with each other and matched to all our solar cables. Thanks to their small number of simple parts, fast and reliable installation is easily possible even under adverse conditions.

The outdoor tool box is suited for all cable and connector types and provides all accessories and tools necessary for field installation or assembly. A fast, flexible and low cost assembly of solar module connections is possible.

General features

- Fast, flexible, cost-effective assembling
- Outdoor handling

| | |
|----------------------------------|----|
| RADOX® SOLAR T-connector | 40 |
| RADOX® SOLAR T-joint connector | 41 |
| RADOX® SOLAR K-connector | 42 |
| RADOX® SOLAR D-connector | 43 |
| RADOX® SOLAR inverter connectors | 44 |
| RADOX® SOLAR branch connector | 46 |
| RADOX® SOLAR outdoor tool box | 47 |



RADOX® SOLAR T-Connector 4 mm² and 6 mm² with integrated twist lock



- Small profile
- Integrated twist lock (for the open junction)
- Cost-effective connectivity solution
- High current carrying capacity
- Constant low transition resistance
- High mechanical resistance
- UV- and ozone-resistant
- Protection mode IP 67
- Easy assembly

Application

- Special T-connector for pre-assembled or field-mounted string lines in all solar applications
- Two in-line crimp connections, one plug to fit all other available RADOX® SOLAR connectors

| Ordering information | Item no. set |
|---|----------------------------------|
| SOLAR T-connector 4 mm ² male (1 plug + 2 grip hood) | 24500163 (package unit 250 pcs.) |
| SOLAR T-connector 4 mm ² female (1 plug + 2 grip hood) | 24500162 (package unit 250 pcs.) |
| SOLAR T-connector 6 mm ² male (1 plug + 2 grip hood) | 84094765 (package unit 250 pcs.) |
| SOLAR T-connector 6 mm ² female (1 plug + 2 grip hood) | 84094764 (package unit 250 pcs.) |

Technical data

| Electrical data | |
|---------------------------|--|
| Current carrying capacity | 38 A at +85 °C |
| Max. system voltage | 1000 V/DC |
| Transition resistance | 0.5 mΩ |
| Protection type | II |
| Protection mode | IP 67 (connected) |
| Physical/mechanical data | |
| Contact carrier diameter | 4 mm |
| Contact carrier | brass tin-plated |
| Contact principle | copper beryllium lamella contact |
| Disengagement force | ~ 75 N |
| Fire resistance | UL 94 - HB (grip hood) / UL 94 - V0 (connector) |
| Compatible cables | depending on used grip hood: 4 mm ² RADOX® SOLAR cable, RADOX® SOLAR SMART, RADOX® SolarLink 6 mm ² RADOX® SOLAR cable, RADOX® SOLAR SMART, RADOX® SolarLink |
| Compatible connectors | all available RADOX® SOLAR connectors |
| Environmental data | |
| Temperature range | -40 °C to +85 °C |
| Weathering resistance | DIN ISO 4892-2 |
| RoHS and REACH | compliant |
| Material data | |
| Connector | TPE |
| Grip hood | TPE |



RADOX® SOLAR T-joint Connector with 3 crimpable Joints



- Small profile
- Cost-effective connectivity solution
- High current carrying capacity
- Constant low transition resistance
- High mechanical resistance
- UV- and ozone-resistant
- Protection mode IP 67
- Easy assembly

Application

- Special T-connector for pre-assembled or field-mounted string bus lines in all solar applications
- Three crimp connections give you maximum flexibility

| Ordering information | Item no. set |
|---|----------------------------------|
| SOLAR T-joint 444 mm ² (1 T-joint + 3 grip hood) | 24500152 (package unit 250 pcs.) |
| SOLAR T-joint 646 mm ² (1 T-joint + 3 grip hood) | 24500241 (package unit 250 pcs.) |
| SOLAR T-joint 666 mm ² (1 T-joint + 3 grip hood) | 84092371 (package unit 250 pcs.) |

Technical data

| Electrical data | |
|---------------------------|---|
| Current carrying capacity | 38 A at +85 °C |
| Max. system voltage | 1000 V/DC |
| Transition resistance | 0.5 mΩ |
| Protection type | II |
| Protection mode | IP 67 (mated) |
| Physical/mechanical data | |
| Contact carrier diameter | 4 mm |
| Contact carrier | brass tin-plated |
| Contact principle | copper beryllium lamella contact |
| Fire resistance | UL 94 - HB (grip hood) / UL 94 - V0 (connector) |
| Compatible cables | depending on crimp connection 4 mm ² RADOX® SOLAR cable, RADOX® SOLAR SMART, RADOX® SolarLink 6 mm ² RADOX® SOLAR cable, RADOX® SOLAR SMART, RADOX® SolarLink |
| Environmental data | |
| Temperature range | -40 °C to +85 °C |
| Weathering resistance | DIN ISO 4892-2 |
| RoHS and REACH | compliant |
| Material data | |
| T-joint | TPE |
| Grip hood | TPE |



RADOX® SOLAR K-Connector with integrated twist lock



- Small profile
- Cost-effective connectivity solution
- High current carrying capacity
- Constant low transition resistance
- High mechanical resistance
- UV- and ozone-resistant
- Protection mode IP 67
- Easy assembly

Applications

- Special K-connector for pre-assembled string bus lines and all other solar applications
- Two crimp connections give you maximum flexibility
- Special K-connector for line termination

| Ordering information | Item no. set |
|--|----------------------------------|
| SOLAR K-connector female-male 4 mm ² (1 plug + 2 grip hood) | 24500159 (package unit 250 pcs.) |
| SOLAR K-connector female 4 mm ² , terminator (1 plug + 2 grip hood) | 24500175 (package unit 250 pcs.) |

Technical data

| Electrical data | |
|---------------------------|-------------------|
| Current carrying capacity | 38 A at +85 °C |
| Max. system voltage | 1000 V/DC |
| Test voltage | 6000 VAC / 1 min. |
| Transition resistance | 0.5 mΩ |
| Protection type | II |
| Protection mode | IP 67 (connected) |

| Physical/mechanical data | |
|--------------------------|--|
| Contact carrier diameter | 4 mm |
| Contact carrier | brass tin-plated |
| Contact principle | copper beryllium lamella contact |
| Fire resistance | UL 94 - HB (grip hood) / UL 94 - V0 (connector) |
| Compatible cables | depending on used grip hood: 4 mm ² RADOX® SOLAR cable, RADOX® SOLAR SMART, RADOX® SolarLink 6 mm ² RADOX® SOLAR cable, RADOX® SOLAR SMART, RADOX® SolarLink |
| Compatible connectors | all available RADOX® SOLAR connectors |

| Environmental data | |
|-----------------------|------------------|
| Temperature range | -40 °C to +85 °C |
| Weathering resistance | DIN ISO 4892-2 |
| RoHS and REACH | compliant |

| Material data | |
|---------------|-----|
| Connector | TPE |
| Grip hood | TPE |



RADOX® SOLAR D-Connector with integrated twist lock



- Encapsulated blocking diode
- Perfect heat dissipation
- Small profile
- Integrated twist lock
- Fits all RADOX® SOLAR connectors
- Cost effective connectivity solution
- Constant low transition resistance
- High mechanical resistance
- UV- and ozone-resistant
- Protection mode IP 67
- No assembly required
- Easy Plug&Play field installation

Application

- Plug&Play D-connector with integrated blocking diode for protection of your solar installation

| Ordering information | Item no. set |
|---------------------------|----------------------------------|
| SOLAR D-connector (EM518) | 24500161 (package unit 250 pcs.) |

Technical data

| Electrical data | |
|---------------------------|------------------------|
| Max. forward current | 1 A |
| Max. blocking voltage | 2000 V/DC |
| Test voltage (insulation) | 6000 VAC / 1 min. |
| Forward voltage drop | < 1.1 V @ RT (I = 1 A) |
| Leakage current | < 5 µA @ RT |
| Protection type | II |
| Protection mode | IP 67 (connected) |

| Physical/mechanical data | |
|--------------------------|---------------------------------------|
| Contact carrier diameter | 4 mm |
| Contact carrier | brass tin-plated |
| Contact principle | copper beryllium lamella contact |
| Disengagement force | ~ 55 N |
| Fire resistance | UL 94 - V0 |
| Compatible cables | n. a. |
| Compatible connectors | all available RADOX® SOLAR connectors |

| Environmental data | |
|-----------------------|------------------|
| Temperature range | -40 °C to +85 °C |
| Weathering resistance | DIN ISO 4892-2 |
| RoHS and REACH | compliant |

| Material data | |
|---------------|-------------|
| Connector | PA6.6 / TPE |



RADOX® SOLAR inverter Connector 4 mm² push-pull



- Small profile
- High current carrying capacity
- Constant low transition resistance
- High mechanical resistance
- UV- and ozone-resistant
- Protection mode IP 68
- Easy assembly
- Compatible to all common drilling and mounting holes
- Double «D» prevents for rotation

Application

- Connector for solar inverter applications to assemble to chassis and sockets

| Ordering information | Item no. set |
|---|----------------------------------|
| SOLAR inverter connector 4 mm ² male (male plug + nut) | 24500088 (package unit 250 pcs.) |
| SOLAR inverter connector 4 mm ² female (female plug + nut) | 24500089 (package unit 250 pcs.) |
| Sealing ring 16.5 x 2 mm | 84120222 (package unit 250 pcs.) |

Technical data

| Electrical data | |
|---------------------------|--|
| Current carrying capacity | 38 A at +85 °C |
| Max. system voltage | 1000 V/DC |
| Transition resistance | 0.5 mΩ |
| Protection type | II |
| Protection mode | IP 68 1 m / 24 h (H+S; mated condition) with optional sealing ring |

| Physical/mechanical data | |
|--------------------------|---|
| Contact carrier diameter | 4 mm |
| Contact carrier | brass tin-plated |
| Contact principle | copper beryllium lamella contact |
| Disengagement force | ~ 75 N |
| Fire resistance | UL 94 - HB / UL 94 - V0 |
| Compatible cables | All available RADOX® SOLAR 4 mm ² cable products from HUBER+SUHNER, refer to catalogue «Wires and cables for industrial application» |
| Compatible connectors | all available RADOX® SOLAR connectors |

| Environmental data | |
|---------------------------|------------------|
| Ambient temperature range | -40 °C to +85 °C |
| Weathering resistance | DIN ISO 4892-2 |
| RoHS and REACH | compliant |

| Material data | |
|---------------|-------------|
| Connector | TPE / PA6.6 |



RADOX® SOLAR inverter Connector 6 mm² with integrated twist lock



- Small profile
- Integrated twist lock
- High current carrying capacity
- Constant low transition resistance
- High mechanical resistance
- UV- and ozone-resistant
- Protection mode IP 68
- Easy assembly
- Compatible to all common drilling and mounting holes
- Double «D» prevents for rotation

Application

- Connector for solar inverter applications to assemble to chassis and sockets

| Ordering information | Item no. set |
|---|----------------------------------|
| SOLAR inverter connector 6 mm ² male (male plug + nut) | 24500139 (package unit 250 pcs.) |
| SOLAR inverter connector 6 mm ² female (female plug + nut) | 24500140 (package unit 250 pcs.) |
| Sealing ring 16.5 x 2 mm | 84120222 (package unit 250 pcs.) |

Technical data

| Electrical data | |
|---------------------------|--|
| Current carrying capacity | 38 A at +85 °C |
| Max. system voltage | 1000 V/DC |
| Transition resistance | 0.5 mΩ |
| Protection type | II |
| Protection mode | IP 68 1 m / 24 h (H+S; mated condition) with optional sealing ring |

| Physical/mechanical data | |
|--------------------------|---|
| Contact carrier diameter | 4 mm |
| Contact carrier | brass tin-plated |
| Contact principle | copper beryllium lamella contact |
| Disengagement force | ~ 75 N |
| Fire resistance | UL 94 - HB / UL 94 - V0 |
| Compatible cables | All available RADOX® SOLAR 6 mm ² cable products from HUBER+SUHNER, refer to catalogue «Wires and cables for industrial application» |
| Compatible connectors | all available RADOX® SOLAR connectors |

| Environmental data | |
|---------------------------|------------------|
| Ambient temperature range | -40 °C to +85 °C |
| Weathering resistance | DIN ISO 4892-2 |
| RoHS and REACH | compliant |

| Material data | |
|---------------|-------------|
| Connector | TPE / PA6.6 |



RADOX® SOLAR branch Connector push-pull



Type A



Type B

- Small profile
- High current capacity
- Constant low transition resistance
- High mechanical resistance
- Easy assembly
- UV- and ozone-resistant
- Protection mode IP 67 in mated condition
- For HUBER+SUHNER standard solar connectors push-pull and twist lock

| Ordering information | Item no. set |
|---|----------------------------------|
| SOLAR branch connector, type A (1 male, 2 female) | 24101773 (package unit 205 pcs.) |
| SOLAR branch connector, type B (2 male, 1 female) | 24101774 (package unit 205 pcs.) |

Technical data

| Electrical data | |
|---------------------------|---------------------------------------|
| Current carrying capacity | 38 A at +85 °C |
| Max. system voltage | 1000 V/DC |
| Transition resistance | 0.5 mΩ |
| Protection type | II |
| Protection mode | IP 67 (TÜV; mated condition) |
| Physical/mechanical data | |
| Contact carrier diameter | 4 mm |
| Contact carrier | brass tin-plated |
| Contact principle | copper beryllium lamella contact |
| Disengagement force | ~ 75 N |
| Fire resistance | UL 94 - HB / UL 94 - V0 |
| Compatible connectors | All available RADOX® SOLAR connectors |
| Environmental data | |
| Temperature range | -40 °C to +85 °C |
| Weathering resistance | DIN ISO 4892-2 |
| RoHS and REACH | compliant |
| Material data | |
| Connector | PA6.6/TPE |



RADOX® SOLAR outdoor Tool Box



- Suited for all RADOX® SOLAR cable and RADOX® SOLAR connector types
- Provides all accessories and tools necessary for field installation or assembly
- For fast, flexible and low cost assembly of solar module connections

| Box | Item no. | Quantity |
|------------|----------|----------|
| Entire box | 24500208 | 1 |

| Content | Item no. | Quantity |
|--|----------------------|---|
| Empty box | 24101522 | 1 |
| Crimp tongs chromium-plated (incl. 1 crimp insert) | 24101803 | Including crimping units 4 and 6 mm ² (connector with twist lock) |
| Crimp insert | 24101732 24101809 | 2.5 and 4 mm ² (connector without twist lock) 4 and 6 mm ² (connector with twist lock) |
| Insulation displacement tongs 2.5, 4 and 6 mm ² | 24101804 | 1 |
| Cable scissors | 24101582 | 1 |
| Measuring tape | 24101580 | 1 |
| 2.5 mm ² connector | 12720820 + 12720821 | 10 male + 10 female |
| 4 mm ² connector | 24500070 + 24500072 | 10 male + 10 female |
| 4 mm ² connector with integrated twist locking | 24500094 + 24500095 | 10 male + 10 female |
| 6 mm ² connector with integrated twist locking | 24500092 + 24500093 | 10 male + 10 female |
| Glycerin lubrication | 24101610 | 1 |
| TAG «do not disconnect» | 24500153 | 1 rol |
| Mounting instruction push pull | 84029716 | 1 |
| Mounting instruction twist lock | 84078174 | 1 |





RADOX® SOLAR technical Information

| | |
|---|----|
| Current carrying capacity | 50 |
| Derating diagramme 2.5 mm ² | 53 |
| Current carrying capacity, installation methods | 54 |



Current carrying Capacity of RADOX® SOLAR Cables single Core

1. Scope

The following tables referring to RADOX® cores give easy and fast support for the layout of apparatus and components.

The following remarks are based on today's state of the art and practical experience as described in the standards IEC 60216, IEC 60287 and IEC 60364. The application of products will frequently vary from the theoretical values of constant ambient temperature, constant current carrying, homogeneous laying and others. That means, in practice the theoretical current carrying will differ from the real values.

For a safe layout of apparatus and components it is recommended to carry out a test with the installed wire under service conditions.

Please note that especially for PV applications other current carrying capacities may apply. See also requirements for PV1-F.

2. Definitions

| | |
|-----------------------|---|
| Current load: | current passed through the cable during operation |
| Continuous operation: | an operation with constant current whose duration is at least long enough to allow the system to reach thermal equilibrium, but may then go on indefinitely |
| Current rating: | max. permissible current under determined operating |
| Temperature: | max. permissible conductor temperature during continuous operation temperature |

3. General remarks

3.1 The current carrying capacity of cables depends on:

- Conductor material (copper, copper alloy, aluminium, steel)
- Surface treatment of the conductor (plain, tinned, silver plated, nickel plated)
- Conductor cross-section
- Thermal capacity of the insulation material
- Ambient temperature (air/ground temperature)
- Installation mode (free in the air, in cable ducts, in earth)
- Accumulation (single core, several cores spaced, bundles)
- Other ambient effects (sun-radiation, UV)

3.2. The conductor cross-section has to be selected in such a way that the actual current load does not exceed the current rating, i.e. the conductor temperature does not exceed the permissible operating temperature. The determining factor is the appropriate, most unfavourable operating condition, encountered during operation over the whole length of the cable.



Current carrying Capacity of RADOX® SOLAR Cables single Core

4. Current rating under service conditions

$$I = I_N \cdot f_1 \cdot f_2 \cdot f_3$$

- I [A] Current rating for continuous operation under service conditions
- I_N [A] Current rating for continuous operation under standard conditions
- f_1 Reduction factor for increased ambient temperature (see # 4.2)
- f_2 Reduction factor for deviated conductor temperature (see # 4.3)
- f_3 Reduktion factor for banded cables (see tables on pages 54 and following)

4.1 Standard conditions for current rating

4.1.1 The tabled values for the current rating were calculated according to IEC 287 for the following standard conditions:

- continuous operation
- single circuit for 3-phase current, single conductor for 1-phase current
- 30 °C ambient temperature and sufficiently large and ventilated spaces, whose ambient temperature is not appreciably increased by the heat coming from the cables.
- 120 °C conductor temperature
- frequency up to 200 Hz

4.1.2 Installation in air, unrestricted heat dissipation, means that the following installation conditions are observed:

- distance of the cables from the wall, from the floor, from the ceiling > cable diameter
- distance between two adjacent power circuits > 2 x cable diameter
- vertical distance between power circuits laid one upon another for individual cables > 2 x cable diameter and for layers of cables > 200 mm
- perforated tray with a perforation > 30 % of the total surface

4.1.3 Open trays are continuous supports with vertical sides, but without cover. A possible perforation accounts for < 30 % of the total surface

4.1.4 Closed ducts are entirely closed. Pipes belong to this category also.
The max. filling degree is 70 %.

4.2 Reduction factors for increased ambient temperature

| Ambient temperature [°C] | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 |
|--------------------------|----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Reduction factor f_1 | 1 | 0.97 | 0.94 | 0.91 | 0.88 | 0.85 | 0.82 | 0.78 | 0.75 | 0.71 | 0.67 | 0.62 | 0.58 | 0.53 | 0.47 | 0.41 | 0.33 | 0.22 |



Current carrying Capacity of RADOX® SOLAR Cables single Core

4.3 Reduction factors for different conductor temperature

| | | | | | | |
|----------------------------|-----|------|------|------|------|------|
| Conductor temperature (°C) | 120 | 110 | 100 | 90 | 80 | 70 |
| Reduction factor f_2 | 1 | 0.96 | 0.91 | 0.85 | 0.79 | 0.72 |

Maximum permitted typical conductor temperature for various insulaton materials according to IEC 60216 (20'000 h / 50 % elongation at break):

| | |
|------------|--------|
| PCV, CR | 70 °C |
| PE-X, EPR | 90 °C |
| RADOX® 125 | 120 °C |

4.4 Lifetime expectation

If cross-linked wires are used at higher temperatures than indicated by the temperature index of IEC 60216, the lifetime is reduced accordingly, conversely, the lifetime will increase at lower temperatures. RADOX® R 125 for example has a life span of 20'000 h at a conductor temperature of +120 °C, which is approx. 2.5 years. If it is used at another temperature, lifetime expectations are as follows:

Example RADOX® solar cables:

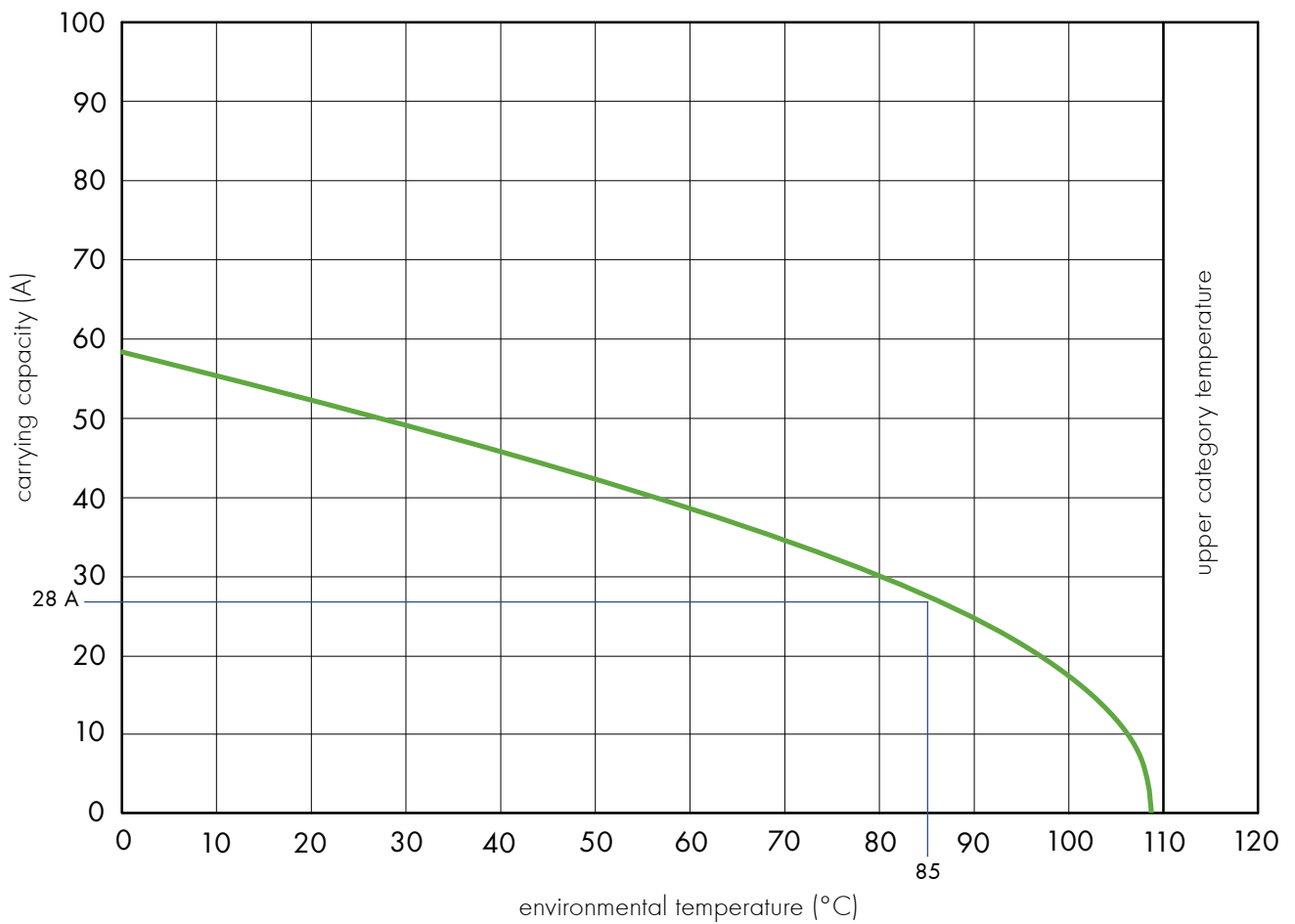
| | |
|--------|-----------|
| 160 °C | 1'250 h |
| 150 °C | 2'500 h |
| 140 °C | 5'000 h |
| 130 °C | 10'000 h |
| 120 °C | 20'000 h |
| 110 °C | 40'000 h |
| 100 °C | 80'000 h |
| 90 °C | 160'000 h |
| 80 °C | 320'000 h |



Derating Diagramme 2.5 mm²

Measured on RADOX[®] SOLAR connectors 2.5 mm² with assembled RADOX[®] SOLAR cables 2.5 mm².

The measurement was made according to EN 60512-5-2. The upper limit of carrying capacity of the cable is not shown in the picture.





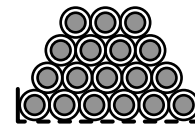
Current carrying Capacity of RADOX® SOLAR Cables single Core

| Installation method | Connecting lead in free air or perforated tray | | | | | | | | | | | |
|---|--|------|------|------|------|------|------|------|------|------|------|--|
| Number of simultaneous loaded conductors on each tray | | | | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 6 | 8 | 10 | 16 | 20 | 4 | 6 | |
| Reduction factor f_3 | 1 | 0.87 | 0.81 | 0.78 | 0.75 | 0.74 | 0.73 | 0.72 | 0.71 | 0.71 | 0.62 | |
| Copper conductor cross section mm^2 | Current carrying capacity in [A] | | | | | | | | | | | |
| 1.5 | 39 | 34 | 32 | 31 | 30 | 29 | 29 | 29 | 28 | 28 | 25 | |
| 2.5 | 53 | 47 | 43 | 42 | 40 | 40 | 39 | 39 | 38 | 38 | 33 | |
| 4 | 71 | 62 | 58 | 56 | 54 | 53 | 52 | 52 | 51 | 51 | 45 | |
| 6 | 92 | 81 | 75 | 72 | 69 | 69 | 68 | 67 | 66 | 66 | 58 | |
| 10 | 129 | 113 | 105 | 101 | 97 | 96 | 95 | 93 | 92 | 92 | 80 | |
| 16 | 171 | 149 | 139 | 134 | 129 | 127 | 125 | 124 | 122 | 122 | 107 | |
| 25 | 228 | 199 | 185 | 178 | 171 | 169 | 167 | 165 | 162 | 162 | 142 | |
| 35 | 281 | 245 | 228 | 220 | 211 | 208 | 206 | 203 | 200 | 200 | 175 | |
| 50 | 355 | 309 | 288 | 277 | 267 | 263 | 260 | 256 | 253 | 253 | 221 | |
| 70 | 447 | 389 | 363 | 349 | 336 | 331 | 327 | 322 | 318 | 318 | 278 | |
| 95 | 530 | 462 | 430 | 414 | 398 | 393 | 387 | 382 | 377 | 377 | 329 | |
| 120 | 622 | 542 | 504 | 486 | 467 | 461 | 455 | 448 | 442 | 442 | 386 | |
| 150 | 720 | 627 | 584 | 562 | 540 | 533 | 526 | 519 | 512 | 512 | 447 | |



Continuous current rating

conductor temperature +120 °C, ambient temperature +30 °C



| | | | | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 8 | 10 | 16 | 20 | 4 | 6 | 8 | 10 | 16 | 20 | 4 | 6 | 8 | 10 | 16 | 20 |
| 0.57 | 0.53 | 0.47 | 0.45 | 0.67 | 0.59 | 0.54 | 0.50 | 0.45 | 0.43 | 0.71 | 0.58 | 0.52 | 0.48 | 0.41 | 0.38 |

| | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 23 | 21 | 19 | 18 | 27 | 24 | 22 | 20 | 18 | 17 | 28 | 23 | 21 | 19 | 16 | 15 |
| 31 | 29 | 25 | 24 | 36 | 32 | 29 | 27 | 24 | 23 | 38 | 31 | 28 | 26 | 22 | 21 |
| 41 | 38 | 34 | 32 | 48 | 42 | 39 | 36 | 32 | 31 | 51 | 42 | 37 | 35 | 30 | 27 |
| 53 | 49 | 44 | 42 | 62 | 55 | 50 | 46 | 42 | 40 | 66 | 54 | 48 | 45 | 38 | 35 |
| 74 | 69 | 61 | 59 | 87 | 77 | 70 | 65 | 59 | 56 | 92 | 75 | 68 | 62 | 53 | 50 |
| 98 | 91 | 81 | 77 | 115 | 101 | 93 | 86 | 77 | 74 | 122 | 100 | 89 | 83 | 71 | 65 |
| 130 | 121 | 108 | 103 | 153 | 135 | 124 | 114 | 103 | 99 | 162 | 133 | 119 | 110 | 94 | 87 |
| 161 | 149 | 133 | 127 | 189 | 166 | 152 | 141 | 127 | 121 | 200 | 163 | 147 | 135 | 116 | 107 |
| 203 | 189 | 167 | 160 | 238 | 210 | 192 | 178 | 160 | 153 | 253 | 206 | 185 | 171 | 146 | 135 |
| 255 | 237 | 211 | 202 | 300 | 264 | 242 | 224 | 202 | 193 | 318 | 260 | 233 | 215 | 184 | 170 |
| 303 | 281 | 250 | 239 | 356 | 313 | 287 | 265 | 239 | 228 | 377 | 308 | 276 | 255 | 218 | 202 |
| 355 | 330 | 293 | 280 | 417 | 367 | 336 | 311 | 280 | 268 | 442 | 361 | 324 | 299 | 256 | 237 |
| 411 | 382 | 339 | 324 | 483 | 425 | 389 | 360 | 324 | 310 | 512 | 418 | 375 | 346 | 296 | 274 |



Current carrying Capacity of RADOX® SOLAR Cables single Core

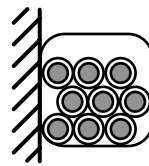
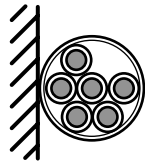
| Installation method | on floor or wall | | | | fixed on a ceiling or under floor | | | | | | | |
|---|---|------|------|------|-----------------------------------|------|------|------|------|------|------|------|
| Number of simultaneous loaded conductors on each tray | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Reduction factor f_3 | 1 | 0.85 | 0.79 | 0.75 | 0.95 | 0.81 | 0.72 | 0.68 | 0.66 | 0.64 | 0.63 | 0.62 |
| Copper conductor cross section mm ² | Current carrying capacity in [A] | | | | | | | | | | | |
| 1.5 | 35 | 30 | 28 | 27 | 34 | 29 | 26 | 24 | 24 | 23 | 23 | 22 |
| 2.5 | 48 | 41 | 38 | 36 | 46 | 39 | 35 | 33 | 32 | 31 | 31 | 30 |
| 4 | 64 | 55 | 51 | 48 | 61 | 52 | 47 | 44 | 43 | 41 | 41 | 40 |
| 6 | 84 | 72 | 67 | 63 | 80 | 69 | 61 | 58 | 56 | 54 | 53 | 53 |
| 10 | 118 | 101 | 94 | 89 | 113 | 96 | 85 | 81 | 78 | 76 | 75 | 74 |
| 16 | 158 | 135 | 125 | 119 | 151 | 128 | 114 | 108 | 105 | 102 | 100 | 98 |
| 25 | 212 | 181 | 168 | 159 | 202 | 172 | 153 | 145 | 140 | 136 | 134 | 132 |
| 35 | 262 | 223 | 207 | 197 | 249 | 213 | 189 | 179 | 173 | 168 | 166 | 163 |
| 50 | 330 | 281 | 261 | 248 | 314 | 268 | 238 | 225 | 218 | 212 | 208 | 205 |
| 70 | 420 | 357 | 332 | 315 | 399 | 341 | 303 | 286 | 278 | 269 | 265 | 261 |
| 95 | 499 | 425 | 395 | 375 | 475 | 405 | 360 | 340 | 330 | 320 | 315 | 310 |
| 120 | 580 | 493 | 459 | 435 | 551 | 470 | 418 | 395 | 383 | 372 | 366 | 360 |
| 150 | 670 | 583 | 543 | 523 | 637 | 543 | 483 | 456 | 443 | 429 | 423 | 416 |



Continuous current rating

Conductor temperature +120 °C, ambient temperature +30 °C

in conduit in a void or in a pipe



| | | | | | | | | | | | | | | |
|------|---|------|------|------|------|------|------|------|------|------|------|------|------|------|
| ≥ 9 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 12 | 14 | 16 | 20 |
| 0.61 | 1 | 0.80 | 0.70 | 0.65 | 0.60 | 0.57 | 0.54 | 0.52 | 0.50 | 0.48 | 0.45 | 0.43 | 0.41 | 0.38 |

| | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 22 | 29 | 24 | 21 | 19 | 18 | 17 | 16 | 16 | 15 | 14 | 14 | 13 | 12 | 12 |
| 30 | 39 | 32 | 28 | 26 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 |
| 40 | 52 | 42 | 37 | 34 | 32 | 30 | 29 | 28 | 26 | 25 | 24 | 23 | 22 | 20 |
| 52 | 66 | 53 | 47 | 43 | 40 | 38 | 36 | 35 | 33 | 32 | 30 | 29 | 28 | 26 |
| 72 | 92 | 74 | 65 | 60 | 56 | 53 | 50 | 48 | 46 | 45 | 42 | 40 | 38 | 35 |
| 97 | 120 | 96 | 84 | 78 | 72 | 69 | 65 | 63 | 60 | 58 | 54 | 52 | 50 | 46 |
| 130 | 160 | 128 | 112 | 104 | 96 | 92 | 87 | 84 | 80 | 77 | 72 | 69 | 66 | 61 |
| 160 | 196 | 157 | 138 | 128 | 118 | 112 | 106 | 102 | 98 | 95 | 89 | 85 | 81 | 75 |
| 202 | 248 | 199 | 174 | 162 | 149 | 142 | 134 | 129 | 124 | 120 | 112 | 107 | 102 | 95 |
| 257 | 309 | 248 | 217 | 201 | 186 | 177 | 167 | 161 | 155 | 149 | 140 | 133 | 127 | 118 |
| 305 | 457 | 286 | 250 | 233 | 215 | 204 | 193 | 186 | 179 | 172 | 161 | 154 | 147 | 136 |
| 354 | 426 | 341 | 299 | 277 | 256 | 243 | 231 | 222 | 213 | 205 | 192 | 184 | 175 | 162 |
| 409 | 485 | 388 | 340 | 316 | 291 | 277 | 262 | 253 | 243 | 233 | 219 | 209 | 199 | 185 |



Further catalogues



Wires and cables
for industrial applications

Item no. 84047253

Datasheets

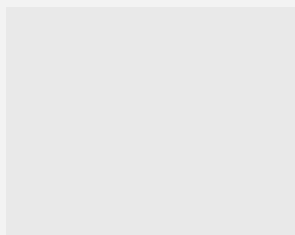


For detailed specifications
please refer to the published
data sheets on our webpage
www.hubersuhner.com.

HUBER+SUHNER is certified according to ISO 9001, ISO 14001, ISO/TS 16949 and IRIS.

WAIVER

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