



**BETAflam® Solar
Photovoltaic power cables**

The Quality Connection

LEONI



We connect technology, efficiency & ecological awareness already today.

BETAflam® Solar **Clean cables for clean energy.**

Whether it is an off-grid application or a grid connected PV-System – our cables meet the same high expectations that are demanded from the solar modules – **which are a long service life and high weather resistance.**

Our double insulated, electron-beam cross-linked cables meets the highest requirements for solar cables in the most important photovoltaic markets of Europe and the USA and can be used unrestrictedly as a module or connecting cable.

Our products have both TÜV approval for the European market and UL approval according to the latest NEC specifications (National Electric Code 2008/UL Outline 4703).

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We reserve the right to make technical modifications, typographical errors and mistakes.

The current version of the catalogue is downloadable under
www.leoni-studer.ch

Safety instructions

Cables are to be used for the designated applications only. In case of failure or damage to the cable or connector, switch off power immediately and replace all damaged parts. Maintenance, repair and replacement of the cables and connectors may only be carried out by authorised and trained personnel.

Waiver

While the information contained in this document has been carefully compiled to the best of our knowledge, it is not intended as a representation or warranty of any kind on our part regarding the suitability of the products concerned for any particular use or purpose and neither shall any statement contained herein be construed as a recommendation to infringe any industrial property rights or as a license to use any such rights. The suitability of each product for any particular purpose must be checked beforehand with our specialists. Our policy is one of continuous material and product development. We reserve the right to offer alternatives consistent with our manufacturing programme at the time of enquiry. All information concerning material properties, Fire performance, construction, electrical and technical data, prices etc. reflects our current level of knowledge and is provided without obligation. Dimensions and weights are only given as a guide. The specifications may change any time without prior notice.

General conditions of sale and delivery

We refer to the currently valid General conditions of sale and delivery which can be obtained from the respective companies.



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The LEONI Group

Cable expertise for the most various industrial markets



LEONI is a leading supplier of cable systems and related services for the automotive industry and various other industrial sectors.

Our group of companies employs more than 61,000 people in 33 countries. Corporate vision, highest quality and innovative power have made us one of the leading cable manufacturers in Europe. LEONI develops and produces technically sophisticated products ranging from wire and optical fibers to cables through to complete cable systems and also offers the related services. Moreover, the product portfolio comprises strands, standardised cables, hybrid cables, glass fiber as well as special cables, cable harnesses, wiring systems components and fully assembled systems for applications in various industrial markets.

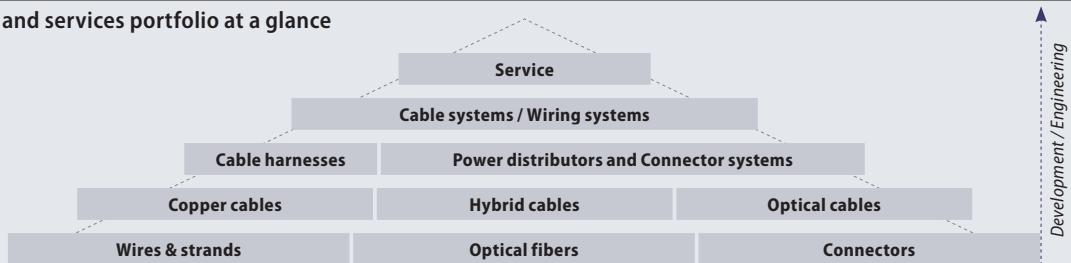
Your markets – our strength.

Our product and service range is as diverse as the markets and sectors that LEONI supplies. We focus our activities on customers in the fields of Automotive & Commercial Vehicles, Industry & Healthcare, Communication & Infrastructure, Electrical Appliances and Conductors & Copper Solutions.

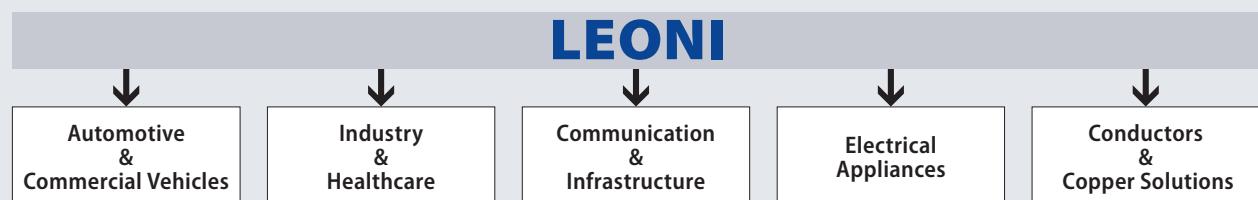
We are among the leading European suppliers in the Communication & Infrastructure market to which at LEONI as a cable manufacturer also belong activities in the fields of Infrastructure & Data Communications, Industrial Plant Projects, Solar & Wind-power, Energy & Telecommunications, Irradiation Cross-Linking and Traffic Engineering. Our customers benefit worldwide from innovative as well as reliable and long-lasting products of high quality. LEONI – we create the best connection for your future.

For further information www.leoni.com

Products and services portfolio at a glance



LEONI's core markets



Nature is brilliant. Cleanly efficient.



Trusting the only true constant – nature – makes sense and is the safest way in the long term.

Solar and wind energy are the energy sources of the future. The basic elements sun and air are natural forces that shape our climate. Using their limitless power sustainably and cleanly for the energy consumption of mankind is the great challenge facing the energy supply of the near future.

Achieving maximum efficiency is the responsibility of leading technology development companies. Innovative strength, creativity, inspiration and the courage to forge new paths are the requirements for tomorrow's clean energy world.

Business Unit Solar- & Windpower

The business unit Solar & Windpower is aware of this task and already combines technology, innovation and ecological awareness today. Environmentally compatible manufacture for environmentally compatible energy production through renewable energy. That is our motto.

Whether it is for local production, manufacturer or grid operator, we offer our customers products, systems and project management support in line with the market.

Our worldwide presence allows us to react flexibly, quickly and competently to our customers' requirements in the most important solar and wind markets. Ambitious large projects like solar heat, solar parks and wind farms are based on more than just the development of renewable energy resources, they also involve ecological and energy awareness. Utilising nature thus also means being consistent in the long run.

For further information www.leoni-solar-windpower.com



Green technology

Our company aim is to combine innovation with sustainability.



Our vision is to create sustainable connections in technological harmony with the natural resources. The cycle of nature gives us the best model to emulate. It is our responsibility to learn from nature and make use of it while conserving it and treating it with care. The growing scarcity of the natural resources and the increasing burden on the environment require a rethink on all levels of society. For LEONI, sustainability is an integral part of group policy. We are the first cable manufacturer in the world to develop a holistic concept for "green technology".

While trends like globalisation, mobility and urbanisation also determine the markets, sustainability and global responsibility are a central credo. To be considered the most innovative cable manufacturer for environmentally friendly technologies – that is our goal. At that, it is of vital interest to us to detect the needs and requirements of tomorrow today and supply the markets of the future with sustainable, future-proof solutions.

Green technology stands for the resource-conserving and low-emission production of sustainable quality cables made with low-pollution elements. We constantly work at optimising the efficiency with which resources are used in the manufacturing process by deploying energy-efficient machines or taking heat recovery measures. More and more locations in our global production network are environmentally certified according to the ISO 14001 standard.

As a worldwide active and leading European supplier of wires, optical fibres, cables and cable systems for communication and infrastructure projects it is our responsibility to constantly optimise the sustainability and durability of our products, system solutions and services and thus lower the environmental load. We have to increase the amount of environmentally compatible raw materials in our cable products as well as the recyclability of processed materials or components and in doing so create end products that are developed for the environmental standard of tomorrow today.

In conjunction with the ecological compatibility, future technologies are measured in terms of efficiency, service life, emission reduction and the conservation of natural resources. Innovative cable products and systems, holistic solutions and maximum performance in project management are the added value which we offer to our customers and business partners. These are also our cornerstones for strong connections into the future.



There are various environmental directives in the European Union (EU). Directive 2012/19/EU WEEE (Waste Electrical and Electronic Equipment) regulates the disposal of electrical and electronic equipment and components. The use of certain hazardous materials in electrical and electronic devices is defined by Directive 2011/65/EU RoHS 2 (Restriction of Hazardous Substances). Chemicals and materials in general are regulated by the law on chemical substances 1907/2006/EC REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals).

This means avoiding the following substances, among others:

- Polybrominated diphenyl ether (PBDE)
- Decabromodiphenyl ether (DecaBDE)
- Perfluorooctane sulfonate (PFOS)
- Pentabromodiphenyl ether (PentaBDE)
- Octabromodiphenyl ether (OctaBDE)
- Lead (Pb)
- Mercury (Hg)
- Cadmium (Cd)
- Hexavalent chromium (Cr VI)
- Polybrominated biphenyls (PBB)



Cables and conductors and their associated connectors are only affected by Directive 2012/19/EU WEEE insofar as they are an internal part of the listed equipment and components.

Cables and conductors have now been included in 2011/65/EU RoHS 2 since 2013 for the first time (Category 11 or as an internal component of the respective product). Fiber optic cables, power cables (>250 V) and installed fixed cables e.g. in premises are not concerned. The only permissible marking according to RoHS 2 is the CE marking, which is printed on the product package.

EU Directive 2012/19/EU on waste electrical and electronic equipment.

EU Directive 2011/65/EU for restriction of the use of certain hazardous substances in electrical and electronic equipment.

EU Regulation 1907/2006/EC (REACH) the chemical regulation of the European Union.



REACH

What does REACH mean?

REACH stands for Registration, Evaluation, Authorisation and Restriction of Chemicals.

With REACH, the previous chemical law is basically harmonised, simplified and valid in all EU Member States.

Under REACH, there is a so-called candidate list with substance of very high concern (SVHC), which are subject to obligatory information and should be substituted in the long run. The list of candidate materials is updated twice per year by the European Chemicals Agency (ECHA) in Helsinki.

The LEONI PV system

Overview of our complete range of products

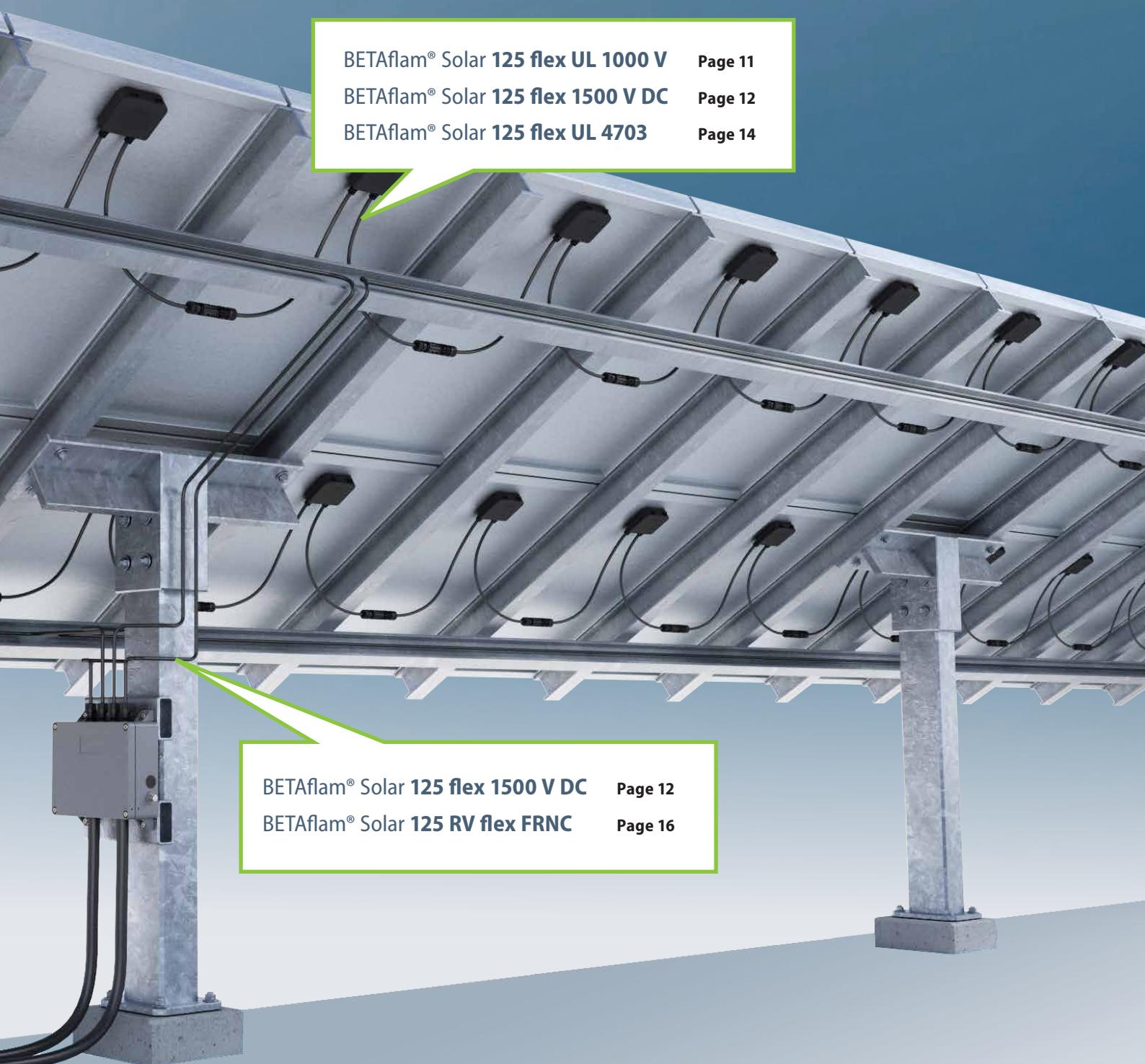


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BETAflam® Solar **125 RV AL FRNC** [Page 20](#)

SOLARpower **Alu-ATA** [Page 22](#)



All cables at a glance



Module connection cables

**For flexible installation
Suitable for connectors
with Class 5 wires**

- BETAflam® Solar 125 flex UL 1000V

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NEW



- BETAflam® Solar 125 flex UL 4703

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- BETAflam® Solar 125 AC flex FRNC

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- BETAflam® Solar 125 flex 1500V DC

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NEW



- BETAflam® Solar 125 RV flex FRNC

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Installation cables

**For fixed installation
without connectors
with Class 2 conductors**

- BETAflam® Solar 125 RV AL FRNC

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NEW



- SOLARpower Alu-ATA

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NEW



- BETAflam® Solar 125 UL 4703

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BETAflam® Solar 125 flex UL 1000V

Photovoltaic power cables, halogen free, flame retardant



NEW

BETAflam® Solar 125 flex UL 1000V



Advantages

- Electron-beam cross-linked compounds
- UV, ozone and hydrolysis resistant
- High temperature resistance, the materials do not melt or flow
- Very long service life, good cold flexibility
- Compatible to all popular connectors
- Improved encapsulation properties

Applications

- Double insulated, electron-beam cross-linked cables for photovoltaic power applications.

Construction

■ Conductor	Tinned fine copper strands acc. to VDE 0295 / IEC 60228, Class 5
■ Insulation	XLPO, flame retardant, halogen free, electron-beam cross-linked
■ Jacket	XLPO, flame retardant, halogen free, electron-beam cross-linked, UV and ozone resistant
■ Jacket colour	● black

Electrical characteristics

Rated value	TÜV U₀ 1500 V DC (max. permitted voltage U ₀ 1800 V DC)
Test voltage	UL 1000 V 11 kV, 50 Hz, 5 min.

Dimensions, weights

Construction	Conductor Ø	Outer Ø	Resistance max.	Weight	Fire load	Order no.
n × mm ²	mm	mm	mΩ/m	kg/km	kWh/m	
1 × 2.5	14 AWG	2.05	6.85	8.21	65	0.264
1 × 4	12 AWG	2.55	7.05	5.09	76	0.287
1 × 6	10 AWG	3.10	7.60	3.39	97	0.323
1 × 10	8 AWG	4.10	9.70	1.95	162	0.512

Order units

Construction	Order no.
n × mm ²	18 × 500 m 8 × 1000 m 1 × 4000 m 1 × 5000 m
1 × 2.5	14 AWG
1 × 4	12 AWG
1 × 6	10 AWG
1 × 10	8 AWG

More information on the standard packaging unit see page 26.

Further packaging units upon request.

Bold printed order no. = stock item

BETAflam® Solar 125 flex 1500V DC

Photovoltaic power cables, halogen free, flame retardant



NEW

BETAflam® Solar 125 flex 1500V DC

Applications

Is used as photovoltaic cable between solar modules and inverters in a photovoltaic system with a rated value $U_0 = 1.5 \text{ kV DC}$.

Construction

■ Conductor	Tinned fine copper strand according to VDE 0295 / IEC 60228, class 5
■ Insulation	XLPO, flame-retardant, halogen free, electron-beam cross-linked
■ Jacket	XLPO, flame-retardant, halogen free, electron-beam cross-linked, UV and ozone resistant, with white or red marking and stripe
■ Jacket colour	● black

Electrical characteristics

Rated value	$U_0 = 1500 \text{ V DC}$ (max. permitted voltage $U_0 1800 \text{ V DC}$)
Test voltage	11 kV AC 50 Hz



Advantages

- Electron-beam cross-linked compounds
- UV, ozone and hydrolysis resistant
- High temperature resistance, the materials do not melt or flow
- Good cold flexibility
- Very long service life
 $>25 \text{ years at } 90^\circ \text{C}$
- Compatible to all popular connectors

Thermal characteristics

Operating temperature	$-50^\circ \text{ C up to } +120^\circ \text{ C}$
Ambient temperature	$-50^\circ \text{ C up to } +90^\circ \text{ C}$
Max. short circuit temp.	$280^\circ \text{ C, } +536^\circ \text{ F, } 5 \text{ s}$

Bending radius

Fixed installation	$> 4 \times \varnothing$
Occasionally moved	$> 5 \times \varnothing$

Standards / Material properties

- Fire performance: IEC 60332-1
- Smoke emission: IEC 61034; EN 61034-2
- Low fire load: DIN 51900
- Approvals: TÜV 2 PfG 1990/05.12
- Application standards: prEN50618



Dimensions, weights

Construction	Marking	Conductor Ø	Outer Ø	Resistance	Weight	Fire load	Order no.
n × mm ²	Colour	mm	mm	max. mΩ/m	kg/km	kWh/m	
1 × 2.5	○ white	2.05	5.65	8.21	55.01	0.124	309344
1 × 4	○ white	2.55	6.15	5.09	71.95	0.141	309345
1 × 6	○ white	3.10	6.70	3.39	93.45	0.159	309346
1 × 10	○ white	4.10	7.70	1.95	135.58	0.191	309347
1 × 2.5	● red	2.05	5.65	8.21	55.01	0.124	309348
1 × 4	● red	2.55	6.15	5.09	71.95	0.141	309349
1 × 6	● red	3.10	6.70	3.39	93.45	0.159	309350
1 × 10	● Rot	4.10	7.70	1.95	135.58	0.191	309351

Order units

Construction	Marking	Order no.	
n × mm ²	Colour	18 × 500 m	8 × 1000 m
1 × 4	○ white	309345V2	309345V3
1 × 6	○ white	309346V2	309346V3
1 × 4	● red	309349V2	309349V3
1 × 6	● red	309350V2	309350V3

More information on the standard packaging unit see page 26.

Further packaging units upon request.

Bold printed order no. = stock item

BETAflam® Solar 125 flex UL 4703

Photovoltaic power cables, halogen free, flame retardant



BETAflam® Solar 125 flex UL 4703

Applications

Double insulated, electron-beam cross-linked cables for photovoltaic power applications.

Construction

■ Conductor	Tinned fine copper strands acc. to VDE 0295 / IEC 60228, Class 5
■ Insulation	XLPO, flame retardant, halogen free, electron-beam cross-linked
■ Jacket	XLPO, flame retardant, halogen free, electron-beam cross-linked, UV and ozone resistant
■ Jacket colour	● black

Electrical characteristics

Rated value	U ₀ /U = 600 / 1000 V AC, 1000 / 1800 V DC
Test voltage	6500 V, 50 Hz, 5 min.

Dimensions, weights

Construction	Conductor Ø	Outer Ø	Resistance max.	Weight	Fire load	Order no.
n × mm ²	mm	mm	mΩ/m	kg/km	kWh/m	
1 × 2.5	14 AWG	2.05	6.50	8.21	67	0.169
1 × 4	12 AWG	2.55	7.05	5.09	86	0.192
1 × 6	10 AWG	3.10	7.60	3.39	109	0.214
1 × 10	8 AWG	4.10	9.30	1.95	155	0.256

Order units

Construction	Order no.
n × mm ²	18 × 500 m
1 × 2.5	14 AWG
1 × 4	12 AWG
1 × 6	10 AWG
1 × 10	8 AWG

More information on the standard packaging unit see page 26.
Further packaging units upon request.

Advantages

- Electron-beam cross-linked compounds
- UV, ozone and hydrolysis resistant
- High temperature resistance, the materials do not melt or flow
- Good cold flexibility
- Very long service life
- Compatible to all popular connectors

Thermal characteristics

Operating temperature	-40° C up to +125° C -40° F up to +257° F
Ambient temperature	-40° C up to +90° C
> 25 years (TÜV)	-40° F up to +194° F
Max. short circuit temp.	280° C, +536° F, 5 s

Bending radius

Fixed installation	> 4 × Ø
Occasionally moved	> 5 × Ø

Standards / Material properties

- Fire performance: IEC 60332-1; UL 1581 1060 / VW1
- Smoke emission: IEC 61034; EN 61034-2
- Low fire load: DIN 51900
- Approvals: TÜV 2 PfG 1169/08.2007 PV1-F; UL 4703 PV wire; UL 854 USE-2; cTÜVus
- Application standards: NEC 2008 / UL PV wire, USE-2; UNE 21123; UNE 20.460-5-52, UTE C 32-502



BETAfam® Solar 125 RV flex FRNC

Photovoltaic power cables, halogen free, flame retardant



BETAfam® Solar 125 RV flex FRNC

Applications

Double insulated, electron-beam cross-linked cables for photovoltaic power applications. With reduced diameter and integrated jacket.

Construction

■ Conductor	Tinned fine copper strands, acc. to VDE 0295 / IEC 60228, Class 5
■ Insulation	XLPO, flame retardant, halogen free, electron-beam cross-linked
■ Jacket	XLPO, flame retardant, halogen free, electron-beam cross-linked, UV and ozone resistant
■ Jacket colour	● black

Electrical characteristics

Rated value	U _{0/U} = 600 / 1000 VAC, 1000 / 1800 VDC
Test voltage	6500 V, 50 Hz, 5 min.



Advantages

- Electron-beam cross-linked compounds
- UV, ozone and hydrolysis resistant
- High temperature resistance, the materials do not melt or flow
- Very long service life
> 25 years at 90 °C
- Compatible to all popular connectors
- Flexible and space-saving installation

Thermal characteristics

Operating temperature	-40° C up to +125° C -40° F up to +257° F
Ambient temperature	-40° C up to +90° C
> 25 years (TÜV)	-40° F up to +194° F
Max. short circuit temp.	280° C, +536° F, 5 s

Bending radius	Ø <10 mm	Ø >10 mm
Fixed installation	> 4 × Ø	> 5 × Ø
Occasionally moved	> 5 × Ø	> 7 × Ø

Standards / Material properties

- Fire performance: IEC 60332-1, IEC 60332-3-24
- Smoke emission: IEC 61034; EN 61034-2
- Low fire load: DIN 51900
- Approvals: TÜV 2 PfG 1169 08.2007 PV1-F
- Application standards: UNE 21123; UNE 20.460-5-52,
UTE C 32-502



Dimensions, weights

Construction	Marking	Conductor Ø	Outer Ø	Resistance	Weight	Fire load	Order no.
n × mm ²	Colour	mm	mm	max, mΩ/m	kg/km	kWh/m	
1 × 2.5	○ white	2.05	4.65	8.21	41	0.079	304467
1 × 4	○ white	2.55	5.05	5.09	56	0.086	304468
1 × 6	○ white	3.10	5.65	3.39	76	0.100	304469
1 × 10	○ white	4.10	6.70	1.95	118	0.126	304471
1 × 16	○ white	5.50	9.70	1.24	211	0.288	304472
1 × 25	○ white	6.60	11.20	0.79	304	0.369	304474
1 × 35	○ white	7.70	12.30	0.56	404	0.414	304475
1 × 50	○ white	9.90	14.90	0.39	582	0.558	304476
1 × 2.5	● red	2.05	4.65	8.21	41	0.079	307701
1 × 4	● red	2.55	5.05	5.09	57	0.086	306470
1 × 6	● red	3.10	5.65	3.39	77	0.100	306471

Order units

Construction	Marking	Order no.	50 × 100 m	24 × 500 m	18 × 500 m	18 × 1000 m	8 × 1000 m
n × mm ²	Farbe						
1 × 4	○ white	304468V8	304468V1	∅	304468V2	∅	
1 × 6	○ white	304469V8	∅	304469V2	∅	304469V3	
1 × 10	○ white	∅	∅	304471V2	∅	∅	
1 × 4	● red	∅	306470V1	∅	306470V2	∅	
1 × 6	● red	∅	∅	306471V2	∅	306471V3	

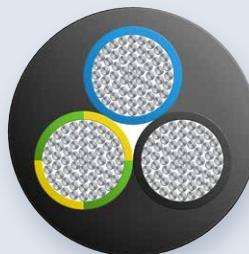
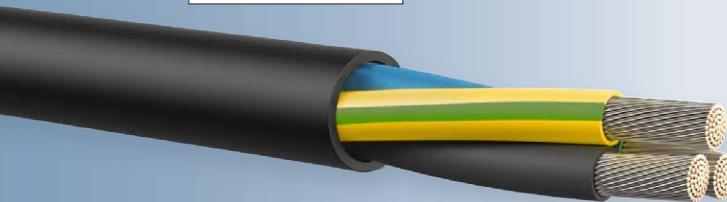
More information on the standard packaging unit see page 26.

Further packaging units upon request.

Bold printed order no. = stock item

BETAflam® Solar 125 AC flex FRNC

Photovoltaic power cables, halogen free, flame retardant



BETAflam® Solar 125 AC flex FRNC

Applications

Double insulated, electron-beam cross-linked cables for the connection of micro inverters.

Construction

■ Conductor	Tinned fine copper strands, acc. to VDE 0295 / IEC 60228, Class 5
■ Insulation	XLPO, flame retardant, halogen free, electron-beam cross-linked
■ Colour	Light blue, black, green-yellow or black with white numbers
■ Jacket	XLPO, flame retardant, halogen free, electron-beam cross-linked, UV and ozone resistant
■ Jacket colour	● black

Electrical characteristics

Rated value	U _{0/U} = 450 / 750 V AC
Test voltage	6500 V, 50 Hz, 5 min.

Advantages

- Electron-beam cross-linked compounds
- UV, ozone and hydrolysis resistant
- High temperature resistance, the materials do not melt or flow
- Very long service life > 25 years at 90 °C
- Compatible to all popular connectors

Thermal characteristics

Operating temperature	-40° C up to +120° C (20,000 h)
Ambient temperature	
Fixed installation	-40° C up to +90° C
Occasionally moved	-35° C
Max. short circuit temp.	280° C

Bending radius

Fixed installation	> 6 × Ø
Occasionally moved	> 8 × Ø

Standards / Material properties

- Approvals: TÜV 2 PfG 1940 / 12.11
- Halogen free: IEC 60754-1
- No corrosive gases: IEC 60754-2
- Fire performance: IEC 60332-1, IEC 60332-3-24
- Smoke emission: IEC 61034; EN 61034-2
- Low fire load: DIN 51900
- UV resistant: HD 605



Dimensions, weights

Construction	Conductor	Conductor Ø	Outer Ø	Weight	Fire load	Order no.
n × mm ²	n × mm	mm	mm	kg/km	kWh/m	
3G 0.75	24 × 0.20	1.15	7.80	82	0.224	308074
4G 0.75	24 × 0.20	1.15	8.70	104	0.293	308075
5G 0.75	24 × 0.20	1.15	9.70	130	0.36	308076
3G 1.0	32 × 0.20	1.25	8.00	91	0.24	308077
4G 1.0	32 × 0.20	1.25	8.80	116	0.31	308078
5G 1.0	32 × 0.20	1.25	9.80	145	0.38	308079
3G 1.5	27 × 0.25	1.55	8.80	115	0.29	308080
4G 1.5	27 × 0.25	1.55	9.80	147	0.37	308081
5G 1.5	27 × 0.25	1.55	11.20	191	0.48	308082
3G 2.5	45 × 0.25	2.05	10.20	164	0.37	308083
4G 2.5	45 × 0.25	2.05	11.40	211	0.50	308084
5G 2.5	45 × 0.25	2.05	12.60	262	0.59	308085
3G 4.0	52 × 0.30	2.55	11.40	226	0.47	308086
4G 4.0	52 × 0.30	2.55	12.90	294	0.60	308087
5G 4.0	52 × 0.30	2.55	14.40	366	0.74	308088
3G 6.0	78 × 0.30	3.10	12.90	307	0.60	308089
4G 6.0	78 × 0.30	3.10	14.50	396	0.73	308090
5G 6.0	78 × 0.30	3.10	16.30	498	0.92	308091

Subject to change.

BETAflam® Solar 125 RV AL FRNC

Photovoltaic power cables, halogen free, flame retardant



NEW

BETAflam® Solar 125 RV AL FRNC

Applications

Double insulated, electron-beam cross-linked cables for large-scale rooftop or photovoltaic power plants.

Construction

■ Conductor	Aluminium, stranded wire, compacted, acc. to VDE 0295 / IEC 60228, Class 2
■ Insulation	XLPO, flame retardant, halogen free, electron-beam cross-linked
■ Jacket	XLPO, flame retardant, halogen free, electron-beam cross-linked, UV and ozone resistant
■ Jacket colour	● black

Electrical characteristics

Rated value	$U_0/U = 600 / 1000 \text{ V AC}$, 1000 / 1800 V DC for fixed installation
Test voltage	6500 V, 50 Hz, 5 min.

Advantages

- Electron-beam cross-linked compounds
- UV, ozone and hydrolysis resistant
- High temperature resistance, the materials do not melt or flow
- Good cold flexibility
- Very long service life
>25 years at 90 °C

Thermal characteristics

Operating temperature	-40° C up to +120° C -40° F up to +248° F
Ambient temperature	-40° C up to +90° C
> 25 years	-40° F up to +194° F

Bending radius

Fixed installation	> 10 × Ø
Occasionally moved	> 12 × Ø

Standards / Material properties

- Fire performance: IEC 60332-1
- Halogen free: IEC 60754-1
- No corrosive gases: IEC 60754-2
- Low fire load: DIN 51900
- Environmentality, EU-Directives: RoHS 2002/95/EC; PAH 2005/69/EC; PFOS 2006/122/EC
- Ozon resistant: EN 50396
- UV resistant: HD605
- Construction and properties: In accordance to TÜV 2 Pfg 1169/08.2007

Dimensions, weights

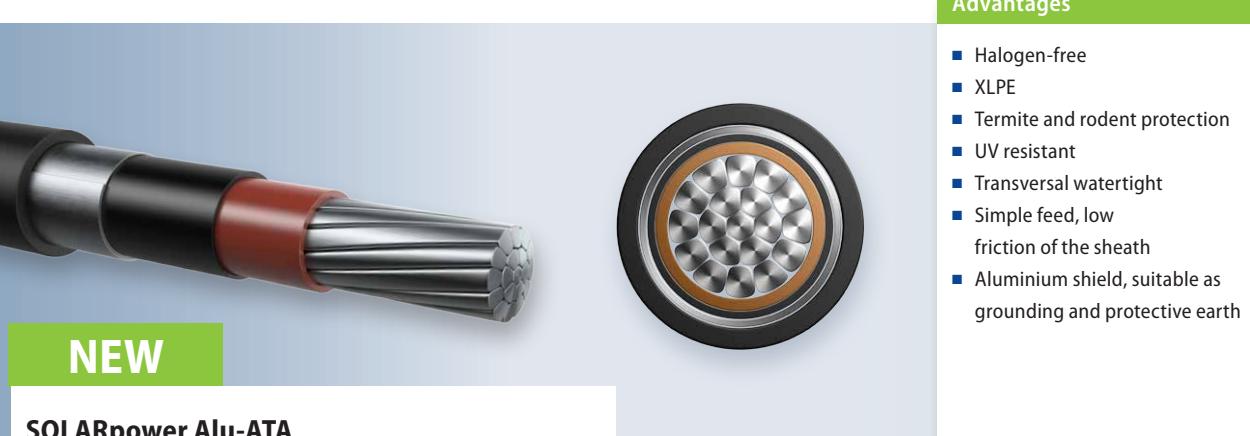
Construction	Conductor Ø	Outer Ø	Resistance max.	Potential drop ¹	Weight	Order no.
n × mm ²	mm	mm	mΩ/m	mV/Am	kg/km	
1 × 50	8.20	13.20	0.641	1.282	266	309110
1 × 70	9.90	14.90	0.443	0.886	341	309111
1 × 95	11.50	16.50	0.330	0.640	431	306756
1 × 120	12.85	18.50	0.253	0.506	551	309112
1 × 150	14.20	19.80	0.206	0.412	630	309113
1 × 185	16.40	22.40	0.164	0.328	788	309114
1 × 240	18.36	24.40	0.125	0.250	969	309115
1 × 300	20.45	27.25	0.100	0.200	1206	309116

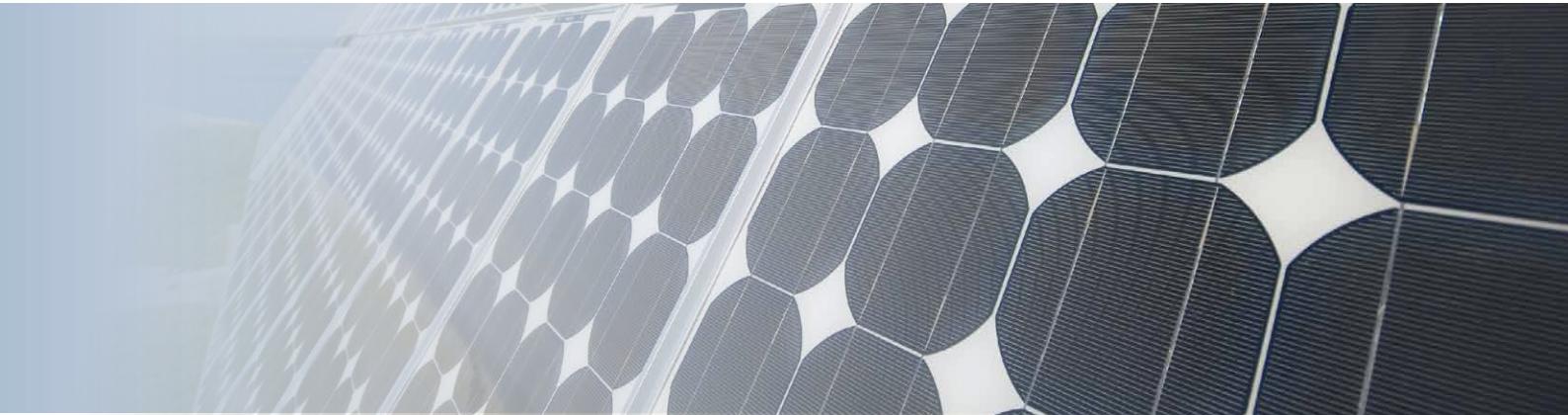
¹ at 20° C



SOLARpower Alu-ATA

Low voltage cable, halogen free




Max. current rating 90° C / 194°F SOLARpower Alu-ATA

Construction	Suspended in air (60 °C) without sun	Suspended in air (60 °C) with sun	In the ground (max. 20 °C, depth 1m)	In concrete pipe (max. 20 °C, depth 1m)			
mm ²	Temp. 90 °C	Temp. 90 °C	Temp. 90 °C	Temp. 70 °C	Temp. 90 °C	Temp. 70 °C	Max. current rating of the shield*
A							
1×50/18	145	121	181	158	154	134	40
1×70/20	182	152	222	194	188	164	44
1×95/22	222	185	265	231	225	196	48
1×120/24	257	213	301	263	256	223	52
1×150/26	292	241	336	294	286	250	54
1×185/28	340	278	383	334	325	284	61
1×240/31	401	327	444	387	377	329	64
1×300/33	461	375	501	438	426	372	66

* not valid in case of full load on conductor

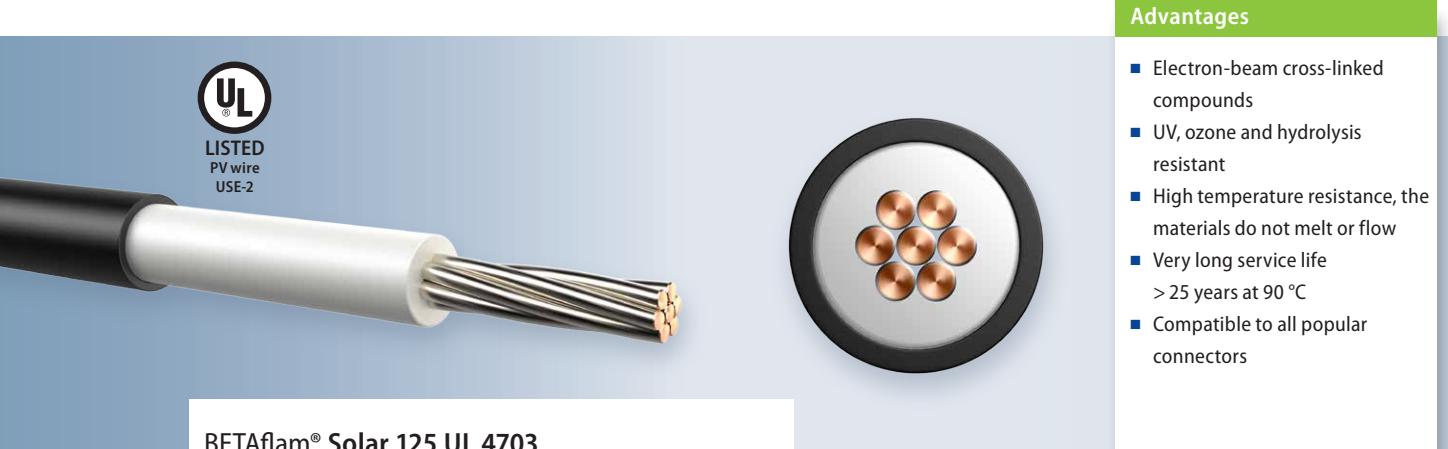
Continuous duty with current loads as per above table.

This gives a conductor temperature of 120° C.

(Calculation according IEC 60287)

BETAfiam® Solar 125 UL 4703

Photovoltaic power cables, halogen free, flame retardant



BETAfiam® Solar 125 UL 4703

Applications

Double insulated, electron-beam cross-linked cables for photovoltaic power applications.

Construction

■ Conductor	Tinned copper strands, acc. to VDE 0295 / IEC 60228, Class 2
■ Insulation	XLPO, flame retardant, halogen free, electron-beam cross-linked
■ Jacket	XLPO, flame retardant, halogen free, electron-beam cross-linked, UV and ozone resistant
■ Jacket colour	● black

Electrical characteristics

Rated value	U _{0/U} = 600 / 1000 V AC, 1000 / 1800 V DC
Test voltage	6500 V, 50 Hz, 5 min.

Dimensions, weights

Construction	Conductor Ø	Outer Ø	Resistance max.	Weight	Fire load	Order no.
n × mm ²	mm	mm	mΩ/m	kg/km	kWh/m	
1 × 10 AWG	3.00	7.50	3.66	107	0.215	303326

Order units

Construction	Order no.					
n × mm ²	18 × 500 m	8 × 1000 m	1 × 4000 m	1 × 5000 m	1 × 6000 m	1 × 8000 m
1 × 10 AWG	Ø	303326V3	Ø	Ø	Ø	Ø

More information on the standard packaging unit see page 26.
Further packaging units upon request.

Advantages

- Electron-beam cross-linked compounds
- UV, ozone and hydrolysis resistant
- High temperature resistance, the materials do not melt or flow
- Very long service life
> 25 years at 90 °C
- Compatible to all popular connectors

Thermal characteristics

Operating temperature	-40° C up to +125° C -40° F up to +257° F
Ambient temperature	-40° C up to +90° C > 25 years (TÜV)
Max. short circuit temp.	280° C, +536° F -40° F up to +194° F

Bending radius

Fixed installation	> 4 × Ø
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Standards / Material properties

- Fire performance: IEC 60332-1; UL 1581 1060 / VW1
- Smoke emission: IEC 61034; EN 61034-2
- Low fire load: DIN 51900
- Approvals: UL 4703 PV wire; UL 854 USE-2
- Application standards: NEC 2008 / UL PV wire, USE-2

Standard packaging / Technical information

Current rating 120° C / 248° F

Ambient temperature 30° C / 86° F

Construction	Exposed	On surfaces without opposite contact	On surfaces with opposite contact	In conduit, casing, duct
mm ²	A	A	A	A
2.5	51	48	34	27
4	68	65	45	36
6	88	84	59	47
10	121	115	80	64
16	160	152	106	85
25	211	200	140	112
35	261	248	174	139
50	320	304	213	170

Continuous duty with current loads as per above table.

This gives a conductor temperature of 120° C.

(Calculation according IEC 60287)

Conversion factors for deviating ambient temperatures (basis 30° C)

Temperature	Current rating at 120° C
°C	Factor
20	×1.05
30	×1.00
40	×0.94
50	×0.88
60	×0.82
70	×0.75
80	×0.67
90	×0.58

Standard packaging / Transport conditions

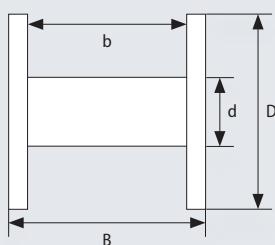
Packaging

- Wooden packaging according to the IPPC ISPM-15 standard (Bew. Nr. CH-90055-HT-DB): All pallets and plywood reels acc. to IPPC standard ISPM15, the producer is registered as CH-90055-HT-DB.
- Fit for sea, air and land transport
- Can be stacked 2-high

Distribution, storage, availability

Customers of LEONI receive their BETAflam® Solar deliveries on schedule from the standard stock in Germany. Large buffer stocks are available there to ensure flexibility. Currently, LEONI manages several individual customer stocks across the world in order to avoid out-of-stock situations in the supply chain. By agreement, suitable purchase contracts can be made to create further buffer stocks on a worldwide basis, which can be tailored and managed to individual requirements.

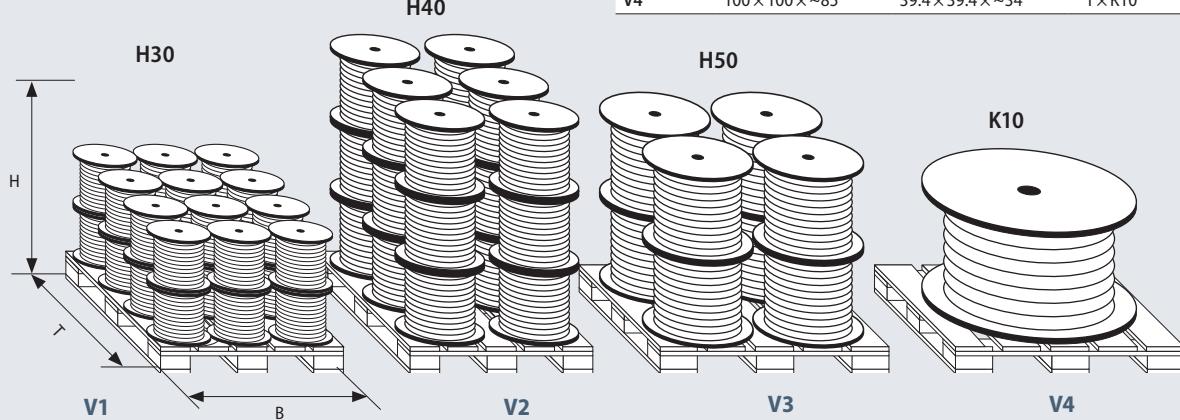
Standard reel dimensions



Reel	\varnothing Flange		\varnothing Core		Distance between flange	
	D	d	external	internal	B	b
	cm	cm	cm	cm	cm	cm
H30	30	12	30	29		
H40	40	18	30	27		
H50	50	15	43	40		
K10	100	50	70	60		

Standard packaging units / pallet

Pallet	Dimensions W×D×H		Load
	cm	inch	
V1	100×120×~80	39.4×47×~32	24×H30
V2	80×120×~105	31.5×47×~41	18×H40
V3	100×100×~101	39.4×39.4×~40	8×H50
V4	100×100×~85	39.4×39.4×~34	1×K10



Smoke density

The formation of smoke has several unpleasant consequences. On the one hand it considerably lowers the visibility in a fire event, thus impeding the people trapped inside closed rooms escape of and the efforts of the firemen to carry on their rescue and fire fighting actions. On the other hand it produces smoke poisoning because of the carbon monoxide. With respect to the formation of combustion gases, PVC performs rather poorly. However, this cannot be blamed on PVC, as is frequently assumed. In fact, it is caused by the additives included in the PVC – particularly the softening agents, which normally lead to considerable smoke production.

Test procedures

The density of smoke emission can be determined by measuring of the light penetrability. Cable samples are lit with alcohol in a test chamber (cubical with an edge length of 3 m). The so formed smoke is uniformly spread by a ventilator and influences the light measuring section.

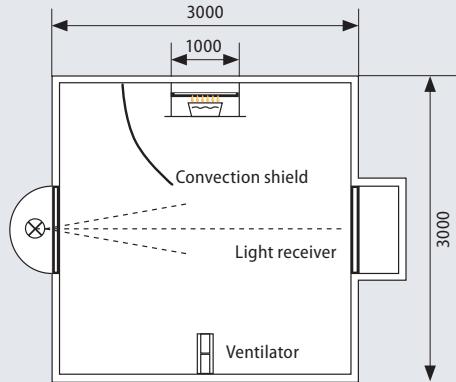
The test is considered to be passed if the following light penetrability is reached:

Hazard level	Requirements
■ HL 1	–
■ HL 2 and HL 3	60 %
■ HL 4	70 %

Test standards

IEC 61034, EN 61034

IEC 61034, EN 61034



Flame retardant

Flame retardant cables are cables which, when installed as a single cable, although ignitable on exposure to flame source, will greatly reduce flame spread and selfextinguish once the flame source is removed.

However in a vertical cable bundle, e.g. in vertical risers, fire can spread along the cables (chimney effect). In order to avoid this danger, the so called «no flame propagating» cables should be used.

Test procedures

This test procedure describes the minimum requirements for flame retardant cables and it is valid for lead wires or on single cables only.

A lead wire or a cable is being aflamed with a propane-air-burner (1 kW flame).

Test duration

- $\varnothing \leq 25$ = 60 s
- $\varnothing 25 \dots 50$ = 120 s
- $\varnothing 50 \dots 75$ = 240 s
- $\varnothing > 75$ = 480 s

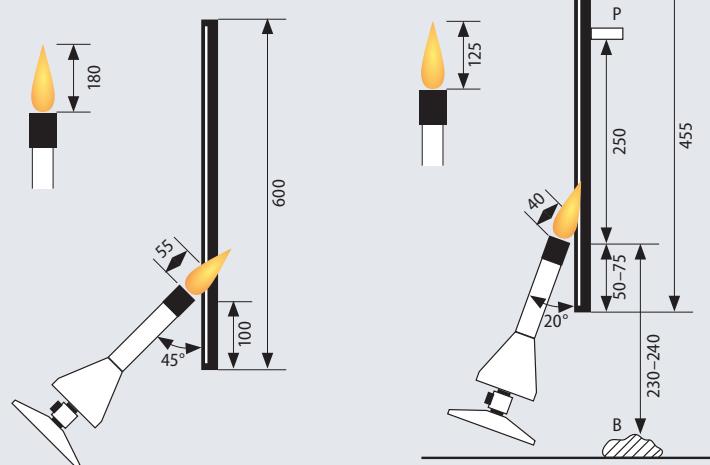
The burning cable should self-extinguish as soon as the fire source has been removed. The fire damage may not be higher than 60 cm.

The test is considered to be passed if the sample has not burned and the damage (carbonisation) has not reached any of the terminations of the sample (> 50 mm). Additional test procedures for individual cables are also undertaken in accordance with UL 1581.

Test standards

IEC 60332-1, EN 60332-1

IEC 60332-1-2, EN 60332-1



Electron-beam cross-linking

Physical cross-linking

We cross-link our cable insulations with highenergy electrons (betarays) in our own state-of-the-art irradiation centre. These electrons cede their kinetic energy when slowed down in the polymer. Through the impact of the electrons radicals are built, which with chemical reaction interlink the molecules.

Cross-linked insulating materials

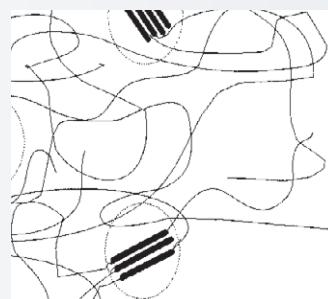
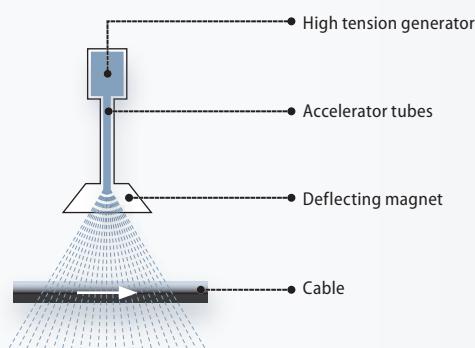
Cross-linking binds together the polymer chains by means of a chemical linking (in the amorphous phase).

This leads to a three-dimensional network. The polymer chain can no longer move freely (irrespective of temperature). Above the melting temperature the material can no longer flow but it goes into a rubber-like elastic state.

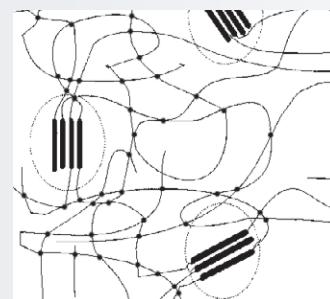
Advantages of cross-linked insulation materials

- Increased shear and compressive strength
- Improved integrity in case of electrical failures (overload, short circuit)
- Improved resistance to chemicals
- Infusible, soldering iron resistance
- Improved impact strength and crack resistance
- Better weather and abrasionresistance

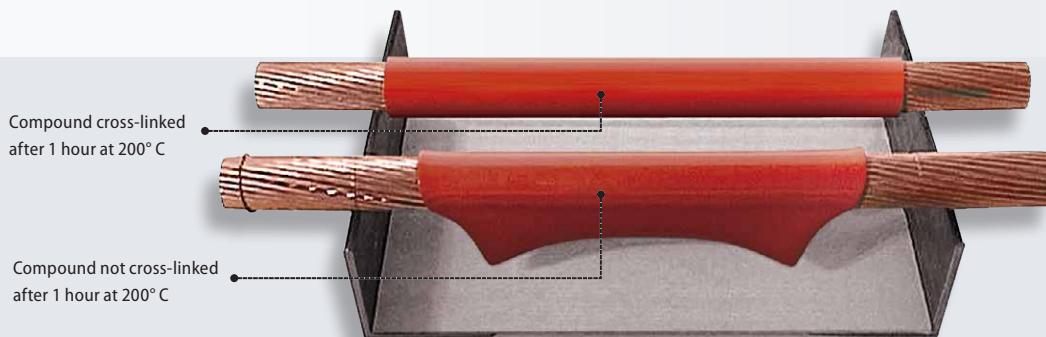
With the electron-beam accelerators the insulation materials can be cross-linked within a few seconds. The homogenous irradiation and implicit the homogenous cross-linking are ensured by thererfore especially adapted handling systems. Other than in the chemical cross-linking in the irradiation cross-linking no peroxides or hydro-silicones are incorporated into the synthetic mixtures.



BEFORE cross-linking:
Schematic representation of the chain-forming macromolecules before cross-linking. Free movement of polymer chains (in the melt and in the solution).



AFTER cross-linking:
Schematic representation of chain-forming macromolecules after cross-linking. Three-dimensional cross-linking of polymer chains (heavily impaired freedom of movement).

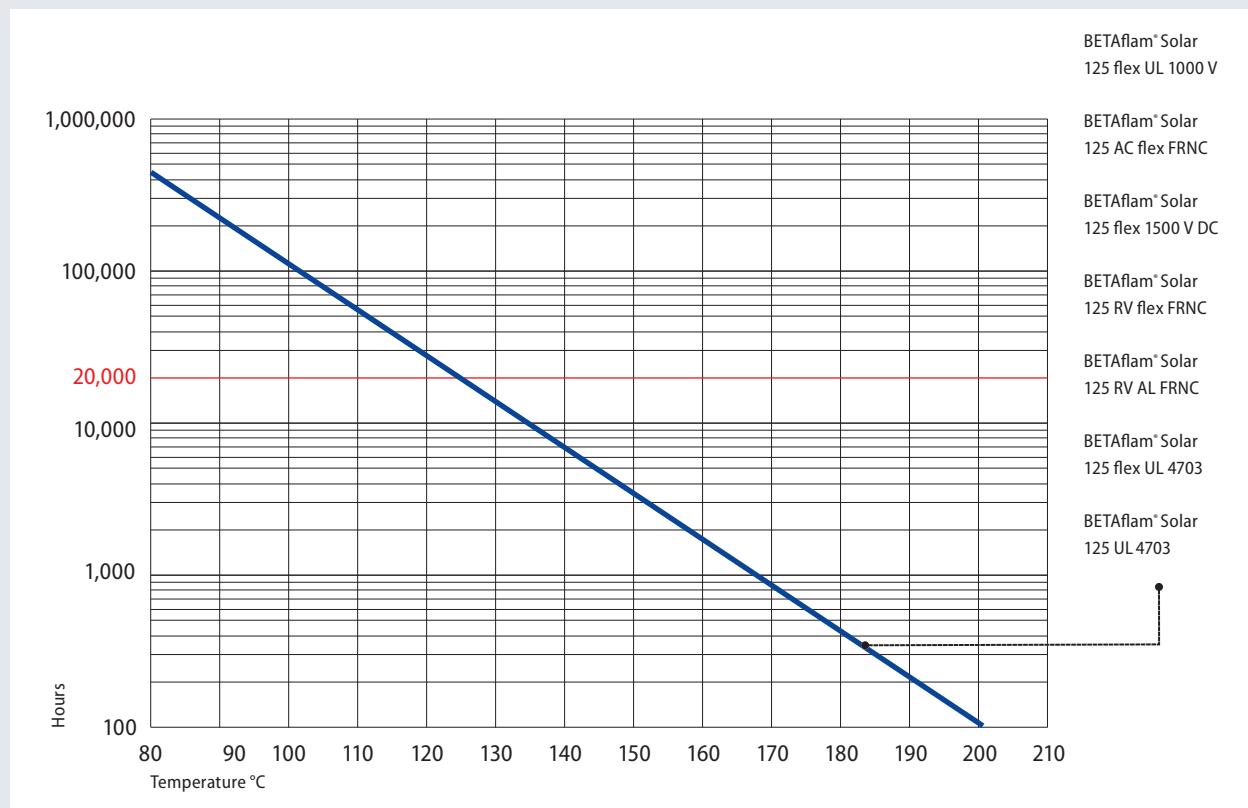


Temperature index as per IEC 60216 / VDE 0304 part 21

The temperature index describes the long-term performance of plastics. The temperature index defines the ageing temperature (in °C), at which the material still has an absolute elongation at break of 50 % after 20,000 hours. A 10° C higher temperature index results in approximately doubling the service life expectation of the plastic.

In order to determine the long term temperature stability of an insulation material the different ageing times corresponding to different temperatures are measured and recorded in a so called Arrhenius-Diagram (ordinate-axis: log time, abscissa axis: the reciprocal absolute temperature). A straight line is drawn to connect the various recorded points.

By prolonging the straight line until it intersects the 20,000 h axis it is possible to determine the service life or the temperature index.



Halogen-free

The halogens are the elements of the 7th group in the Periodic table of elements:

- **Chlorine (Cl)**
- **Fluorine (F)**
- **Bromine (Br)**
- **Jodine (I)**

Halogen-free cables must be free of chlorine, fluorine and bromine (PVC cables contain halogen, PVC = Polyvinylchloride).

The halogens are an integrated component of many acids.

- **HCl = Hydrochloric acid, salt acid**
- **HF = Hydrogenfluorid**
- **HBr = Hydrogenbromid**

The most popular plastic containing halogens is PVC (polyvinylchloride). In case of fire or at high temperature PVC starts to degrade. Hydrochloric acid and other fission products are generated and leads to extremely aggressive corrosion. Therefore the current trend is to replace the halogen containing plastics with halogen-free ones. For instance PVC is currently being replaced at a large scale with polyolefin i.e. polyethylene.

Thanks to halogen-free cables the formation of corrosive and toxic gases can be prevented.

Test procedures

A sample of between 0.5 g and 1.0 g is heated in a tube. The resulting gases are released and tested for their halogen content. Using this process, all halogen-based acids, with the exception of hydrofluoric acid, are separated as hydrochloric acid.

Test standards

IEC 60754-1

Degree of acidity of combustion gases

Corrosive gases react with moisture to produce aggressive acids which corrode metal parts and cause extensive long-term damage, even though the fire damage may only be limited; this is because corrosive gases often spread throughout a building through the ventilation system or within whole installations. The damage may not be limited to the area immediately affected by the fire. Electronic units and electronic contacts are particularly vulnerable, as are free-standing or concrete enclosed steel constructions.

Test procedures

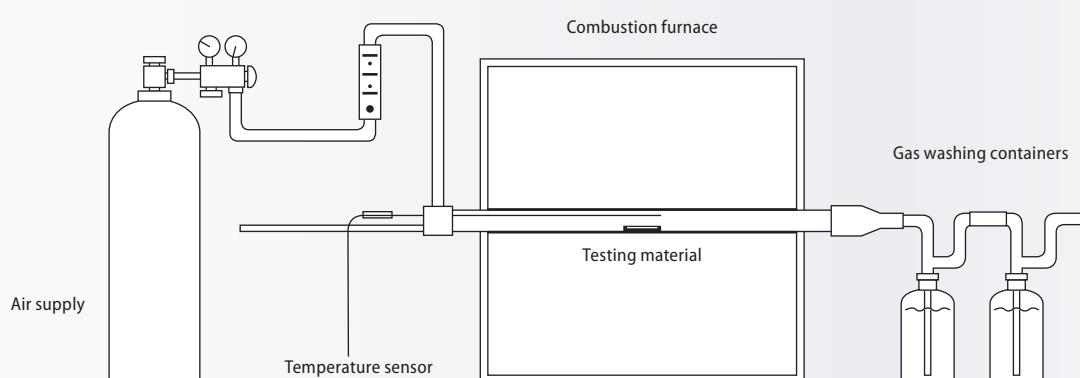
1000 mg insulation material is burned in a combustion furnace at $\geq 935^{\circ}\text{C}$ with pre-defined air supply for over 30 minutes. By means of two gas washing containers, held in the airflow the conductivity and the pH-value are measured. Like that even small quantities of halogen containing substances can be detected and proven.

The test is considered to be passed if

- **the PH value > 4.3**
- **the conductivity $< 10 \mu\text{S/mm}$**

Test standards

IEC 60754-2, EN 50267-2-2



Further products

BETATHERM^{*}

- Premium, halogen-free and electron-beam cross-linked lead wires
- Temperature resistant, increased dielectric strength, easy stripping

BETAflam^{*} flex

- Premium flexible connection and power cables
- Good resistance to aggressive media, halogen-free and flame retardant

BETAflam^{*} CHEMAflex^{*}

- Oil and chemical resistant connection and power cables
- Temperature resistant, halogen-free, flame retardant, easy stripping

BETATRANS^{*}

- Premium flexible halogen-free connection and power cables
- Excellent mechanical and dielectric strength

BETAflam^{*} Solar

- Double insulated lead wires
- Electron-beam cross-linked and halogen-free
- For solar power applications

BETAjet^{*}

- 400 Hz ground power cable systems
- For mobile and static applications

BETALUX^{*}

- Media resistance 5 kV-primary cables
- Feeder cables for airfield lighting

BETAflam^{*}

- Fire resistant safety cables for highest demand
- Flame retardant, low smoke density, no flame propagation

BETAFIXSS^{*}

- Laying systems with circuit integrity under fire

BETAPower

- Medium voltage power cables TRI -DELTA^{*} and Fireprotec
- Low voltage power cables GKN and GN-CLN
- Flexible single-core cable BETAflam^{*} TRAFO-FLEX
- Accessories for cables

BETASOLUTION^{*}

- The solution for cable system engineering
- Power and communication transmission – all from one source

MegaLine^{*}

- Quality solutions for the passive copper cabling infrastructure in data, patch and trunk cables
- Innovative MegaLine^{*} Connect connection technology

GigaLine^{*}

- Fiber optic data, patch and trunk cables for extremely high bandwidth and longer transmission distances
- Perfectly matched GigaLine^{*} connection technology – powerful tools for building a fiber optic infrastructure

VarioLine^{*}

- Modular system with peripheral collector and underfloor programs
- For simple and fast integration in different applications

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