



**BETAflam<sup>®</sup> Solar**  
**Photovoltaic power cables**

**The Quality Connection**

**LEONI**



# We connect technology, efficiency & eco- logical 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](http://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 59,000 people in 32 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.

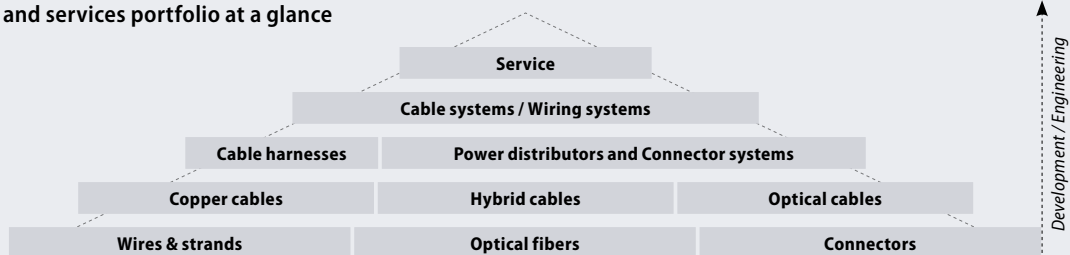
**Your markets – our strength.**

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

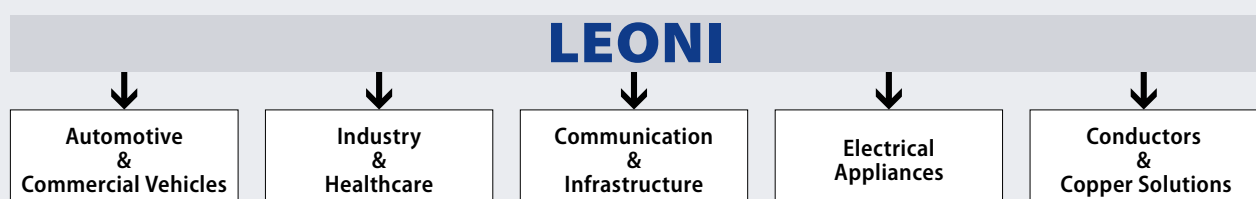
We are among the leading European suppliers in the Communication & Infrastructure market to which at LEONI as a cable manufacturer also belong activities in the fields of Infrastructure & Data Communications, Industrial Plant Projects, Solar & Wind-power, Energy & Telecommunications, Irradiation Cross-Linking 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](http://www.leoni.com)

## Products and services portfolio at a glance



## LEONI's core markets



**Nature is brilliant. Cleanly efficient.**



## Business Unit Solar- & Windpower

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

Solar and wind energy are the energy suppliers 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.

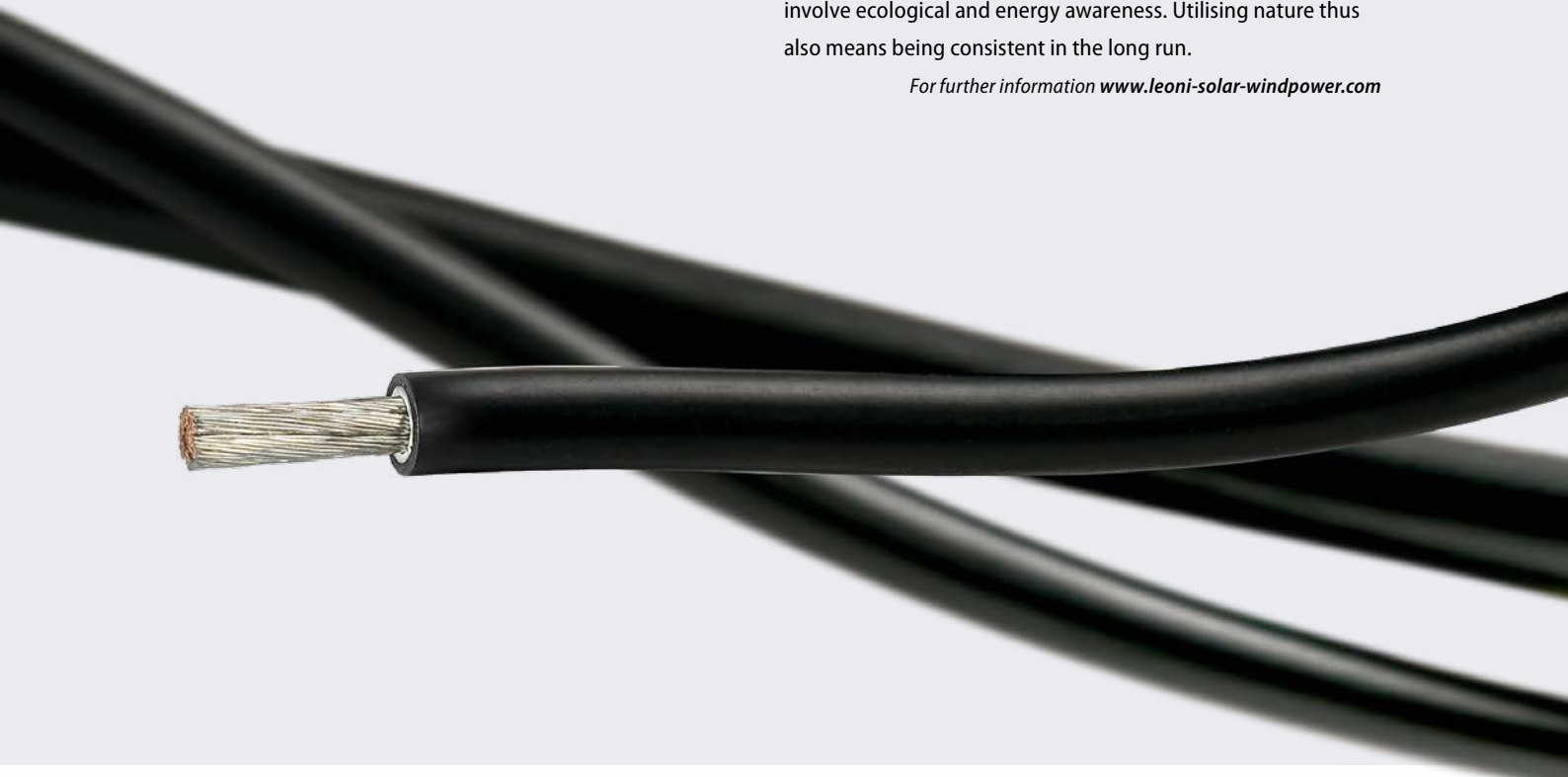
Achieving maximum efficiency is the responsibility of leading technology development companies. Innovative strength, creativity, inspiration and the courage to forge new paths are the requirements for tomorrow's clean energy world.

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](http://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.

### Quality management

One of the most important factors in the success of LEONI was and remains the uniformly high quality of its products over the decades.

We pay particularly close attention to this through precise planning, testing and documentation. Quality management for the wire and cable types produced by LEONI is certified worldwide in accordance with ISO 9001:2008.







New environmental regulations have been in force in the European Union since July 2006. EU Directive 2002/96/EC WEEE (Waste Electrical and Electronic Equipment) regulates the disposal of electrical and electronic components and devices. Furthermore, the use of certain hazardous substances is limited in electrical and electronic equipment by the EU Directive 2011/65/EU (RoHS).

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)



Although not all cable applications are affected by these guidelines we have designed our entire solar cable range of products so that the environmental directives are satisfied. As the disposal of cables around the world is not always undertaken by specialists, problem-free and environmentally-friendly disposal, however it is accomplished, is a key criterion. Our halogen-free and RoHS compliant cables take account of this fact.

*For further information [www.leoni-green-technology.com](http://www.leoni-green-technology.com)*

EU Directive 2002/96/EC

on waste electrical and electronic equipment.

EU Directive 2011/65/EU

on the restriction of the use of certain hazardous substances in electrical and electronic equipment.



What does RoHS mean?

RoHS stands for Restriction of the use of certain Hazardous Substances in electrical and electronic equipment.

# All cables at a glance



## Approval acc. to TÜV



■ BETAflam® Solar 125 flex FRNC  
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■ BETAflam® Solar 125 RV flex FRNC  
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**NEW**

## Approval acc. to TÜV and UL



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■ BETAflam® Solar 125 flex **UL 1000 V**  
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**NEW**

## Approval acc. to UL



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## Approval acc. to TÜV



■ BETAflam® Solar 125 AC flex FRNC  
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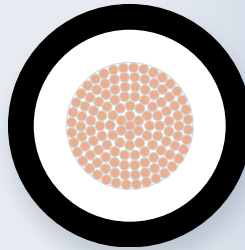
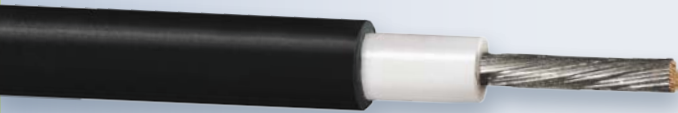


**NEW**



# BETAflam® Solar 125 flex FRNC

Photovoltaic power cables, halogen free, flame retardant



## Advantages

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

## BETAflam® Solar 125 flex FRNC

### 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

Operation temperature	U <sub>0</sub> /U = 600 / 1000 V AC, 1000 / 1800 V DC
Test voltage	6500 V, 50 Hz, 5 min.

### Thermal characteristics

Operation 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
Short circuit temperature	280 °C, +536 °F max.

### Bending radius

Fixed installation	> 4 × Ø
Occasionally moved	> 5 × 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	Conductor-Ø	Outer Ø	Resistance max.	Weight	Fire load	Order no.
n × mm <sup>2</sup>	mm	mm	mΩ/m	kg/km	kWh/m	
1 × 2.5	2.05	5.50	8.21	52	0.117	<b>226111</b>
1 × 4	2.55	6.05	5.09	69	0.136	<b>224803</b>
1 × 6	3.10	6.95	3.39	96	0.174	<b>225577</b>
1 × 10	4.10	8.30	1.95	147	0.235	<b>302191</b>

### Order units

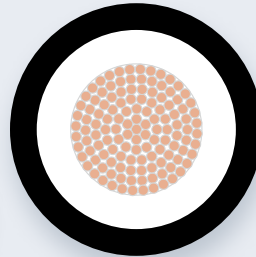
Construction	Order no.	Order no.	Order no.	Order no.	Order no.
n × mm <sup>2</sup>	18 × 500 m	8 × 1000 m	1 × 4000 m	1 × 5000 m	1 × 6000 m
1 × 2.5	226111V2	226111V3	Ø	Ø	Ø
1 × 4	224803V2	<b>224803V3</b>	Ø	Ø	224803V4
1 × 6	225577V2	<b>225577V3</b>	Ø	225577V4	Ø
1 × 10	Ø	Ø	Ø	Ø	Ø

More information on the standard packaging unit see transport conditions page 19.  
Further packaging units upon request.

**Bold** printed order no. = stock item  
Further designs upon request.

# BETAflam® Solar 125 RV flex FRNC

Photovoltaic power cables, halogen free, flame retardant



## Advantages

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

## BETAflam® 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

Operation temperature	$U_0/U = 600 / 1000 \text{ V AC,}$ $1000 / 1800 \text{ V DC}$
Test voltage	6500 V, 50 Hz, 5 min.

### Thermal characteristics

Operation temperature	-40 °C up to +125 °C	-40 °F up to +257 °F
Ambient temperature	-40 °C up to +90 °C	> 25 years (TÜV)
Short circuit temperature	280 °C, +536 °F max.	

### Bending radius $\varnothing < 10 \text{ mm}$

Fixed installation	$> 4 \times \varnothing$	$> 5 \times \varnothing$
Occasionally moved	$> 5 \times \varnothing$	$> 7 \times \varnothing$

### 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	Inscription	Conductor construction	Conductor $\varnothing$	Outer $\varnothing$	Resistance	Weight	Fire load	Order no.
$n \times \text{mm}^2$	Colour	$n \times \text{mm}$	mm	mm	max. m $\Omega$ /m	kg/km	kWh/m	
1 × 2.5	○ white	45 × 0.25	2.05	4.65	8.21	41	0.079	<b>304467</b>
1 × 4	○ white	52 × 0.30	2.55	5.05	5.09	56	0.086	<b>304468</b>
1 × 6	○ white	78 × 0.30	3.10	5.65	3.39	76	0.100	<b>304469</b>
1 × 10	○ white	75 × 0.40	4.10	6.70	1.95	118	0.126	<b>304471</b>
1 × 16	○ white	119 × 0.40	5.50	9.70	1.24	211	0.288	<b>304472</b>
1 × 25	○ white	182 × 0.40	6.60	11.20	0.79	304	0.369	<b>304474</b>
1 × 35	○ white	259 × 0.40	7.70	12.30	0.56	404	0.414	<b>304475</b>
1 × 50	○ white	380 × 0.40	9.90	14.90	0.39	582	0.558	<b>304476</b>
1 × 2.5	● red	45 × 0.25	2.05	4.65	8.21	41	0.079	<b>307701</b>
1 × 4	● red	52 × 0.30	2.55	5.05	5.09	57	0.086	<b>306470</b>
1 × 6	● red	78 × 0.30	3.10	5.65	3.39	77	0.100	<b>306471</b>

### Order units

Construction	Inscription	Order no.	Order no.	Order no.	Order no.	Order no.
$n \times \text{mm}^2$	Colour	50 × 100 m	24 × 500 m	18 × 500 m	18 × 1000 m	8 × 1000 m
1 × 4	○ white	<b>304468V8</b>	<b>304468V1</b>	∅	<b>304468V2</b>	∅
1 × 6	○ white	<b>304469V8</b>	∅	<b>304469V2</b>	∅	<b>304469V3</b>
1 × 10	○ white	∅	∅	<b>304471V2</b>	∅	∅
1 × 4	● red	∅	<b>306470V1</b>	∅	<b>306470V2</b>	∅
1 × 6	● red	∅	∅	<b>306471V2</b>	∅	<b>306471V3</b>

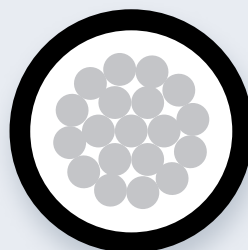
More information on the standard packaging unit see transport conditions page 19.  
Further packaging units upon request.

**Bold printed order no.** = stock item  
Further designs upon request.



# 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

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

### Dimensions, weights

Construction	Conductor $\varnothing$	Outer $\varnothing$	Resistance max.	Weight	Order no.
$n \times \text{mm}^2$	mm	mm	m $\Omega$ /m	kg/km	
1 × 50	8.20	13.20	0.641	266	Ø
1 × 70	9.90	14.90	0.443	341	Ø
1 × 95	11.50	16.50	0.330	431	Ø
1 × 120	12.85	18.50	0.253	551	Ø
1 × 150	14.20	19.80	0.206	630	Ø
1 × 185	16.40	22.40	0.164	788	Ø
1 × 240	18.36	24.40	0.125	969	Ø
1 × 300	20.45	27.25	0.100	1206	Ø

Larger cross sections upon request.

### Advantages

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

### Thermal characteristics

Operation 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
Short circuit temperature	280 °C, +536 °F max.

### Bending radius

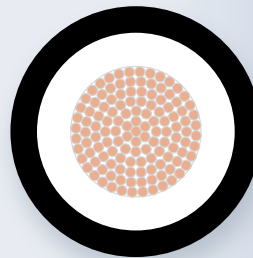
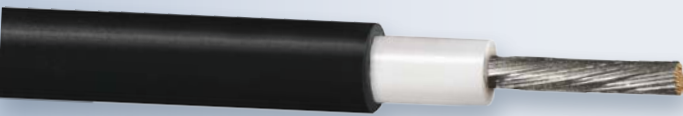
Fixed installation	> 10 × $\varnothing$
Occasionally moved	> 12 × $\varnothing$

### Standards / Material properties

- Fire performance: IEC 60332-1
- Halogen free: IEC 60754-1
- No corrosive gases: IEC 60754-2
- Low fire load: DIN 51900
- Environmentalty, 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

# BETAflam® Solar 125 flex UL 4703

Photovoltaic power cables, halogen free, flame retardant



## Advantages

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

## 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

Operation temperature  $U_0/U = 600/1000$  V AC,  
1000/1800 V DC

Test voltage 6500 V, 50 Hz, 5 min.

### Thermal characteristics

Operation temperature  $-40^\circ\text{C}$  up to  $+125^\circ\text{C}$   
 $-40^\circ\text{F}$  up to  $+257^\circ\text{F}$

Ambient temperature:  $-40^\circ\text{C}$  up to  $+90^\circ\text{C}$   
> 25 years (TÜV)  $-40^\circ\text{F}$  up to  $+194^\circ\text{F}$

Short circuit temperature  $280^\circ\text{C}$ ,  $+536^\circ\text{F}$  max.

### Bending radius

Fixed installation  $> 4 \times \varnothing$

Occasionally moved  $> 5 \times \varnothing$

### 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

### Dimensions, weights

Construction	Conductor $\varnothing$	Outer $\varnothing$	Resistance max.	Weight	Fire load	Order no.
$n \times \text{mm}^2$	mm	mm	m $\Omega$ /m	kg/km	kWh/m	
1 × 2.5 14 AWG	2.05	6.50	8.21	67	0.169	<b>226243</b>
1 × 4 12 AWG	2.55	7.05	5.09	86	0.192	<b>224780</b>
1 × 6 10 AWG	3.10	7.60	3.39	109	0.214	<b>226135</b>
1 × 10 8 AWG	4.10	9.30	1.95	155	0.256	<b>302192</b>

### Order units

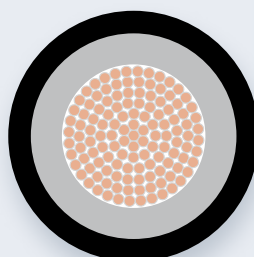
Construction	Order no.	Order no.	Order no.	Order no.	Order no.
$n \times \text{mm}^2$	18 × 500 m	8 × 1000 m	1 × 4000 m	1 × 5000 m	1 × 6000 m
1 × 2.5 14 AWG	<b>226243V2</b>	<b>226243V3</b>	$\varnothing$	<b>226243V4</b>	$\varnothing$
1 × 4 12 AWG	$\varnothing$	<b>224780V3</b>	$\varnothing$	<b>224780V4</b>	$\varnothing$
1 × 6 10 AWG	$\varnothing$	<b>226135V3</b>	<b>226135V4</b>	$\varnothing$	$\varnothing$
1 × 10 8 AWG	$\varnothing$	$\varnothing$	$\varnothing$	$\varnothing$	$\varnothing$

More information on the standard packaging unit see transport conditionspage page 19.  
Further packaging units upon request.

**Bold** printed order no. = stock item  
Further designs upon request.

# BETAflam® Solar 125 flex UL 1000 V

Photovoltaic power cables, halogen free, flame retardant



## Advantages

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

**NEW**

## BETAflam® Solar 125 flex UL 1000 V

### 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

Operation temperature **TÜV U<sub>0</sub> 1500 VDC**  
(max. permitted voltage 1800 VDC)  
**UL 1000 V**  
Test voltage 11 kV, 50 Hz, 5 min.

### Thermal characteristics

Operation 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  
Short circuit temperature 280 °C, +536 °F, 5 s max.

### 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; TÜV 2 PFG 1990/05.2012 PV 1500 DC-F; UL 4703 PV wire
- Approvals (in progress): cTÜVus
- Application standards: NEC 2008 / UL PV wire; UNE 21123; UNE 20.460-5-52, UTE C 32-502

### Dimensions, weights

Construction	Conductor Ø	Outer Ø	Resistance max.	Weight	Fire load	Order no.
n × mm <sup>2</sup>	wmm	mm	mΩ/m	kg/km	kWh/m	
1 × 2.5 14 AWG	2.05	6.85	8.21	65	0.264	307009
1 × 4 12 AWG	2.55	7.05	5.09	76	0.287	307010
1 × 6 10 AWG	3.10	7.60	3.39	97	0.323	307011
1 × 10 8 AWG	4.10	9.70	1.95	162	0.512	307012

### Order units

Construction	Order no.	Order no.	Order no.	Order no.
n × mm <sup>2</sup>	18 × 500 m	8 × 1000 m	1 × 4000 m	1 × 5000 m
1 × 2.5 14 AWG	Ø	307009V3	Ø	<b>307009V4</b>
1 × 4 12 AWG	Ø	307010V3	Ø	<b>307010V4</b>
1 × 6 10 AWG	Ø	307011V3	Ø	Ø
1 × 10 8 AWG	Ø	Ø	Ø	Ø

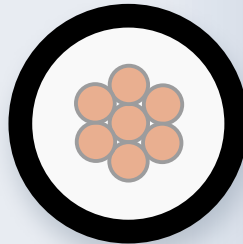
More information on the standard packaging unit see transport conditions page 19.  
Further packaging units upon request.

**Bold printed order no.** = stock item  
Further designs upon request.



# BETAflam® Solar 125 UL 4703

Photovoltaic power cables, halogen free, flame retardant



## Advantages

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

## BETAflam® 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

Operation temperature  $U_0/U = 600 / 1000 \text{ V AC}, 1000 / 1800 \text{ VDC}$   
 Test voltage 6500 V, 50 Hz, 5 min.

### Thermal characteristics

Operation temperature  $-40 \text{ °C up to } +125 \text{ °C}$   
 $-40 \text{ °F up to } +257 \text{ °F}$   
 Ambient temperature:  $-40 \text{ °C up to } +90 \text{ °C}$   
 $> 25 \text{ years (TÜV)} \quad -40 \text{ °F up to } +194 \text{ °F}$   
 Short circuit temperature  $280 \text{ °C}, +536 \text{ °F max.}$

### Bending radius

Fixed installation  $> 4 \times \varnothing$

### 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

### Dimensions, weights

Construction	Conductor $\varnothing$	Outer $\varnothing$	Resistance max.	Weight	Fire load	Order no.
$n \times \text{mm}^2$	mm	mm	m $\Omega$ /m	kg/km	kWh/m	
1 × 10 AWG	3.00	7.50	3.66	107	0.215	303326

### Order units

Construction	Order no.	Order no.	Order no.	Order no.	Order no.	Order no.
$n \times \text{mm}^2$	18 × 500 m	8 × 1000 m	1 × 4000 m	1 × 5000 m	1 × 6000 m	1 × 8000 m
1 × 10 AWG	$\varnothing$	<b>303326V3</b>	$\varnothing$	$\varnothing$	$\varnothing$	$\varnothing$

More information on the standard packaging unit see transport conditionspage page 19 .  
 Further packaging units upon request.

**Bold** printed order no. = stock item  
 Further designs upon request.

# BETAflam® Solar 125 AC flex FRNC

Photovoltaic power cables, halogen free, flame retardant



**NEW**

## BETAflam® Solar 125 AC flex FRNC

### Applications

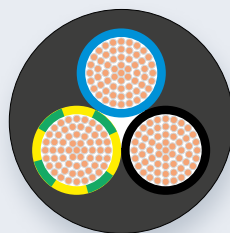
Double insulated, electron-beam cross-linked cables for the connection of micro inverters.

### 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

Operation temperature	$U_0/U = 450/750$ V AC
Test voltage	6500 V, 50 Hz, 5 min.



### Advantages

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

### Thermal characteristics

Operation temperature	-40 °C up to +120 °C (20,000 h)
Ambient temperature	
Fixed installation	-40 °C up to +90 °C
Occasionally moved	-35 °C
Short circuit temperature	280 °C, 5 s. max.

### Bending radius

Fixed installation	$> 6 \times \varnothing$
Occasionally moved	$> 8 \times \varnothing$

### 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 $\varnothing$	Outer $\varnothing$	Weight	Fire load	Order no.
n × mm <sup>2</sup>	n × mm	mm	mm	kg/km	kWh/m	LSA
3 G 0.75	24 × 0.20	1.15	7.60	82	0.224	308074
4 G 0.75	24 × 0.20	1.15	8.60	104	0.293	308075
5 G 0.75	24 × 0.20	1.15	9.60	130	0.36	308076
3 G 1.0	32 × 0.20	1.25	7.80	91	0.24	308077
4 G 1.0	32 × 0.20	1.25	8.80	116	0.31	308078
5 G 1.0	32 × 0.20	1.25	9.80	145	0.38	308079
3 G 1.5	27 × 0.25	1.55	8.70	115	0.29	308080
4 G 1.5	27 × 0.25	1.55	9.80	147	0.37	308081
5 G 1.5	27 × 0.25	1.55	11.20	191	0.48	308082
3 G 2.5	45 × 0.25	2.05	10.10	164	0.37	308083
4 G 2.5	45 × 0.25	2.05	11.40	211	0.50	308084
5 G 2.5	45 × 0.25	2.05	12.60	262	0.59	308085
3 G 4.0	52 × 0.30	2.55	11.40	226	0.47	308086
4 G 4.0	52 × 0.30	2.55	12.90	294	0.60	308087
5 G 4.0	52 × 0.30	2.55	14.40	366	0.74	308088
3 G 6.0	78 × 0.30	3.10	12.90	307	0.60	308089
4 G 6.0	78 × 0.30	3.10	14.50	396	0.73	308090
5 G 6.0	78 × 0.30	3.10	16.30	498	0.92	308091

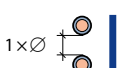



Subject to change.



# Technical informations

## Current rating 120 °C / 248 °F

### Ambient temperature 30 °C / 86 °F

Construction	Free in air	On surfaces without opposite contact	On surfaces with opposite contact	In conduit, casing, duct
				
mm <sup>2</sup>	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

# Transport Conditions

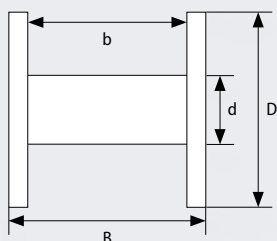
## Packaging

- Wooden packaging according to the IPPC ISPM-15 standard (Bew. Nr. CH-90055-HT-DB): All pallets and plywood drums 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.

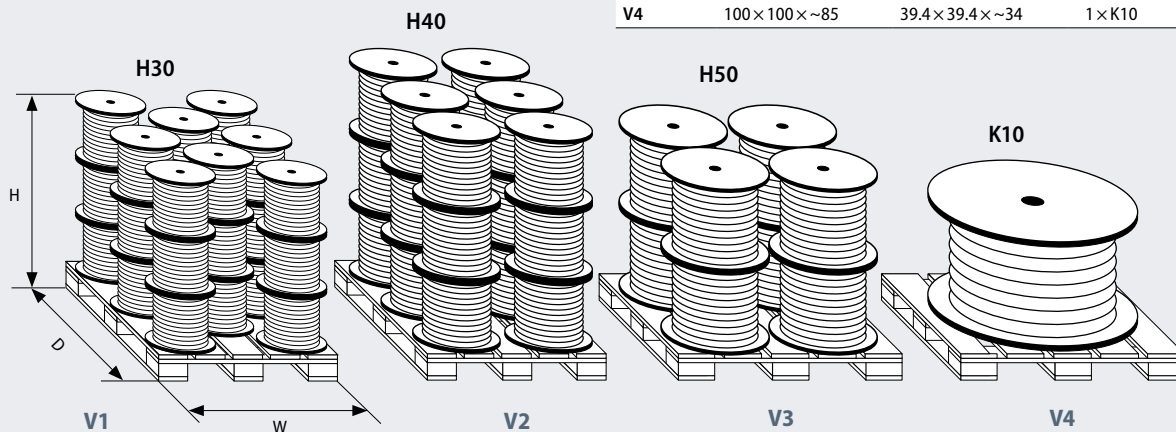
## Standard reel dimensions



Reel	Ø Flange		Ø Core		Distance between flange	
	D	d	B	b	external	internal
	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	Reel / Pallet
V1	80 × 120 × ~100	31.5 × 47 × ~39	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



# 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

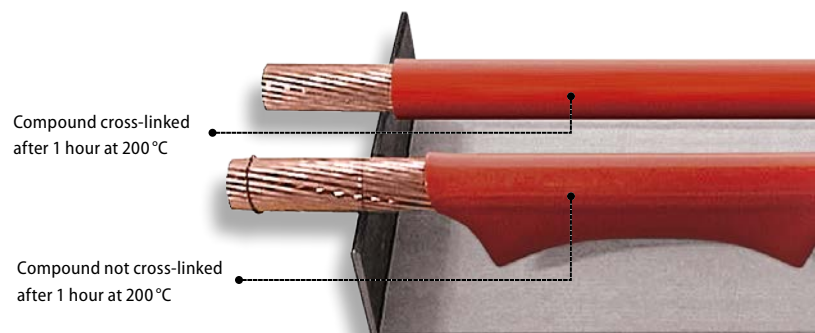
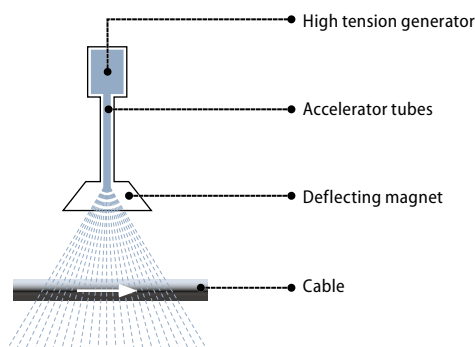
Cross-linking binds together the polymer chains by means of a chemical linking (in the amorphous phase).

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.

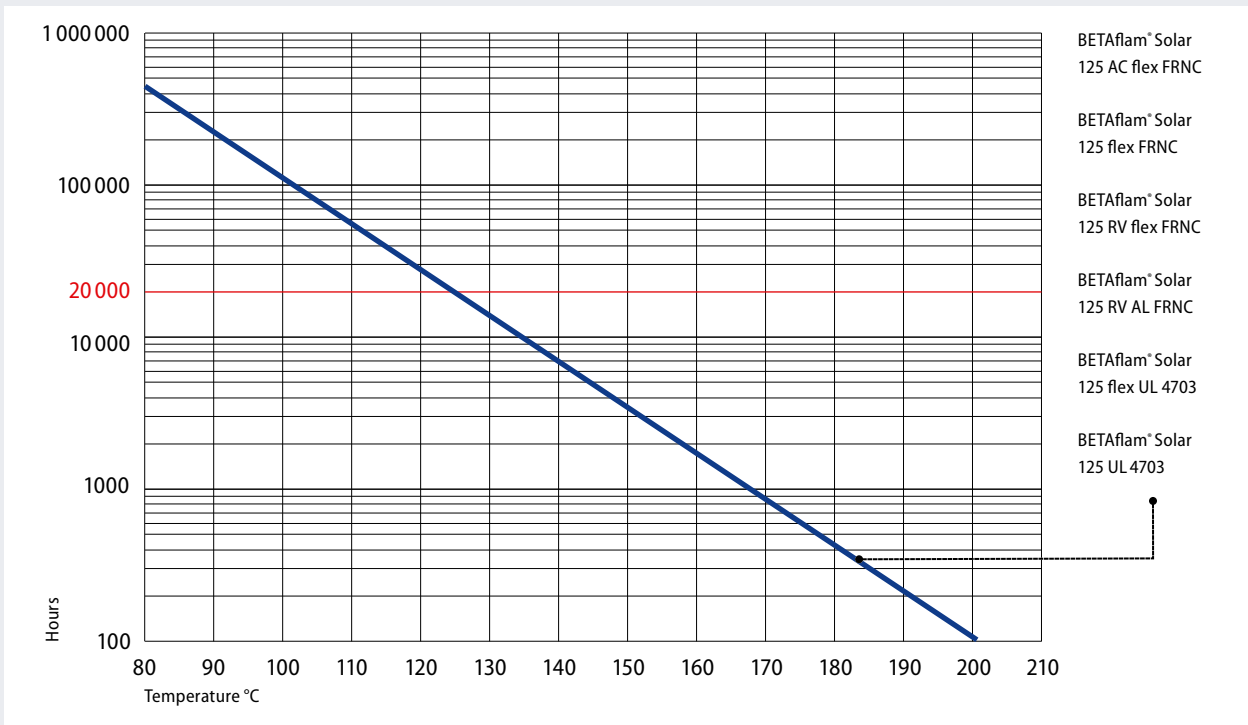


**Temperature index as per IEC 60216 / VDE 0304 part 21**

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 act 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 withing 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

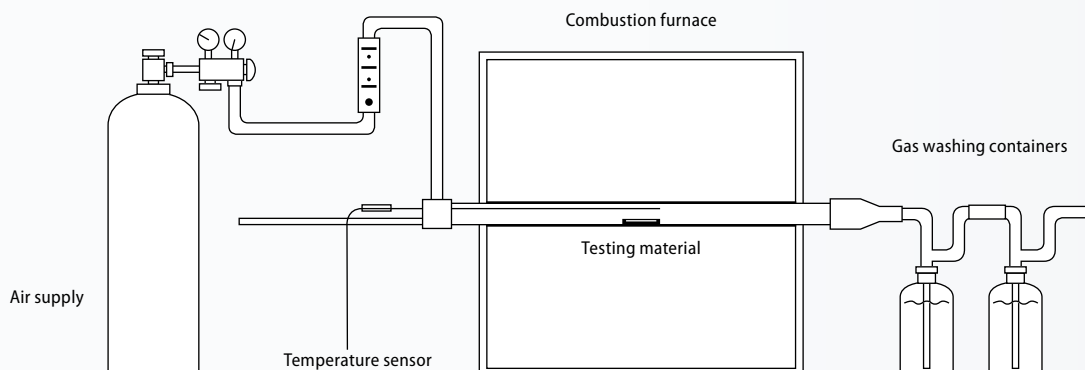
1000 mg insulation material is burned in a combustion furnace at  $\geq 935$  °C with pre-defined air supply for over 30 minutes. By means of two gas washing containers, held in the airflow the conductivity and the pH-value are measured. Like that even small quantities of halogen containing substances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

The test is considered to be passed if

- the PH-value > 4.3
- the conductivity < 10  $\mu$ S/mm

### Test standards

IEC 60754-2, EN 50267-2-2



## Smoke density

The formation of smoke has several unpleasant consequences. On 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. Regarding the formation of the combustion gases the PVC comes off quite badly. However, this cannot be blamed on the PVC, as 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

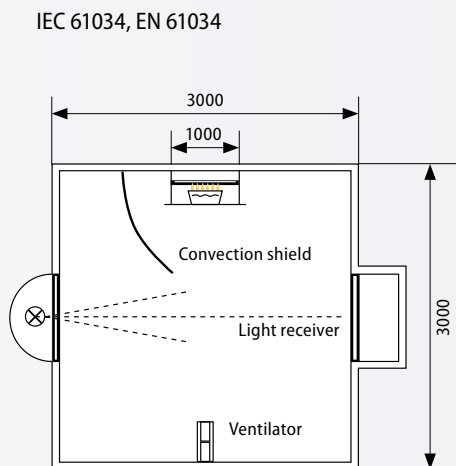
The density of smoke emission can be determined by measuring of the light penetrability. Cable samples are lit with alcohol in a test chamber (cubical with an edge length of 3 m). The so formed smoke is uniformly spread by a ventilator and influences the light measuring section.

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



## 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 self-extinguish 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

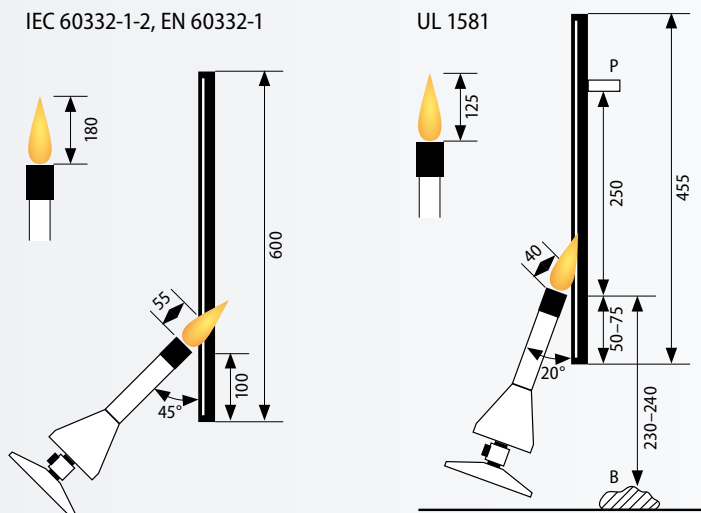
- $\varnothing \leq 25$  = 60 s
- $\varnothing 25 \dots 50$  = 120 s
- $\varnothing 50 \dots 75$  = 240 s
- $\varnothing > 75$  = 480 s

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



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