

BETAflam® Solar 125 RV flex 1500V DC

Photovoltaic power cables, halogen free, flame retardant

NEW



EN50618
certified

CPR

D_{ca}

Identification code
CCHDA0000021

Advantages

- EN50618 approval
- 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
- Compatible to all popular connectors

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Applications

Is used as photovoltaic cable between solar modules and inverters in a photovoltaic system with a rated value $U_0 = 1.5$ 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	$U_0 = 1500$ V DC (max. permitted voltage U_0 1800 V DC)
Test voltage	6.5 kV AC 50 Hz

Thermal characteristics

Operating temperature	-50 °C up to +120 °C
Ambient temperature	-50 °C up to +90 °C
Max. short circuit temp.	+280 °C, +536 °F / 5 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: EN50618; H1Z2Z2-K

Fire properties according to the CPR

- D_{ca}-s2, d2, a2, EN 50575, EN 13501-6
- Fire performance D_{ca}: EN 50399
- Low corr. of the combustion gases: EN 60754-2 – halogen free a2
- Medium smoke density s2: EN 50399
- Flaming droplets d2: EN 50399
- No flame propagation: EN 60332-1-2
- RoHS-compliant material selection

Nominal cross section	Conductor \varnothing	Outer \varnothing	Resistance max. at 20°C	Weight	Fire load	Order no.	
						○ White*	● Red*
$n \times \text{mm}^2$	mm	mm	mΩ/m	kg/km	kWh/m	○ White*	● Red*
1 × 2.5	2.05	5.00	8.21	46	0.093	313738	313739
1 × 4	2.45	5.50	5.09	61	0.107	313740	313741
1 × 6	3.00	6.10	3.39	82	0.127	313742	313743
1 × 10	4.10	7.20	1.95	126	0.158	313744	313745
1 × 16	5.00	8.50	1.24	190	0.213	313746	–
1 × 25	6.20	10.40	0.79	291	0.314	313747	–
1 × 35	7.70	11.90	0.56	400	0.392	313748	–
1 × 50	9.70	14.30	0.39	570	0.549	313749	–

* Jacket colour black with red or white inscription

Nominal cross section	Order no.					
	8 × 500 m		18 × 500 m		8 × 1000 m	
$n \times \text{mm}^2$	○ White*	● Red*	○ White*	● Red*	○ White*	● Red*
1 × 4	–	–	313740V2	313741V2	313740V3	313741V3
1 × 6	–	–	313742V2	313743V2	313742V3	313743V3
1 × 10	313744V3	–	–	–	–	–

More information on the standard packaging unit see page 34. Further packaging units on request.
Bold printed order no. = stock item * Jacket colour black with red or white inscription

Unter Angabe der Leistungserklärungs-Nummer können Sie auf unserer Website www.leoni.com/de/baupv die entsprechende Leistungserklärung herunterladen.

Standard packaging / Transport conditions

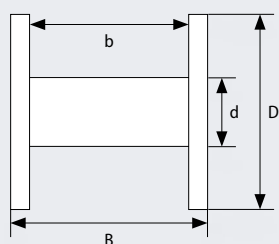
Packaging

- 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.

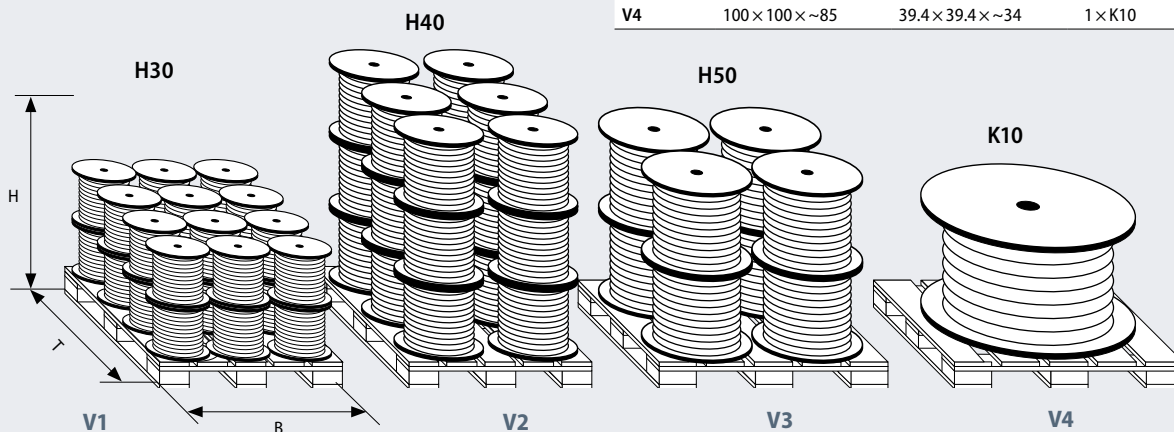
Standard reel dimensions



Reel	Flange D	Core d	Distance between flange	
			external B	internal b
	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	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.

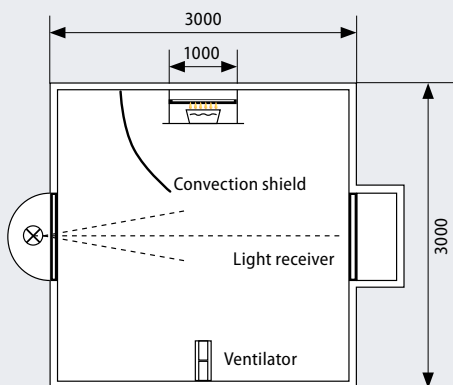
The test is considered to be passed if the following light penetrability is reached:

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 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

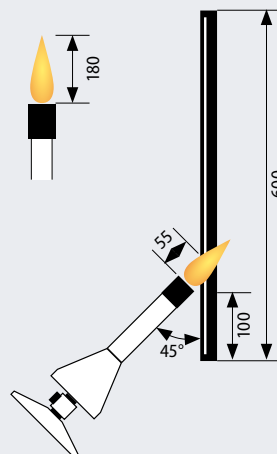
The burning cable should self-extinguish as soon as the fire source has been removed. The fire damage may not be higher than 60 cm.

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.

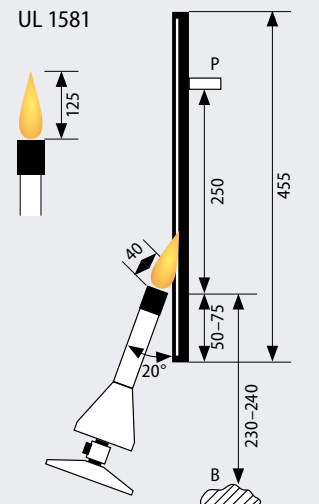
Test standards

IEC 60332-1, EN 60332-1

IEC 60332-1-2, EN 60332-1



UL 1581



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 degradate. 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 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

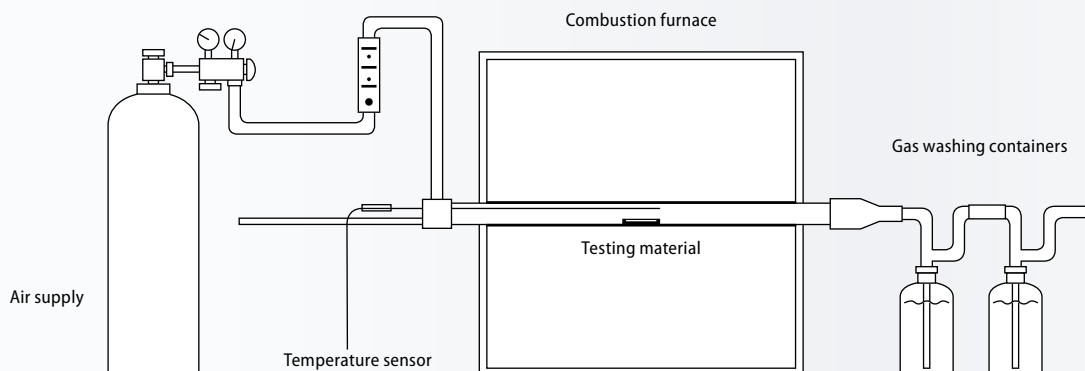
1000 mg insulation material is burned in a combustion furnace at ≥ 935 °C with pre-defined air supply for over 30 minutes. By means of two gas washing containers, held in the airflow the conductivity and the pH-value are measured. Like that even small quantities of halogen containing substances can be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

The test is considered to be passed if

- **the PH value > 4.3**
- **the conductivity < 10 μ S/mm**

Test standards

IEC 60754-2, EN 50267-2-2



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

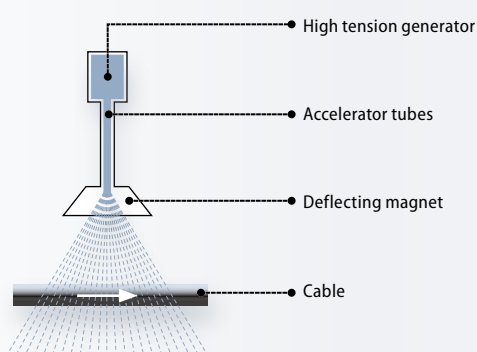
Cross-linking binds together the polymer chains by means of a chemical linking (in the amorphous phase).

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

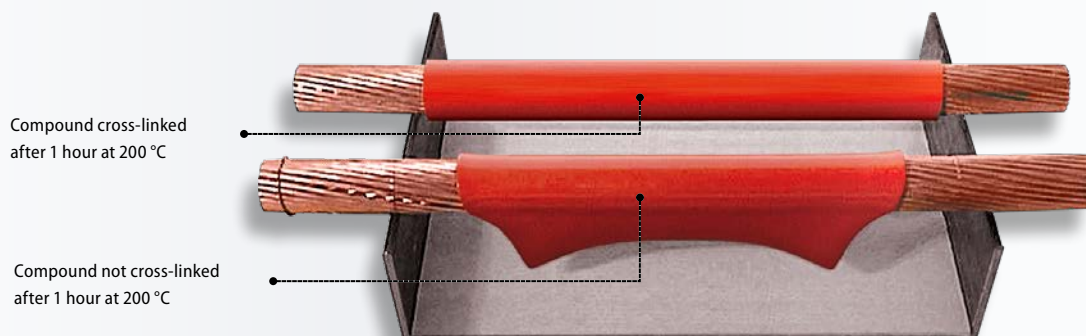
With the electron-beam accelerators the insulation materials can be cross-linked within a few seconds. The homogenous irradiation and implicit the homogenous cross-linking are ensured by theretofore especially adapted handling systems. Other than in the chemical cross-linking in the irradiation cross-linking 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).



Electron-beam cross-linking

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.

