



EFFICIENCY. SOLAR. SURFACES.



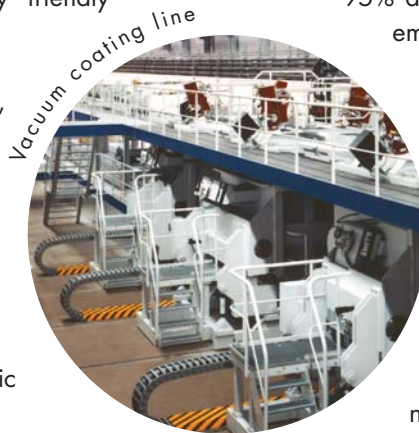
Alanod-Solar GmbH & Co. KG

EFFICIENCY. SOLAR. SURFACES.

Surface treatment par excellence

As a wholly own subsidiary of ALANOD®, Alanod-Solar® benefits from more than 30 years of experience in the production of surface finished aluminium and copper strips. This expertise enables Alanod-Solar to focus with its products on the environmentally friendly generation of solar energy.

On four vacuum coating systems (PVD), selective absorbing or highly reflective coating systems are produced in an air-to-air process. An existing global sales network ensures tailor-made, on-site advice and support. Whichever world wide market you are in, we have on hand the resources and logistics to look after your specific needs.



Solar reflection

With our reflecting surfaces, we offer various materials with a total solar reflectance ranging between 85% and 95%. Thanks to a weather-resistant nano-composite layer, MIRO-SUN® is an ideal material for outdoor applications. This is used in CPC reflectors (CPC= Compound Parabolic Concentrator), evacuated tube collectors and parabolic trough concentrators (CSP = Concentrated Solar Power). In addition, MIRO-SUN® can also be used as a concentrating reflector material for photovoltaic applications (CPV = Concentrated Photovoltaics). The nine different products in the portfolio enables Alanod-Solar to offer an ideal component for every possible application.

Solar absorption

sunselect®, mirotherm® and mirosol® are the three selective absorber coating systems for solar collectors. These coating systems are continuously vaporised in a PVD procedure as part of the air-to-air process. This achieves 95% absorption and, at the same time, a low emission of not more than 5%.

All the absorbing products are used in a diverse range of solar-thermal collectors. Mostly copper or aluminium tubes are welded to the rear side of the absorbers to conduct heat, whereby laser welding has become established as the optimum technology for joining together both identical and contrasting metals. This method ensures that the joints achieve not only long-term mechanical stability but also excellent thermal conductivity.

Global player

Our top quality products are now sold, processed and installed by our partner companies on all five continents. We are the world's first company to have reached the milestone of having sold more than 10 million square metres of absorber surface area.

Furthermore, we have an integrated and certified quality and environmental management system according to DIN EN ISO 9001: 2000 and 14001: 2005.



Product advantages

EFFICIENCY. SOLAR. SURFACES.

Absorption:

- 10 - year material warranty
- selective coating system ensures maximum absorption and lowest emission
- all standard joining technologies can be used
- protective film or paper interleaving available upon request
- CO₂ savings per sqm:
100 kg / year compared to natural gas
130 kg / year compared to heating oil
- > 10 Mio sqm supplied and installed worldwide
- more than 1 Mio tons CO₂ savings annually
- state-of-the-art continual in-line measurement processes guarantee maximum quality standards
- environmentally friendly / emission-free manufacturing process
- low energy balance

Applications:

- flat plate collectors
- air collectors
- vacuum tube collectors

Reflection:

- 10 - year material warranty
- weather resistant thanks to nano-composite layer
- optimised, maximum solar reflection
- UV - resistant
- heat resistant
- easy to clean
- formable
- flexible
- scratchproof
- no delamination
- low energy balance
- environmentally friendly / emission - free manufacturing process

Applications:

- evacuated tube collectors
(CPC Compound Parabolic Concentrator)
- parabolic trough power plants
(CSP Concentrated Solar Power)
- photovoltaics
(CPV Concentrated Photovoltaics)
- solar cookers
- heliostats

Absorption

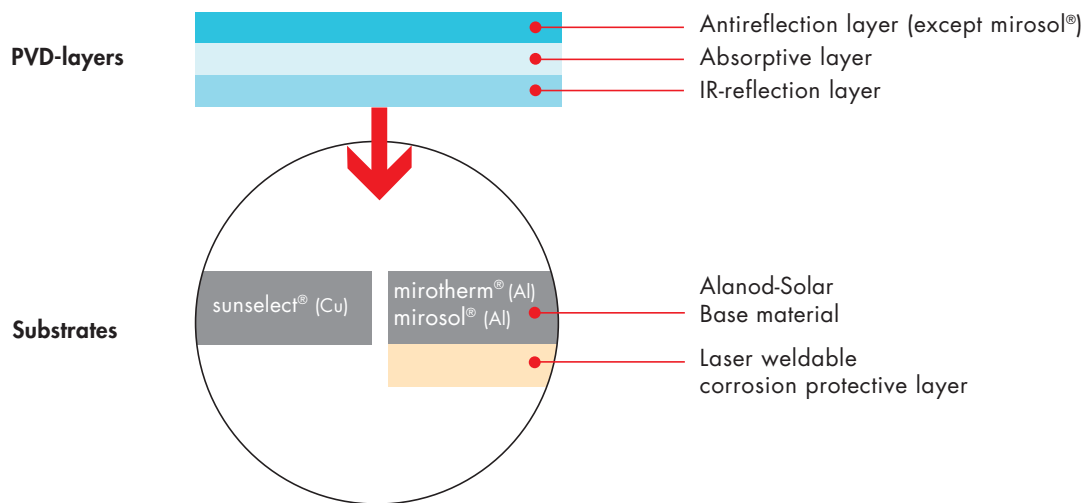
Technical information

sunselect®, mirotherm® and mirosol®

Consists of an aluminium- or copperstrip which has been anodised on both sides; then in a world-wide unique air-to-air process, a system of three layers is applied using the physical vapour deposition technique (PVD). While an infrared reflecting layer

ensures low thermal emission (ϵ), the metal oxide absorption- and antireflection layers ensure highest solar absorption (α) while offering resistance against outside agents.

Design

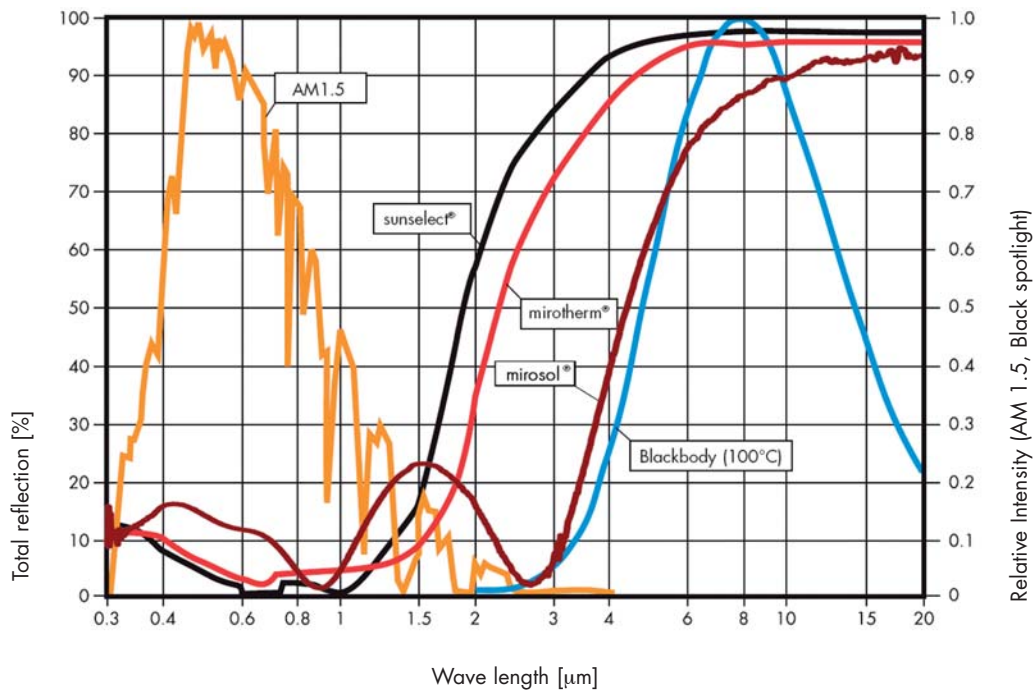


Properties	Parameter	sunselect	mirotherm	Norm
Mechanical	Alloy:	Cu-DHP*, Cu-OF*, Cu-HCP*	Al 1050* or purer	*DIN EN13599 / *DIN EN 573-3
	Hardness:	Half hard*	Hard*	*DIN EN 1652 / *DIN EN 485-2
Optical	Solar absorption, α_{sol} :	0.95 ± 0.02	0.95 ± 0.01	
	Thermal emission, $\epsilon_{100\text{ °C}}$:	0.05 ± 0.02	0.05 ± 0.02	
	Colour coordinate a* (D 65):	0 to +14	-12 to 0	DIN 5033
	Colour coordinate b* (D 65):	-35 to -10	-25 to 0	DIN 5033
Physical	Heat conductivity W/(m*K):	295 - 395	210 - 220	
	Specific weight, g/cm ³ :	8.9	2.7	
Dimensions	Width in mm (inch):	max. 1250 (49.21)	max. 1250 (49.21)	
	Thickness in mm (inch):	0.12 - 0.3 (.0047 - .012)*	0.3 - 0.5 (.012 - .020)*	
Delivery	Coils or sheets with:	Paper interleave or protection foil	Paper interleave or protection foil	
	Innerdiameter 400 or 500 mm:	✓	✓	
Aging test	Passed:	✓	✓	ISO/CD 12592.2 Task X
Warranty	10 years:	✓	✓	

* = other thickness on request

Absorption

Reflection spectrum sunselect®, mirotherm® & mirosol®



Properties	Parameter	mirosol	Norm
Mechanical	Alloy:	Al 1050* or purer	*DIN EN 573-3
	Hardness:	Hard*	*DIN EN 485-2
Optical	Solar absorption, α_{sol} :	0.90 ± 0.02	
	Thermal emission, $\epsilon_{100\text{ °C}}$:	0.15 ± 0.02	
	Colour coordinate a* (D 65):	-12 to +2	DIN 5033
	Colour coordinate b* (D 65):	-25 to 0	DIN 5033
Physical	Heat conductivity W/(m*K):	210 - 220	
	Specific weight, g/cm ³ :	2.7	
Dimensions	Width in mm (inch):	max. 1250 (49.21)	
	Thickness in mm (inch):	0.3 - 0.5 (.012 - .020)*	
Delivery	Coils or sheets with:	Paper interleave or protection foil	
	Innerdiameter 400 or 500 mm:	✓	
Aging test	Passed:	✓	ISO/CD 12592.2 Task X
Warranty	10 years:	✓	

* = other thickness on request

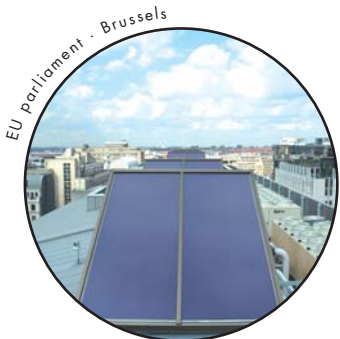
Projects examples Absorption



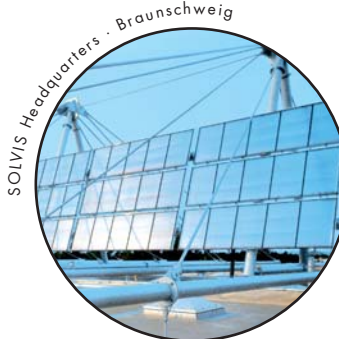
Flat plate collector



Ackermannbogen · Munich



EU parliament · Brussels



SOLVIS Headquarters · Braunschweig



Absorber field · Oberndorf



High-rise with vertical absorber collectors
Private home · Würzburg



National sports school · Albstadt



Private home



Private home · Würzburg



Private home

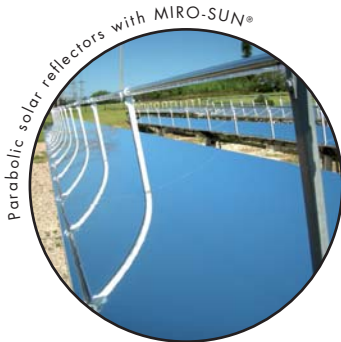
Picture proof:
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Projects examples Reflection



CPC application

CSP application



Parabolic solar reflectors with MIRO-SUN®



Parabolic solar reflectors - Hotel Turkey



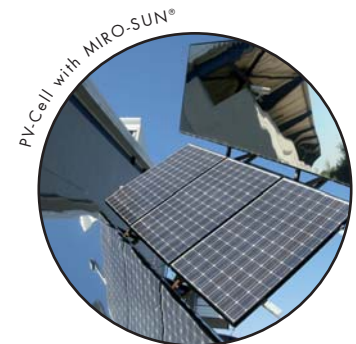
Parabolic solar reflectors - Newcastle Australia



Parabolic solar reflectors with MIRO-SUN®



Solar cooker with MIRO-SUN®



PV-Cell with MIRO-SUN®

Picture proof:
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Reflection

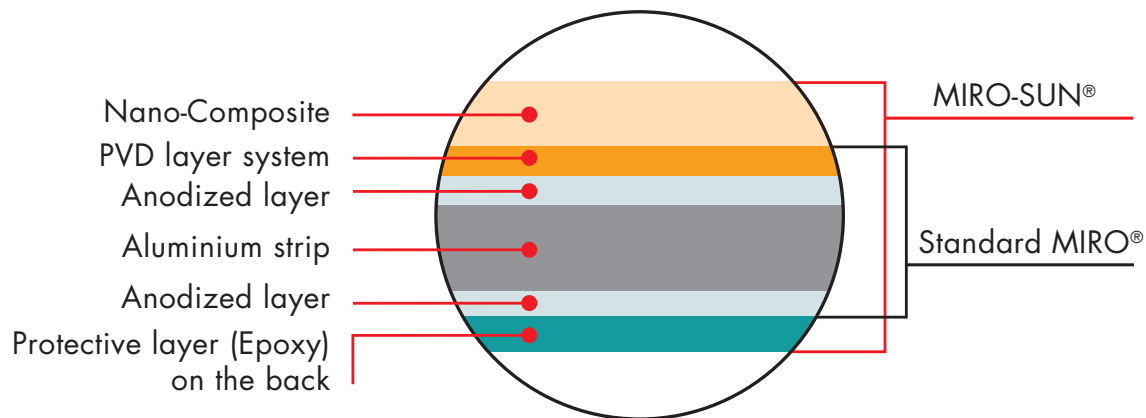
Technical information

MIRO-SUN®

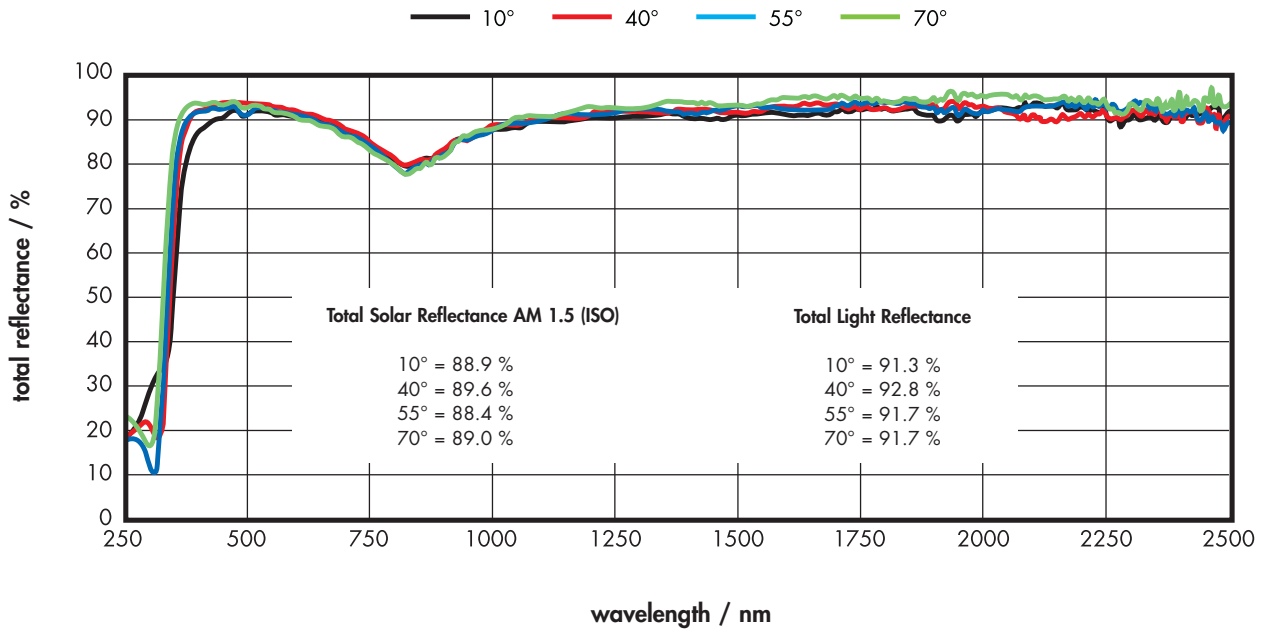
Based on our MIRO®-product range which produces approx. 95% total light reflection we have developed MIRO-SUN® especially for outdoor-applications. A continuous air-to-air PVD-process applies a super-

reflective layer (MIRO®) to coil anodized material and afterwards (MIRO-SUN®) is protected by a Nano-Composite in a coil-coating process.

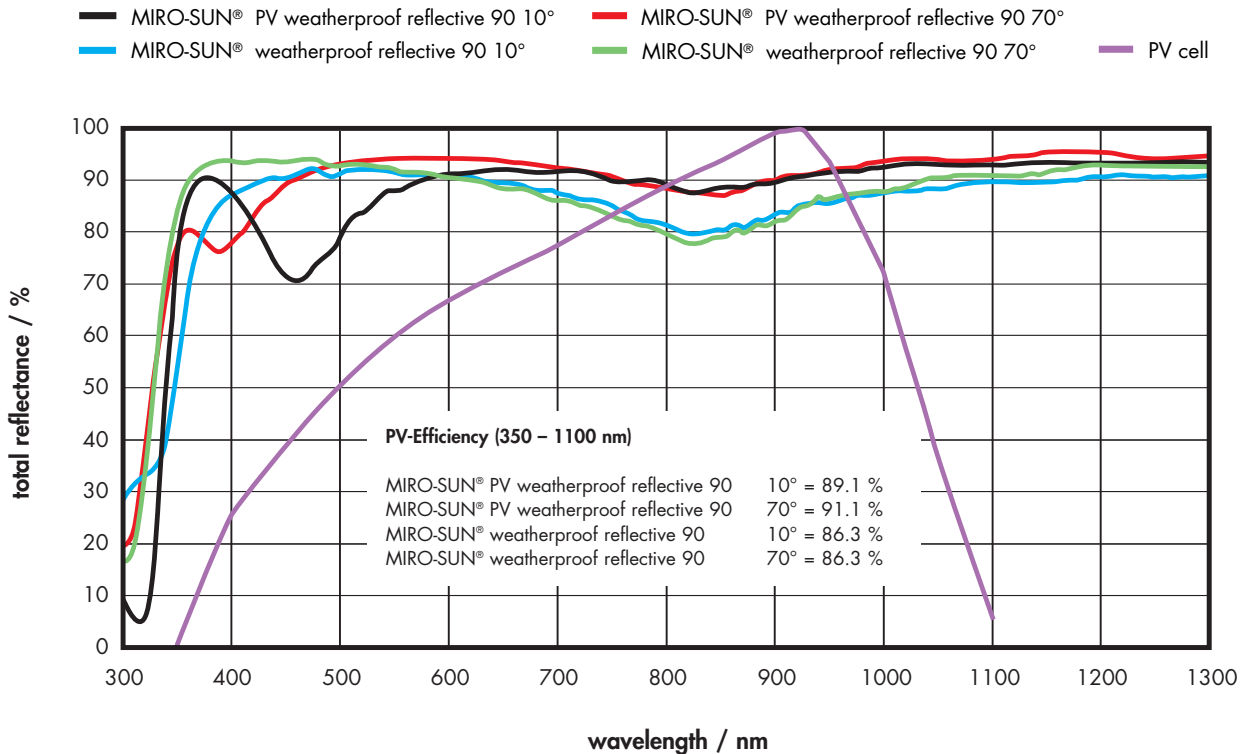
Layer System



Total spectral reflectance of **MIRO-SUN® weatherproof reflective 90** in the solar range



Comparison of total spectral reflectance and PV-cell-efficiency with PV-matched **MIRO-SUN® PV weatherproof reflective 90** and **MIRO-SUN® weatherproof reflective 90**



Reflection

Properties	Parameter	reflective 85	MIRO reflective 90	MIRO high reflective 95	Norm
Mechanical	Tensile Strength (Mpa):	160 - 200	160 - 200	160 - 200	EN 485-2
	Yield Strength (Mpa):	140 - 180	140 - 180	140 - 180	EN 485-2
	Elongation A 50 %:	≥ 2	≥ 2	≥ 2	EN 485-2
	Bending radius:	≥ 1.5 fold thickness	≥ 1.5 fold thickness	≥ 1.5 fold thickness	
Optical	Total solar reflectance:	85	90	95	ASTM 891-87
	Specular reflectance:	80 / 76 along/across	91 / 90 along/across	93 / 92 along/across	ISO 7668 60°
	Total light reflectance:	86	95	98	DIN 5036-3
	Front side:	anodised	PVD - improved	PVD - improved	
	Reverse side:	anodised	anodised	anodised	
Physical	Density, g/cm ³ :	2.7	2.7	2.7	
	Coefficient of heat expansion (10 ⁻⁶ /K ⁻¹):	23.5	23.5	23.5	
	Heat resistance:	250 °C	250 °C	180 °C	
Dimensions	Width in mm (inch):	max. 1250 (49.21)	max. 1250 (49.21)	max. 1250 (49.21)	
	Thickness in mm (inch):	0.3 - 0.8 (.012 - .031)	0.3 - 0.8 (.012 - .031)	0.2 - 0.5 (.008 - .020)	
Delivery	Coils or sheets with:	protective film	protective film	protective film	•
	Innerdiameter 400 or 500 mm:	✓	✓	✓	
Corrosion and Weather Resistance	Fit for Outdoor use:				
	Salt spray test:				
	Δ T-Test:				
	500 h QUV-B-Test: 24 h boiling test:				
Warranty	10 years:				

- = Products with protective film are guaranteed for 6 month after date of delivery if they are stored in a conditioned room (temperature 20-30°C and relative humidity 50-60°C) and kept away from sunlight and any heating source. Protective film is not UV resistant.

Reflection

Properties	Parameter	weatherproof 85	MIRO-SUN weatherproof reflective 90	MIRO-SUN PV weatherproof reflective 90	Norm
Mechanical	Tensile Strength (Mpa):	130 - 160	130 - 160	130 - 160	EN 485-2
	Yield Strength (Mpa):	125 - 155	125 - 155	125 - 155	EN 485-2
	Elongation A 50 %:	≥ 2	≥ 2	≥ 2	EN 485-2
	Bending radius:	≥ 2 fold thickness	≥ 2 fold thickness	≥ 2 fold thickness	
Optical	Total solar reflectance:	85	90	90	ASTM 891-87
	Specular reflectance:	75 - 85 / 70 - 80 along/across	87 / 87 along/across	86 / 86 along/across	ISO 7668 60°
	Total light reflectance:	85	92	87	DIN 5036-3
	Front side:	anodised & protected	PVD & protected	PVD & protected	
	Reverse side: Backside lacquered:	anodised possible	anodised possible	anodised possible	
Physical	Density, g/cm ³ :	2.7	2.7	2.7	
	Coefficient of heat expansion (10 ⁻⁶ /K ¹):	23.5	23,5	23.5	
	Heat resistance:	200 °C	200 °C	200 °C	
Dimensions	Width in mm (inch):	max. 1250 (49.21)	max. 1250 (49.21)	max. 1250 (49.21)	
	Thickness in mm (inch):	0.3 - 0.8 (.012 - .031)	0.3 - 0.8 (.012 - .031)	0.3 - 0.8 (.012 - .031)	
Delivery	Coils or sheets with:	protective film	protective film	protective film	•
	Innerdiameter 400 or 500 mm:	✓	✓	✓	
Corrosion and Weather Resistance	Fit for Outdoor use:	✓	✓	✓	
	Salt spray test:	✓	✓	✓	DIN EN ISO 9227
	Δ T-Test:	✓	✓	✓	DIN 50 928, chapt. 9.5
	500 h QUV-B-Test:	✓	✓	✓	DIN EN ISO 4892-3
	24 h boiling test:	✓	✓	✓	GSB-guideline
Warranty	10 years:	✓	✓	✓	

- = Products with protective film are guaranteed for 6 month after date of delivery if they are stored in a conditioned room (temperature 20-30°C and relative humidity 50-60°C) and kept away from sunlight and any heating source. Protective film is not UV resistant.



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