

AKASOL[®] back-panel laminated films for solar engineering

For transparent PV modules



For optical compatible PV modules



For spherical PV modules



Best protected by

KREMPEL

AKASOL® PV laminated films

The strong backbone

With our laminated films for solar engineering we enjoy world-wide trust.

As a **TEDLAR® distributor** and hence a **TEDLAR® specialist**, we produce laminated films under the brand of **AKASOL®** for the back panel in photovoltaic modules. Because of their outstanding mechanical, electrical and chemical properties together with the exceptionally high stability to weathering, our laminates ensure truly effective protection for your sensitive solar cells. Based on our **extensive knowledge and skills** in the product areas of »**Laminated Films / Special Laminates**« and in the processing technologies of »**Bonding / Coating**«, we conduct intensive **research and development** to find new combinations, customer-specific solutions and other interesting applications.

A new and innovative approach is for example for weight reasons, to substitute the front panel of the photovoltaic module by a laminated film as well. The requirements here on light transmission, transparency, stability to UV radiation and mechanical stresses are then particularly high. We also supply our **AKAFLEX® copper laminates** as a new approach for establishing the electrical connections for the silicon cells.

Areas where AKASOL® shows its particular strengths

- ✓ A product family developed especially for photovoltaic engineering from combinations of polymer film (PET / PVF / ETFE / PC), transparent adhesive coatings and layers for physical functions
- ✓ Long service life and constant product quality assured by QS-9000, ISO 9001 and TÜV certification
- ✓ Choice of qualitatively high-grade 3-layer or economic 2-layer designs
- ✓ Large product variety of different thickness grades and individual colour combinations
- ✓ Compatible with all types of EVA film; very good adhesion assured by using special primers
- ✓ Simple handling and straightforward further processing as intermediates supplied on reels in widths specified by the customer

The **multiple-component adhesives** used in the manufacture of our photovoltaic laminated films are the results of the specific development work undertaken for applications both for outdoors as well as for different climatic zones. The adhesive-coating and dissolving processes are **monitored continuously** throughout production.

To realise a **dependable bond** with all the different types of EVA films commercially available, we will also coat our laminates with an additional **chemical primer** on request. This thin film of adhesive assures straightforwardness in handling our PV laminated films. As an alternative, we can also supply a bonding agent on a **physical basis**.

Technical data for AKASOL®

Types	PTL 3-38/75	PTL 2-38/75	PTL 3-25/125	PTL 3-25/75 TUT
Design	PVF/PET/PVF + primer	PVF/PET + primer	PVF/PET/PVF + primer	PVF/PET/PVF + primer
Thickness	180 µm	140 µm	205 µm	155 µm
Weight	240 g/m ²	180 g/m ²	280 g/m ²	210 g/m ²
Density	1.4 g/cm ³	1.4 g/cm ³	1.4 g/cm ³	1.4 g/cm ³
Length on reel	150 - 300 m	150 - 300 m	150 - 300 m	150 - 300 m
Properties	white**	white**	white**	transparent
Adhesion to EVA	40 N/cm	40 N/cm	40 N/cm	40 N/cm
Peel strength	75 N/5cm	75 N/5cm	75 N/5cm	75 N/5cm
Moisture vapour transmission	< 1.3 g/m ² d	< 1.6 g/m ² d	< 1.2 g/m ² d	< 1.4 g/m ² d
Dielectric strength	> 14 kV	> 11 kV	> 18 kV	> 14 kV
Partial load operating system voltage	760 VDC	710 VDC	> 815 VDC	750 VDC

** other colours on request

Overview of films

Abbreviations	Designations	Brands
PVF + PET	PV laminated films product group	AKASOL® PTL
PVF + Polymer + Cu	Metal-laminates product group	AKAFLEX® TCL
PVF	Polyvinyl fluoride	TEDLAR®
PET	Polyethylene terephthalate	MYLAR®, HOSTAPHAN®, LUMIRROR®, SKYROL®
EVA	Ethylene vinyl acetate	VISTASOLAR®
TPU	Thermoplastic polyurethane	VISTASOLAR®
ETFE	Ethylene tetrafluorethylene	TEFZEL®, NOWOFLON®
PC	Polycarbonate	MAKROFOL®



Our production equipment is **state-of-the art** and the machines are special developments for manufacturing **qualitatively high-grade laminates**. Production takes place in a **clean climate-controlled manufacturing environment**. All intermediates are kept in storage hung on reels for such a time until the adhesive has reached full cross-linkage. Having passed quality control, the photovoltaic laminated films are then made up to give reels or sheet material in accordance with customer requirements.

for your solar modules.

Design, production and properties of AKASOL®.

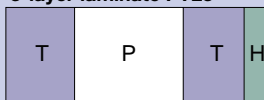
AKASOL® laminated films are manufactured in to give a variety of designs from **polymer film** and/or **TEDLAR® films**. The most common material for the inner layers is PET film with a thickness of 75 µm, and the outer layer is usually a PVF film 38 µm in thickness. Alternatively a 25 µm PVF film can be used as the outer film. PET films are **dimensionally stable**, **moisture-resistant** and are characterised by their **outstanding electrical insulation properties** whereas PVF films assure dependable **protection from UV radiation**.

In the case of transparent photovoltaic laminated films, particular attention is paid to **good light transmission**. It is for this reason that we also supply combinations with ETFE films for extremely high transparency. As these laminates have to be particularly thin, PET film with exceptional stability to moisture is used here.

AKASOL® laminated films are supplied as the standard in white, black or transparent designs. On request, special types with other colour combinations – e.g. in blue or green – are also possible to assure harmony in integrating the solar modules in the surroundings.

Designs for AKASOL® laminates

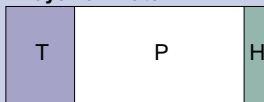
3-layer laminate PTL3



T = PVF film TEDLAR®

Colours: white, black, blue, green
(other colours on request)
transparent clear
Thickness: 25 µm or 38 µm

2-layer laminate PTL2



P = Polyester film

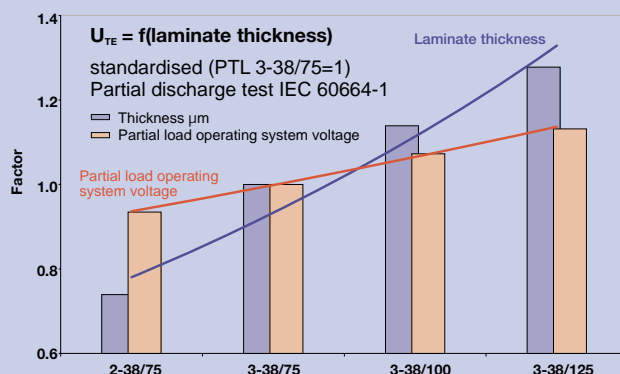
Colours: transparent, white
Thickness: 25 µm up to 300 µm

H = Bonding agent

Polymer coating
or physical treatment

The **laminate design** as well as the **types and film thickness** all have a significant influence of the characteristics of the finished laminates – e.g. on the moisture vapour transmission or on the dielectric strength. The trend towards bigger photovoltaic modules leads to ever higher electrical voltages. Thicker laminates then have to be used to assure the requirements are met.

Dependency of the partial load operating system voltage on the laminate thickness



The requirements placed on photovoltaic laminates by the market are continually increasing. With **KREMPEL**, you have a **skilled partner** willing to **develop solar engineering products further**. Also, we will give you extensive advice and you can rely on us at all times: Regardless of the products you select from our large product family, **we will guarantee outstanding quality**. Convince yourself of these advantages. **We will provide the support you need.**

Best protected by

KREMPEL

KREMPEL GROUP

Take a closer look: www.krempeel-group.com

Parent Company and Headquarters

KREMPEL



August Krempeel Soehne GmbH & Co. KG
Papierfabrikstr. 4 · D-71665 Vaihingen/Enz
Germany
Tel. +49 (0) 7042 915-0
Fax +49 (0) 7042 15985
e-mail: info@krempeel.com

Member of the KREMPEL-GROUP

JSI



Jones Stroud Insulations Ltd.
Longridge · Preston · PR3 3BS
United Kingdom
Tel. +44 (0) 1772 783 011
Fax +44 (0) 1772 784 200
e-mail: info@jsi.krempeel.com

Member of the KREMPEL-GROUP

AAF



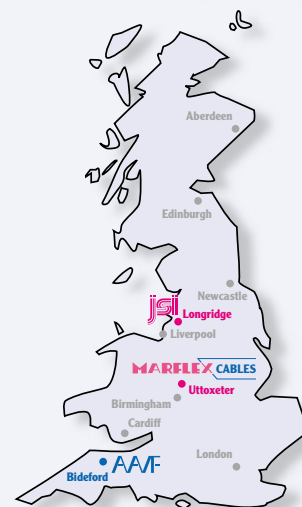
Anglo-American Vulcanized Fibre Co. Ltd.
Clovelly Road · Bideford · Devon · EX39 3EX
United Kingdom
Tel. +44 (0) 1237 475 501
Fax +44 (0) 1237 479 879
www.aavf.co.uk · e-mail: info@aavf.co.uk

Member of the KREMPEL-GROUP

MARFLEX CABLES



MARFLEX CABLES
Eastfields Road · Uttoxeter
Staffordshire · ST14 8EE · UK
Tel. +44 (0) 1889 569 330
Fax +44 (0) 1889 569 277
e-mail: info@marflex.krempeel.com



KREMPEL-GROUP distribution agencies

For the countries

Austria, Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Macedonia, Poland, Romania, Serbia & Montenegro, Slovakia, Slovenia

KREMPEL

August Krempeel Soehne
Vertriebsgesellschaft m.b.H. Wien
Webgasse 43 · A-1060 Vienna · Austria
Tel. +43 (0) 1 5975 345
Fax +43 (0) 1 5964 226
e-mail: info@krempeel.at

In the United Kingdom

KREMPEL

KREMPEL LIMITED
Longridge · Preston · PR3 3BS
United Kingdom
Tel. +44 (0) 1772 783 011
Fax +44 (0) 1772 784 200
e-mail: info@jsi.krempeel.com

In the USA

KIT KREMPEL
INSULATION
TECHNOLOGIES

Krempeel Insulation Technologies, LP
Birchwood Plaza #5 · 143 Raymond Road
PO Box #7 · Candia NH 03034 · 0007
Tel. 603-483-8030
Fax 603-483-8355
Toll Free 877-745-3730
e-mail: dsklarski@krempeel-usa.com

In Asia

KREMPEL

KREMPEL-GROUP
Asia-Pacific Office
333 LPN Building, Tower 1
24th floor, Unit C1
Soi Chaypuang, Viphavadi-Rangsit Road
Ladyao, Jatujak
Bangkok, 10900
Thailand
Tel. +66-2-618-8112
Fax +66-2-618-8114
e-mail: info@krempeelasia.com

Further representation:

Argentina, Australia, Brazil, Canada, Chile, China, Columbia, Denmark, Finland, France, Greece, Hong Kong, India, Iran, Israel, Italy, Japan, Jordan, Korea, Malaysia, Mexico, the Netherlands, New Zealand, Norway, Pakistan, Peru, Portugal, South Africa, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, Uruguay, Venezuela, Vietnam.

Fibre composites

Prepreg systems with thermosetting and thermoplastic resins · Filament windings · Pultruded plastic profiles · Laminated tubes and rods · Plastic sheets · Moulded parts · Plastic mouldings – Injection and Compression · Machined precision parts · Component assembly

Base materials and special laminates

Materials for flexible printed circuits · Materials for Smart Cards · Sheets for solder frames · Laminates for solar engineering and in protection applications · Materials with self-adhesive coatings and special metal foils

Special products

Temperature-resistant cables and seals for domestic appliances · Special sleeves for automotive electrical applications

Electrical insulations

Presspahn: Presspaper, pressboard, corrugated board · Multi-layer insulation materials · Prepregs · Mica products · Electrically conductive materials · Side and top ripple springs · Banding tapes · Woven tapes · Insulation sleeves · Tying cords · Sealing tapes · Silicone elastomer cables

Authorised distributor for Du Pont

In Germany, Austria and Eastern Europe:
KAPTON® polyimide film
In Germany, Austria, the Netherlands and Eastern Europe:
TEDLAR® PVF protective film and release film
In Great Britain:
NOMEX® aramide paper

Certification

All companies in the KREMPEL-GROUP are certified according to ISO 9001. Certain divisions are also certified to QS-9000. In addition to this, some products are UL-listed or are UL-recognised components. We shall be pleased to provide you with more detailed information.