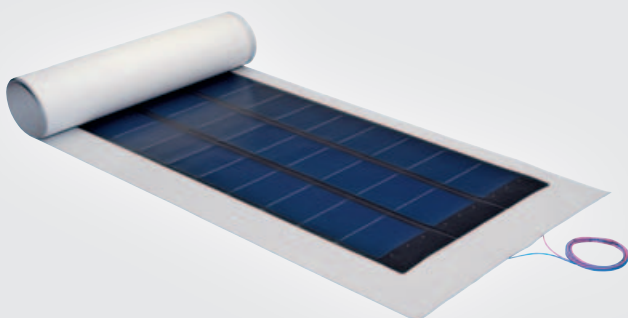




## EVALON<sup>®</sup> Solar

The power-generating roofing membrane



**EVALON<sup>®</sup> Solar**

# Building-Integrated PV Systems (BIPV)

## Design guide:

■ Building-integrated photovoltaic (PV) systems, made of multi-purpose EVALON® Solar roofing membranes, can be installed on roof areas without ballast, e. g. gravel, which are not designed for permanent foot traffic and not for vehicular traffic or green roofs (non-used roof areas).

■ Multi-purpose roofing membranes are suitable for both non-ventilated (warm) and ventilated (cold) roof constructions. Impeded drainage and ponding water on the roof sealing should be avoided (**roof slope  $\geq 3^\circ$** ). Best applications are barrel-vaulted, mono-pitched, double pitch, butterfly and, in particular, saw tooth roofs with south-facing pitched surfaces to be waterproofed. In Central Europe, a south-facing  $30^\circ$  pitch is ideal for maximum power generation, but not essential.

■ Installation of EVALON® Solar multi-purpose roofing membranes is the same as for conventional single ply roofing membranes. EVALON® Solar roofing membranes are loose laid and mechanically fastened. For lightweight steel or timber (plywood, OSB, T&G) decks the membranes should run parallel to the roof purlins (joists).

■ EVALON® Solar membranes should ideally be installed on central roof areas (subject to lower wind uplift forces). Shading of PV modules by upstands, rooflights and other roof penetrations should be avoided. Perimeter and corner areas (subject to high and maximum wind uplift forces) should be covered with standard EVALON® single ply roofing membranes.

■ Connecting cables of the PV modules are laid hidden beneath the EVALON® Solar membranes and passed through the supporting deck and the other functional layers below the deck.

■ Where distribution of cable conduits is difficult, as in the case of e. g.

- solid supporting decks (reinforced concrete, ribbed floor with hollow stone fillers and the like),
- high buildings or
- suspended ceilings beneath the supporting deck

DC junction boxes can be located inside alwitra rooflights positioned on the roof with the connecting cables of the DC module laid beneath the roofing membrane. The DC string cables coming from the junction boxes can be placed together in a cable conduit installed in the thermal insulation layer beneath the roofing membrane and directed towards a roof penetration into the building, also weather-protected.

■ In grid supply areas grid-connected PV systems are installed, i. e. with feed-in into an existing low-voltage power grid (230/400 V, 50 Hz). Up to 36 EVALON® Solar membranes are connected to one inverter.

■ The grid connection is subject to national/local regulations etc. Please contact your local electricity supplier (DNO) for more details.

■ Monitoring equipment and data display screens for PV systems can be connected to the inverter interface. This equipment, if required, needs to be specified separately taking into consideration the PV-system's power generating capacity and monitoring requirements.

■ Additional lightning protection for building-integrated PV systems is not required, as the BIPV system does not have any effect on the statistical frequency of lightning strikes. Lightning conductors should be positioned at least 0.5 m away from the PV modules.



▲ Medina High School, Newport/Isle of Wight



▲ Ocean Side, Sandbanks, Poole



▲ FKT Kunststoffwerk, Triptis, Germany



▲ Ständlerstraße, Munich, Germany



▲ Huddersfield Royal Infirmary, Huddersfield



▲ School Complex, Remerschen, Luxemburg

**alwitra-EVALON® Solar roofing membranes are part of the proven alwitra product systems. Furthermore, these systems comprise:**

- roofing and waterproofing membranes (single ply and elastomeric membranes) - EVALON®-SK roofing and waterproofing membranes
- EVALON®-SKA flashing membranes - roof edge trims - wall cappings
- wall flashing profiles - synthetic coatings - coated steel sheets - rooflights (smoke venting systems) - rainwater outlets - flat roof vents
- paving slab supports

# EVALON® Solar roofing membranes

**EVALON® Solar** is a high-performance single ply roofing membrane with flexible and lightweight photovoltaic (PV) modules for multi-purpose roof covering which offers

- reliable protection of buildings against precipitation and
- direct conversion of solar energy into electric power.

The **UNI-SOLAR®** PV modules consist of flexible solar cells (240 x 340 mm) configured in series, with bypass diodes between all cells, and are fully weather-proofed with a transparent polymer coating. The triple-junction solar cells have a power-generating layer structure made of amorphous silicon vapour deposited on stainless steel foils (negative) with a transparent electrode and a pick-up grid (positive). Each of the three silicon layers uses a different wavelength of solar light.

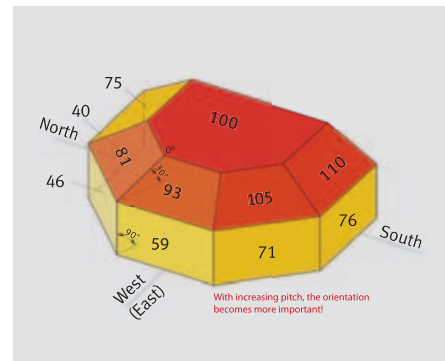
EVALON® membranes consist of a high polymer alloy of ethylene vinyl acetate terpolymer (EVA) and polyvinyl chloride (PVC), a purpose-made thermoplastic material with decades of practical experience. Both components are solids, maintaining optimum properties for a maximum service life. The membranes are homogeneous with a polyester fleece backing.

The flexible PV modules are arranged on the membranes in a way that makes installation of the EVALON® Solar membranes as easy as for standard single ply roofing membranes. Complex frameworks and additional heavy supports (e. g. concrete or gravel base), necessary in the case of framed flat PV modules under glass, are not required. Connection cables of the PV modules are installed hidden beneath the EVALON® Solar membranes. DC cables are protected from rain, wind and weather. Inverters with integrated mains monitoring devices (ENS) and all other electrical components are mounted to the underside of the roof.



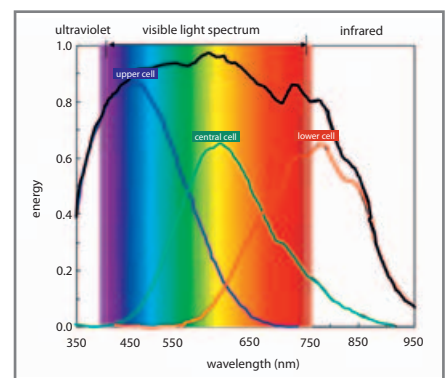
▲ BG Wiederaufbau, Braunschweig, Germany

Pollution-free and direct conversion of solar energy into electric power by photovoltaic (PV) systems requires large areas, as the effective free and inexhaustible supply of solar energy per year on a horizontal surface is only about 1000 kWh/m<sup>2</sup> e. g. in Central Europe. Large low-pitched roof areas, in particular those of industrial and commercial buildings, are ideally suited for installing building-integrated PV systems like the multi-purpose EVALON® Solar roof waterproofing. EVALON® Solar is suitable for both new build and refurbishment projects.



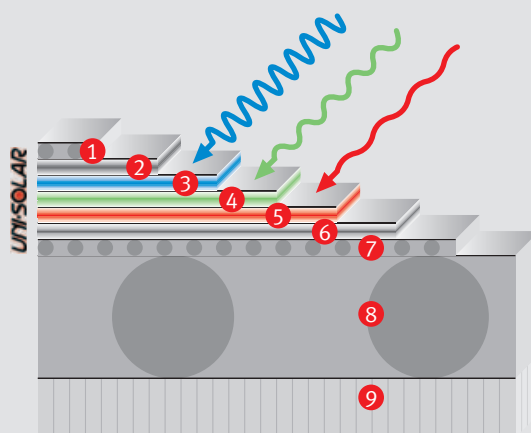
▲ Global irradiation onto differently pitched and oriented surfaces (%) (100% = 1000 kWh/m<sup>2</sup>\*a, location: Berlin, Germany)

The irradiation potential which can be used by EVALON® Solar depends on the pitch and the orientation of the roof. With increasing pitch, the orientation becomes more important. By introducing a pitch to the roof surface, in Central Europe the potential for power generation can be increased by a maximum of 12%.



▲ Spectral sensitivity - triple junction solar cell

- 1 Polymer coating
- 2 Pick-up grid (+)
- 3 Silicon cell (a-Si)
- 4 Silicon cell (a-SiGe)
- 5 Silicon cell (a-SiGe)
- 6 Stainless steel foil (-)
- 7 Polymer coating
- 8 EVALON® membrane
- 9 Polyester fleece



▲ View of the EVALON® Solar layer structure (cross section)

## Performance profile



Building Integrated



Flexible



Extremely  
Light Weight



Triple-Junction-  
Technology



High Output



Certified



▲ VAG Municipal Transport Services,  
Nuremberg, Germany



▲ Sports Hall, Folgaria, Italy

■ **EVALON® Solar** provides reliable protection of buildings from precipitation (**roof waterproofing**) coupled with resource-saving, pollution-free power generation through direct conversion of solar irradiation (**photovoltaic**).

■ **EVALON® Solar** is flexible, needs no glass or frames, and follows any shape of roof.

■ **EVALON® Solar** has PV modules with an even matt black-blue and finely structured surface with only 1/3 of the directed reflection of glass.

■ **EVALON® Solar** is weather resistant. The PV modules are encapsulated between transparent and dirt-repellent TEFZEL® (top) and an EVA-containing foil (below). The underside is additionally protected by the EVALON® membrane.

■ **EVALON® Solar** has an extremely low own weight (4 or 4.3 kg/m<sup>2</sup> respectively) and is therefore suitable even for roof constructions with low bearing capacity (e. g. lightweight steel decks).

■ **EVALON® Solar** with triple-junction thin-film technology for an optimum utilisation of the light spectrum is also suitable for roof areas with less than ideal pitch or orientation.

■ **EVALON® Solar** with its bypass diodes between all cells of a module avoids shut-down of whole modules in the case of partly shaded areas. Power is generated even in low light conditions. Energy yield in low light exceeds that of identically rated crystalline solar cells.

■ **EVALON® Solar** is less affected by temperature fluctuations than crystalline solar cell modules, when it comes to performance, current and voltage.

■ **EVALON® Solar** has a 20% higher yield than identically rated crystalline solar cells; constant output, in Central Europe 750...950 kWh/kWp per year.

■ **EVALON® Solar** uses resources rationally. The solar cells will generate the electricity required to manufacture them in approximately 1.8 years. For thin-film cells only a fraction of the ultra pure silicon required for crystalline solar cells is used.

■ **EVALON® Solar** is CE-certified and certified by ESTI-Ispra according to IEC 61646/CEC 701 and by TÜV as safety class II equipment for system voltages up to 1,000 VDC.

■ **EVALON® Solar** is the first power-generating roofing membrane on the world market.

## Installation

EVALON® Solar multi-purpose roof coverings are installed by trained and licensed roofing contractors. Application is possible in most weather conditions, and economical fast-track installations can be achieved with automatic fastening machines and seam welders.

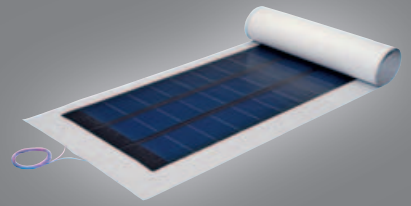
EVALON® Solar membranes are:

- laid so that standing water and ponding are avoided;
- normally used on the central area of the roof (approximately 60% of the total roof area), laid with or across the falls, whilst perimeter and corner zones are covered in standard EVALON® membranes;

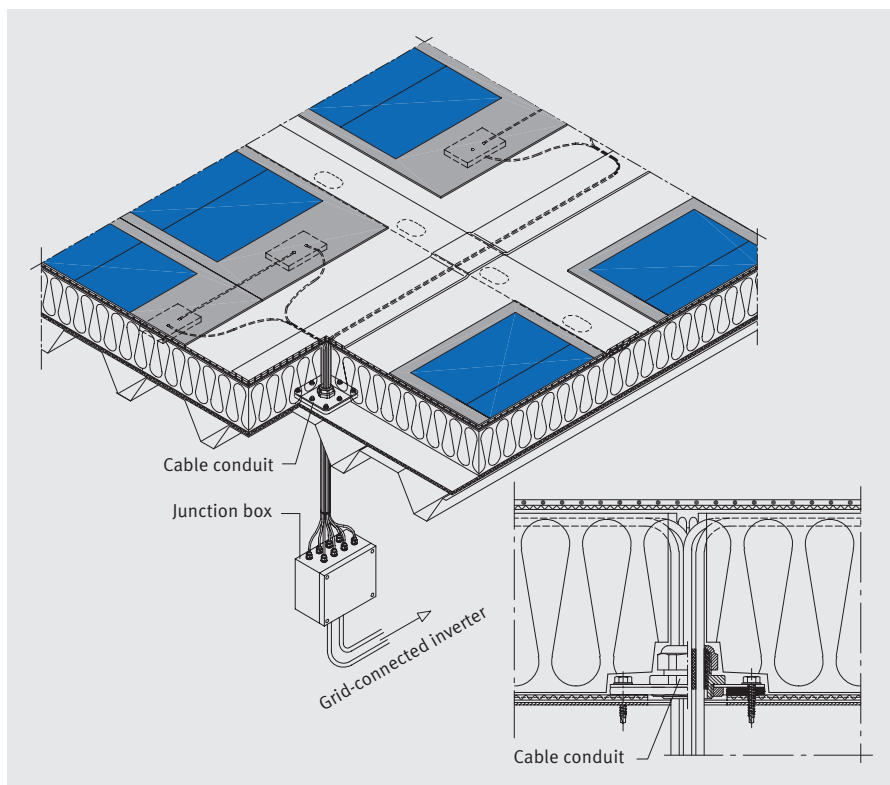
Membrane attachment is ideally made using proprietary mechanical fastening systems, usually hidden under the side laps. The number of fasteners and fastener centres are determined for individual buildings in accordance with local/national conditions and Building Regulations/Codes of Practice. All installations must be carried out in strict conformity with the current printed installation instructions for EVALON® roofing sheets and the EVALON® Solar check list.

The factory-fitted electrical connections are located beneath the EVALON® Solar membrane and protected from

EVALON®-Solar membranes are supplied in rolls with flexible PV modules (including wiring) factory-laminated to the EVALON® carrier membrane. **Testing** is carried out before shipment so they are **ready for installation**.



Location of PV modules on the membrane allows easy use of installation aids such as automatic seam welders and fastening tools.



- joined with 110 mm side laps with a minimum weld width of 20 mm;
- are butt-jointed at ends (after 6 or 3,36 m respectively) and covered with a 100 mm wide unbacked EVALON® tape centrally welded over the joint.

the weather. The DC cables of several modules are normally routed through the roofing package (thermal insulation, VCL, roof deck) and connected to an inverter located beneath the roof deck. Connection to the inverter, testing and commissioning of the system should be carried out only by qualified electricians.



EVALON® Solar membranes are laid on a fire-resistant intermediate layer or non-flammable substrate according to local/national regulations. Insulation boards made from mineral wool are recommended.

## PRODUCT RANGE

EVALON® V-Solar [1]	EVALON® V-Solar 408	EVALON® V-Solar 272	EVALON® V-Solar 204	EVALON® V-Solar 136
Membrane width	1,55 m	1,05 m	1,55 m	1,05 m
Membrane length	6 m		3,36 m	
Nominal thickness incl. PV module and roofing membrane backing	5,1 +/- 1 mm 1,8 mm			
Mass (weight per square metre)	4,30 kg/m <sup>2</sup>	4,33 kg/m <sup>2</sup>	4,03 kg/m <sup>2</sup>	4,17 kg/m <sup>2</sup>
PV module, nominal width x nominal length	1185 mm x 5490 mm	790 mm x 5490 mm	1185 mm x 2850 mm	790 mm x 2850 mm
PV module, nominal output (at STC)	408 W <sub>p</sub>	272 W <sub>p</sub>	204 W <sub>p</sub>	136 W <sub>p</sub>
Voltage at MPP	99 V	66 V	49,5 V	33 V
Required roof surface area (with 110 mm overlap)	21,18 m <sup>2</sup> /kWp	20,74 m <sup>2</sup> /kWp	23,72 m <sup>2</sup> /kWp	23,22 m <sup>2</sup> /kWp
DC connection cable (factory fitted)	double sheathed / insulated, single conductor / flexible 5 m / 2 x 4,0 mm <sup>2</sup>			
DC cable conduit (off centre)	for 1 x 8 or 2 x 8 DC connecting cables 4 mm <sup>2</sup>			
DC junction box	with 8 terminals for string connection (optional overvoltage protection)			
DC field junction box	for up to 6 DC junction boxes, with welding flange for flashing to the roofing membrane			
DC isolator, max 500 V / 16 A (with rated switch disconnecter)	with up to 10 terminals for string connection and 2 terminals for inverter connection (optional overvoltage protection)			
DC isolator, max 500 V / 25 A (with rated switch disconnecter)				
Line-commutated DC/AC string inverters with galvanic insulation and integrated ENS	AC rated output power			
	4.600 W	3.500 W	2.500 W	1.800 W
Max. input voltage (at 1,000 W/m <sup>2</sup> ; -10°C)	530V		500 V	
Line-commutated DC/AC central inverters with galvanic insulation	AC rated output power			
	40.000 W	32.000 W	29.900 W	24.000 W
Max. input voltage (at 1,000 W/m <sup>2</sup> ; -10°C)	530 V			

Technical data	EVALON® V-Solar 408	EVALON® V-Solar 272	EVALON® V-Solar 204	EVALON®, V-Solar 136
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PV module	Testing according to	Test results (1)			
	Rated power at STC	DIN EN 61646 Test 10.2 at STC	408 W <sub>p</sub>	272 W <sub>p</sub>	204 W <sub>p</sub>
Open circuit voltage	DIN EN 61646 Test 10.2 at STC	138,6 V	92,4 V	69,3 V	46,2 V
Short circuit voltage		5,1 A	5,1 A	5,1 A	5,1 A
Voltage at MPP	DIN EN 61646 Test 10.2 at STC	99 V	66 V	49,5 V	33 V
Current at MPP		4,13 A	4,13 A	4,13 A	4,13 A
Temperature coefficient	DIN EN 61646 Test 10.4	-0,21% per °C			
Safety class	DIN EN 50178	II up to 1000 V DC			
Evalon® V membrane	Max. tensile force	> 500 N/50 mm			
	Elongation at max. tensile force	EN 12311-2	> 60%		
	Resistance to impact load	EN 12691 method A	≥ 1100 mm		
	Bitumen compatibility	prEN 1548	passed		
	Reaction to fire	EN 13501-1	class E		
	External Fire Spread	ENV 1187 or BS 476, Part 3: 1958	class B <sub>ROOF</sub> (t1) F.AB		

(1) The results contained in this Technical Data are taken from tests and comply with the current standards.  
Normal tolerances apply. Technical changes reserved.

EVALON® Solar is ESTI-Ispra certified according to IEC 61646 / CEC 701 and by TÜV Rheinland as safety class II equipment. alwitra's integrated management system has been certified by TÜV according to DIN EN ISO 9001 - Quality Management Systems - and DIN EN ISO 14001 - Environmental Management System - and validated according to the EC eco-audit regulation.



## EVALON® Solar

### Roofing Membranes



▲ Max Bahr, Hamburg, Germany



▲ Learning Centre, Jena, Germany



▲ Municipal Transp. Services, Kassel, Germany

## Service

**The reliable way to generate electricity from your roof covering with the alwitra team:**

Planning and installing building-integrated PV systems requires comprehensive expert advice. We assist building owners, designers, roofing contractors and electricians:

- during **early planning**, by professionally estimating the global irradiation at the location, developing the technical concept for the PV system and providing a cost estimate;
- during the **design stage**, by producing specifications, individual wind uplift calculations and installation and fastening schemes;
- with respect to **funding**, by providing detailed information on subsidies and, if required, by calculating pay-back periods and financial planning;
- during **installation and commissioning**, by providing on-site technical assistance.

Technical changes reserved

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