Flisom eFlex Series

Safety & Installation Guideline for eFlex

This manual applies only on Flisom's eFlex Series modules

Table of Contents

Warning

Flisom eFlex PV-Modules are electrical devices for outdoor use. They generate electricity by sunlight. This manual contains important safety information and describes the correct installation, use and disposal of the product. Please read the manual carefully before installation to avoid endangering your life and the environment.

If no other local regulations apply a solar system has to be constructed, installed and commissioned by a qualified and certified electrically skilled person. Only use proper tools and equipment described in the manual. In case of any questions contact sales@flisom.ch.

1 Introduction

Flisom eFlex Series modules are thin film photovoltaic devices which convert sun light into direct electrical current (DC). The eFlex is a flexible and lightweight solar panel designed for integration into roofs, structures with limited load bearing capacity, mobility applications on trailers, RVs, boats and many more demanding applications.

1.1 Before you start

This manual is intended as a guideline to assist a qualified solar systems integrator in the design and installation of a solar energy system using Flisom eFlex Series modules. It is for installation purposes only. Flisom takes no warranty for Installation.

The electrical and mechanical design of a system using Flisom eFlex Series modules must be completed, and the installation must be approved by a qualified solar systems integrator. The system integrator and installer are responsible to complete installation in accordance with the industry's "Best Practices" methods and all applicable building, electrical, fire and other codes and regulations in addition to the specific recommendations stated in this manual. The Flisom eFlex Series modules are not intended for self-installation by end users.

This manual contains information for the installation of the following modules:

- Flisom eFlex Series 0.8m module
- Flisom eFlex Series 1.6m module
- Flisom eFlex Series 2.3m module
- Flisom eFlex Series 3.1m module

Fig. 1: Flisom eFlex

1.2 Safety

Danger

Electrical shock

The generated current of a module under illumination is dangerous. Modules should be connected only, if the system is covered and thus potential and current free. Do not modify the module, the junction box or the connectors. Make sure that you work with dry tools and under dry working conditions. Current has a linear behaviour with incoming radiation and can exceed the mentioned current if the illumination is higher than under Standard Test conditions (STC). Fix issues in the grounding immediately.

Working on live parts

When working on wiring use safety equipment (insulating gloves, shoes, etc) and appropriate tools (insulating tools, etc). Make sure that you have grounded the modules and the mounting construction. Do not use damaged or broken modules. Repair or replace damaged modules or cables immediately. Do not dismantle modules or the junction box.

High Voltage

In a PV system the voltage is multiplied by the number of modules in series up to the stated system voltage. Do not allow the system to exceed the stated system voltage. Be aware that almost the same voltage stated on the label is present under low light conditions.

Arcing

PV modules generate direct current when exposed to light. When disconnected a dangerous arc between the wires may be generated which will not extinguish on its own. Do not disconnect under load.

Fire Protection

Do not use PV modules in explosive atmospheres. Check the local regulations for fire protection

Warning

Do not use aggressive solvents or scrubbing materials for cleaning the modules. Do not use sharps objects. Do not walk on the panels if there is any risk that sharp stones under the soles, or sharp shoe elements would damage the panel.

The safety instructions for other system components apply. Local standards, building norms and accident prevention regulations must be followed. Disregarding the warnings can cause serious injuries or even death.

Keep a minimum distance of 5m[1] to a burning PV system. Inform the public authorities about the PV installation.

Attention

Do not concentrate light on the modules. Modules and insulations can be destroyed by concentrated light.

Do not remove the label or use modules without labels attached by the manufacturer.

Reverse currents may damage modules. To avoid reverse currents, maintain an equivalent voltage in each parallel connected string of the circuit.

Do not cut or thin eFlex panels. Do not drive screws into the laminate.

[1] *Source: www.arbeit-und-gesundheit.de/2/2349*

2 Storage and Transportation

The eFlex modules with applied PV600BT adhesive should be stored in a shaded, dry and clean area between 15°C - 25°C. When stored correctly the adhesive is usable up to 12 months. (see datasheet HELIOBOND® PVA 600 BT in section 9.1)

Do not stand or step on the modules or their packaging. Do not accept modules delivered in damaged packaging. Do not put pressure on the modules. Do not bend the modules to a radius of less than 500mm.

2.1 Packaging

The eFlex modules are packed in cardboard boxes. Box must not be stacked more than 3 Boxes high

	eFlex 2x1	**eFlex 3x1**	**eFlex 4x1**
Dimension (LxWxH)	80x40x47cm	80x40x47cm	80x40x47cm
Quantity of modules	4	4	4
Weight of a full box modules without glue	10.4 kg	15.2 kg	19.2 kg
Weight of a full box modules with glue	7.2 kg	10.8 kg	14,0 kg

Note: Other sizes to be confirmed.

3 Installation

Before installing modules, contact the appropriate authorities to obtain any required building permits and to determine installation and inspection requirements that apply to the installation. Make sure that unauthorised people have no access to the construction place. Do not install when it is raining, snowing, windy or the ground is slippery. Flisom recommends to use personal protective equipment such as safety gloves, safety googles and safety boots etc. Respect general safety rules.

3.1 Environment

Ambient temperature to install Flisom eFlex Series modules must be between 10°C and 50°C. They can be operated in the range of -40°C to 85°C. Check if it is necessary to protect animals from the PV system for example by installing cable guides or fences etc. Depending on the area it is necessary to protect the modules from standing water, snow or extreme soiling. The described application solution is limited to a snow and wind load (wind suction) of 2400 N/m^2. At consistent solar radiation Flisom PV modules generate more power at lower temperatures. To improve the energy yield of the plant increasing cooling or ventilation is an option (see thermal coefficients in the data sheet).

3.2 Handling

Flisom eFlex Series use thin polymeric sheets as backsheet. Hence they can bend by applying forces while installation (e.g. dropping on the edges or corner). Please handle with care. Store modules in a dry place. Do not transport modules without packaging. Do not put modules on top of each other to avoid small scratches (this can accelerate module degradation by environmental factors). Do not use Junction Box cables as handles to carry or lift the modules. Be cautious when frontsheet is wet since the surface will be slippery. Do not apply solvents, adhesives, paint or stickers on the frontsheet. Do not place the modules face-down in direct contact to abrasive surfaces. Do not bend a module over a sharp edge.

3.3 Mechanical

A structural analysis of the roofing structure has to be conducted before installation.

3.4 Module Orientation and Shading

In general, the modules can be mounted either in portrait or in landscape mode, depending on different limiting factors:

Casting shadow on the panels should be avoided.

- Always install the Flisom eFlex Series modules in a location that has good sun exposure throughout the year. Less power is generated in shaded locations.
- Plan the installation in such a way, that the Flisom eFlex Series modules receive the same amount of direct sunlight within the same string (taking in account their orientation and shadowing).

If direct shadow on active surface could not be avoided:

- Orientation of the shadow on the active surface is crucial: the panel may only be installed as in fig 2 (Parallel shade). To compare, fig 3 shows a series shade - shading the complete length of several full cells. This type of casting shadow will negatively affect the power generation of the module and can cause degradation by overheating.

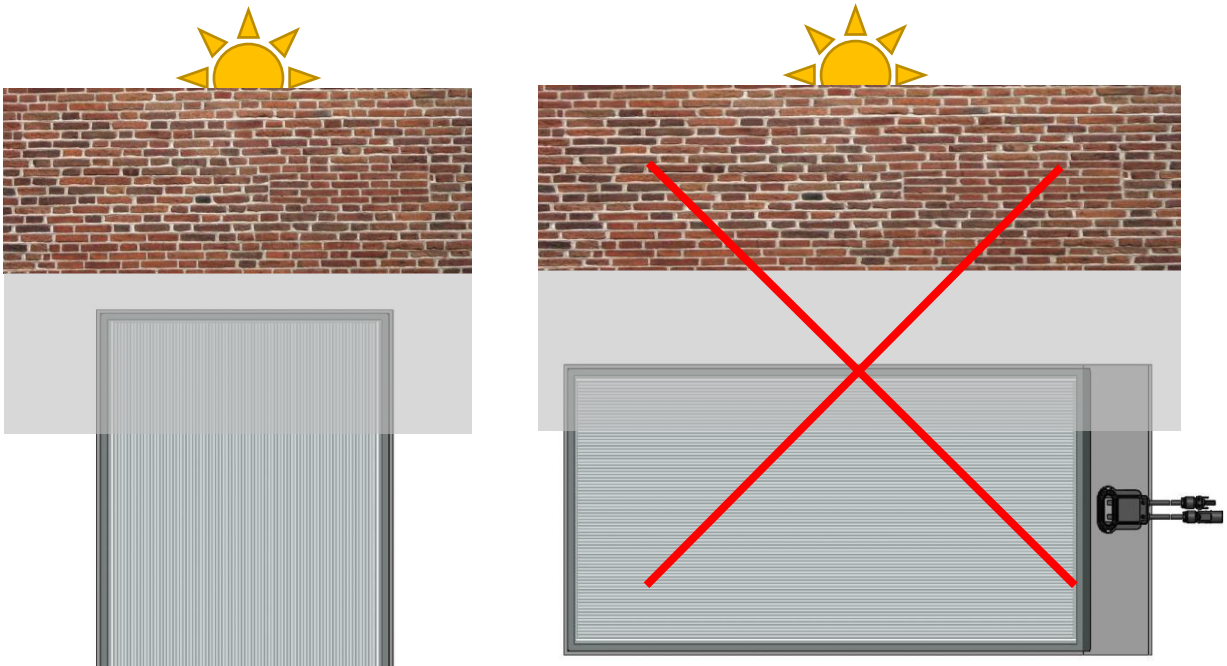


Fig. 2: series shade

Fig. 3: parallel shade

Negative impact on the system performance from full or partial shading from rooftop equipment, structural elements of a building and nearby trees, poles power lines or nearby buildings should be avoided. A professional shading analysis prior to installation is recommended by Flisom.

3.5 Application

The Flisom eFlex modules with self-adhesive PVA 600BT backing are suitable to bond different roof materials. The compatible roof materials are listed in the table below. All other roof materials have to be tested before application. It is not possible to glue the eFlex modules with PVA 600BT on PVC materials. The roofs should have a minimum slope of 2% to avoid standing water on the modules.

roof material category	type	
TPO membrane	Carlisle TPO	ask supplier if primer is necessary
	Firestone TPO	ask supplier if primer is necessary
	GAF TPO	ask supplier if primer is necessary
	Stevens TPO	ask supplier if primer is necessary
	Johns-Manville TPO	ask supplier if primer is necessary
Rubber membrane	Carlisle EPDM	ask supplier if primer is necessary
	Firestone EPDM	ask supplier if primer is necessary
Bitumen	Johns-Manville Granulated Mod-Bit	primer necessary
	Garland Smooth Mod-Bit	primer necessary
	Garland Granulated Mod-Bit	primer necessary
	Garland Coated/Granulated Mod-Bit	primer necessary
Acrylic / Elastomeric coating	Eternalastic 911 (Tropical Roof)	ask supplier if primer is necessary
	Siplast PC-227	ask supplier if primer is necessary
Metal	PVDF coated steel	
	Galvaneal (zinc-iron alloy)	
	Galvalume Plus (aluminum-zinc alloy)	
	Aluminium	preparation work is necessary contact Flisom for technical support
Others (PV Materials)	LPL Backsheet	
	PVDF film (Kynar)	
	Tefzel (ETFE)	
	Glass	
	FRP Backsheet (fluorpolymer)	

3.5.1 Unpacking the Module

The module will be delivered in a carton box (Fig. 4). The long sides of the modules are held by a carton block with slots. The upper block has to be removed first. Afterwards the modules can be taken out. The 0.8m module can be handled by 1 person, 1.6m, 2.3m and 3.1m modules need to be handled by 2 persons. Do not scratch the remaining modules with the one you are removing (the edges are sharp)

Fig. 4: packaging of Flisom eFlex Series modules

3.5.2 Site Preparation

The roof substrate must be even, clean, dry and free of contaminations. In case of excessive soiling, the roof has to be cleaned according to the roof manufacturer's instructions. If a roof is damaged it has to be replaced before installation of the modules.

To clean a TPO, EPDM or metal roof use IPA (2-propanol isopropyl alcohol) and lint free wipes. The cleaning should not be more than 30 minutes prior to bonding of PVA 600BT adhesive backed part. The roof substrate has to be completely dry. If necessary, the drying time can be accelerated with a hot air dryer.
To clean a modified bitumen roof use a soft broom or leaf blower to remove any loose aggregate. Be careful and do not remove aggregate still bound to the surface. Do not clean the substrate with solvents. The modified bitumen has to be coated with a roof coating recommended by membrane supplier and ADCO/Kömmerling.

Before application of Flisom eFlex modules check, if a primer is required by the roof substrate manufacturer. Check also that the roughness of the roof substrate is never greater than the thickness of the adhesive layer. Gluing modules on overlapping membranes should be avoided.

3.5.3 Module arrangement recommendation

All lanes of modules should be positioned parallel and should have enough space between for thermal expansion (ca. 2 mm). Provide sufficient space between the module lanes to ensure that there are walk ways, between the modules, so that there is no walking on the eFlex modules. Leave enough space between module strings for the cable duct. Check that the cable duct is not shading the modules. Cover the Junction box with the cable duct system for additional UV protection.

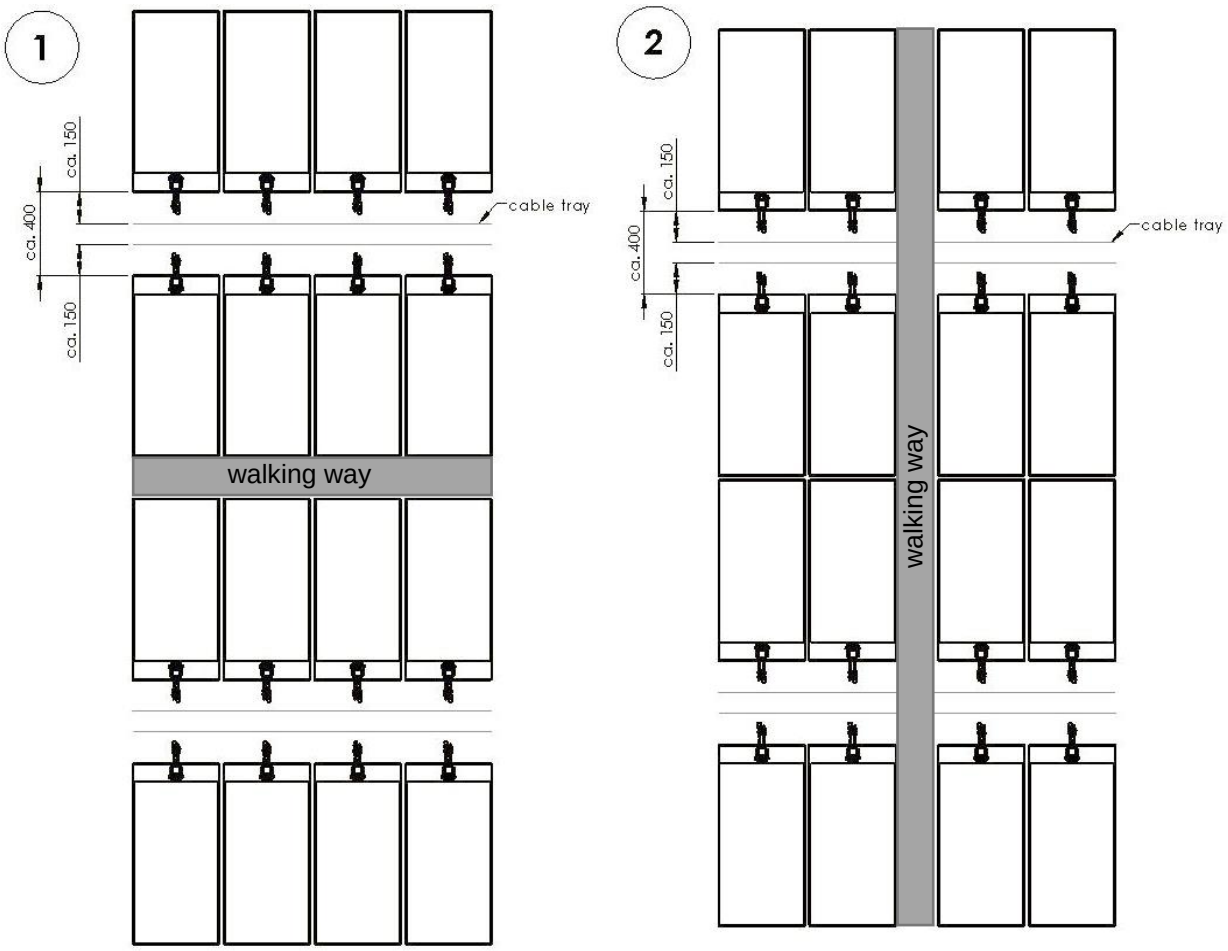


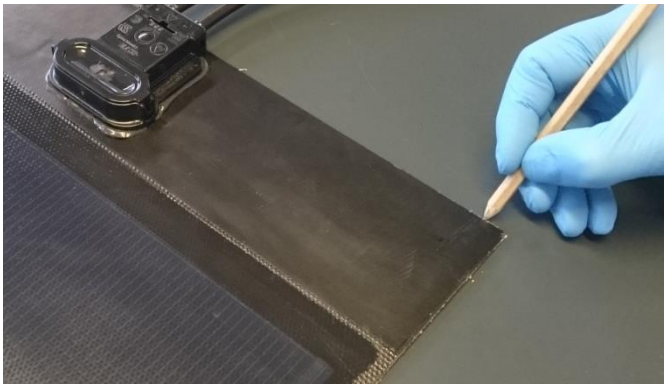
Fig. 5: arrangement eFlex

3.5.4 Roof Application

According to the ADCO PVA 600BT tape application guideline the protective foil has to be removed immediately prior to applying. Avoid contaminating the adhesive. The substrate has to be placed within 30 minutes after any primer has been applied. Best application temperature for the PVA 600BT is 10°C to 50°C.

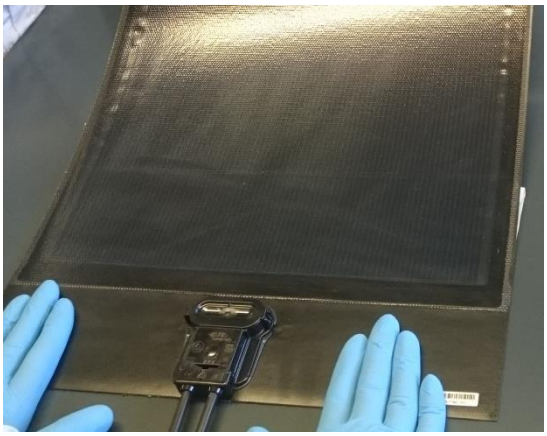
Application Steps:

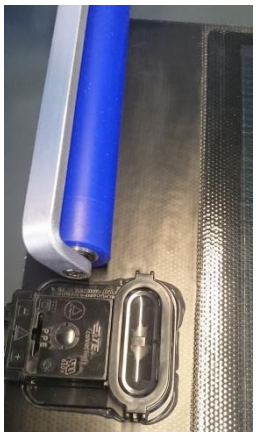
1. Mark the module position on the roof.



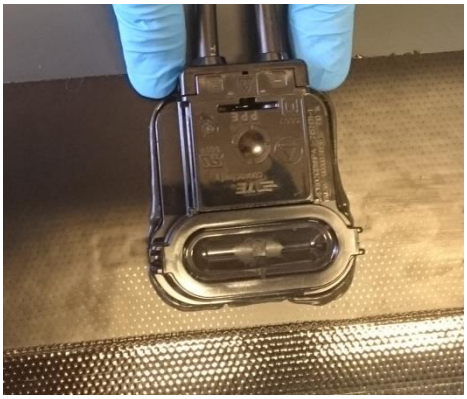
2. Remove 15cm of the white protective foil on the short side with the junction box

3. Put the module on the marked position and press it on the roof with a rubber roller.

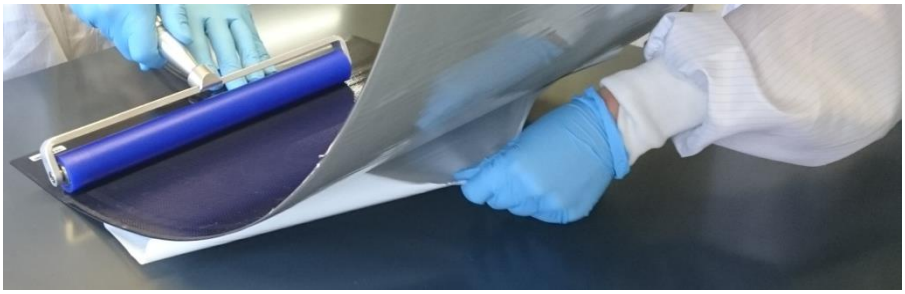




4. Press firmly the area around the junction box and the junction box on the roof



5. Remove slowly the rest of the white protection foil and press the module simultaneously with a rubber roller on the roof. Always roll from middle to outside in order to avoid entrapped air.



In the end there should be no gaps between the adhesive and the module or the roofing material.

3.6 Electrical

For elevated areas irradiation can be higher than at STC. Therefore, multiply I_{SC}- and V_{OC}- values with a factor of 1.25 for the electrical layout of cables, fuses and converters (worst case scenario). For a serial connection the voltage of a single module is multiplied by the number of modules to calculate the system voltage. Make sure that you are always within the limits of the maximum system voltage.

Use an adequate device for overcurrent protection (fuse, blocking diode). Maximum Isc multiplied by a factor of 1.56 to protect a string in parallel configuration.

The maximum number of modules connectable in series is calculated by adding Voc of each single module multiplied by 1.25 up to the maximum system voltage which you can find on the label.

Do not use PV modules of different power classes or configurations in the same PV system. Flisom eFlex Series modules use PV4-S connectors. Only use these connectors or compatible connector types which are authorised from both producers. Use solar cables for outside use (ø 2.5 to 4mm² and min. 90 °C). Check that no cable is under tensile stress or bended over a sharp edge.

Secure all electrical connections and use stress relief appliances. Do not go below the minimum bending radius of the cables. Use cable guides to prevent connectors and cables from lying in excess water, snow or dirt.

The junction box rating is IP65 and IP67 and is not to be opened. The diode cannot be replaced.

For electrical system installation check all relevant codes, guidelines and regulations. The system connection has to be done by a qualified installer.

3.6.1 Grounding modules

Flisom eFlex modules do not require grounding of the modules. For system grounding check all relevant codes, guidelines and regulations.

3.6.2 Inverter

Inverters convert direct current into alternating current. Inverters of the latest generation, with MPPT (Maximum Power Point Tracker), optimize the production, even in situations of weather changes or variable sunlight.

Suitable inverter configurations are:

- Central inverters
- String inverters
- Multi-String inverters
- Inverters on single module level

Not all inverter without transformers can be used. Please contact Flisom for further information.

4 Technical Information

Dimensions eFlex Series		**eFlex 0.8m**	**eFlex 1.6m**	**eFlex 2.3m**	**eFlex 3.1m**
Length	[mm]	873	1617	2361	3105
Width	[mm]	411			
Thickness at module	[mm]	2.2			
Thickness at JB	[mm]	21 ± 1			
Weight	[kg]	0.8	1.3	1.9	2.4
Weight with adhesive backside	[kg]	1.1	1.8	2.6	3.3
min. bend radius	[mm]	500			
Cable length	[mm]	650			
Connector Type		PV4-S			

Electrical characteristics* at STC			**eFlex 0.8m**	**eFlex 1.6m**	**eFlex 2.3m**	**eFlex 3.1m**
Nominal power	P_{MPP}	[W]	30	55	85	110
Tolerance of nom. power	ΔP	[W]	-0/+5	-0/+5	-0/+5	-0/+5
Voltage at nom. power	V_{MPP}	[V]	34	35	37	36
Current at nom. power	I_{MPP}	[A]	0.88	1.54	2.29	3.06
Open circuit Voltage	V_{OC}	[V]	46	47	49	48
Short Circuit Current	I_{SC}	[A]	0.97	1.82	2.53	3.30
Max. system voltage	IEC	[V]	1000			
Max. series fuse		[A]	10			
Application Class			A	A	A	A
Safety Class			II	II	II	II

Thermal characteristics			**eFlex 0.8m**	**eFlex 1.6m**	**eFlex 2.3m**	**eFlex 3.1m**
Temperature coefficient	V_{OC}	[%/°C]	-0.3			
Temperature coefficient	I_{SC}	[%/°C]	0.01			
Temperature coefficient	P_{MPP}	[%/°C]	-0.35			
Operating temperature		[°C]	-40 – 85			

There are more power classes available.

** Electrical parameters can change because of improvements of material and semiconductor stack*

5 Operation

According to local regulations it might be necessary to contact authorities before the PV system is connected to the grid. Also check if this has to be performed by authorized personnel.

6 Inspection and Maintenance

It is recommended to have a visual check on a regular basis (quarterly). Plan check-ups according to the given environmental and safety conditions and regulations.

- Remove dust and dirt (sediments, leaves, pollen, bird droppings, etc.) from the surface.
- Do not use aggressive cleaning agents or scrubbing materials for cleaning
- Do not use steam blasting for cleaning.
- Use soft water to avoid chalk stains
- Soft Sponges can be used
- Check if connectors and grounding are tight and without corrosion and if the insulation is not damaged also check for loose mechanical or electrical contacts.
- Check if the Junction Box is securely attached and that no deep scratches are penetrating the frontsheet

7 Disposal

Flisom eFlex series modules must be disposed of in a responsible manner. Please contact your local supplier or disposal company for further information. For health and safety reasons, Flisom eFlex Series modules should not be disposed of with household garbage, and must be dealt with in accordance with local codes and regulations.

8 Disclaimer

Flisom eFlex series modules can change in appearance and electrical parameters because of the improvements of components or changes of suppliers or minor design modifications. These changes are typically made without customer notification. Modules with the same classification have the same functionality and are fully compatible with one another.

Since Flisom has no control of the correct use of the safety and installation guideline, Flisom is not responsible for injuries, operational errors, damages and expenses caused by incorrect handling, installation, operation or maintenance.

Flisom is not responsible for licence or patent infringements or other rights of third parties caused by the usage of the eFlex Series modules. There is no implicit guarantee of licences, patents implicated.

9 Information

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9.1 Third Party Supplier Information

PRODUCT INFORMATION

Version 02/2015

HelioBond® PVA 600 BT

KÖMMERLING

KÖMMERLING CHEMISCHE FABRIK GMBH

HelioBond® PVA 600 BT is a high performance elastomeric (butyl) adhesive tape designed to provide very high tack and excellent adhesion. "Best in Class" water and moisture resistance, in a "peel and stick" bonding solution for the integration of flexible thin film PV modules and membrane roofing systems. HelioBond® PVA 600 BT is designed to bond to most commercially available PV flexible thin film module back sheets and to commonly subscribed installation slip sheets. HelioBond® PVA 600 BT can be applied with commercially available laminators, using industry accepted lamination techniques.

Features	Benefits
Proven performance in the field	20+ years in the field with exemplary performance
Integrated single roofing and PV module "peel and stick" bonding solution	Supply chain simplicity using material for complete integration of roof material to sub structure and PV module to roofing material
"peel and stick" installation concept	Provides for lower labor costs, faster installation times
ADCO experience with established installation procedures	Eliminates the second guessing and provides step by step inspection, installation and maintenance guidelines
"Best in class" environmentally resistant adhesive	Impervious to water, humidity, sunshine, snow, hail, UV
Environmentally safe installation	No primers needed, no VOC's, simple safe installation method not using torches or solvents
Simple and easy release liner removal	Installations are simple and quick under rooftop conditions
Excellent tack and adhesion under outside conditions	Quick stick with proven long term adhesion performance

TECHNICAL DATA

Base	Thermal setting butyl		
Colour	Black		
Density	0,97	g/cm³	ASTM D 71
Brittleness Temperature	-45°C	°C	ASTM D 746
Elongation at break	> 1000	%	ASTM D 412
Peel Strength	1,75 0,88	N/mm N/mm	at +21°C at +88°C
Shear Strength	0,035	N/mm²	at +88°C
Temperature Resistance	-40°C to +120°C		

HELIOBOND® PVA 600 BT

PROCESSING

HelioBond® PVA 600 BT is an extruded tape with installation friendly quick release liner. It comes in various dimensional profiles with a 0.020" thickness and a 20.0" maximum width. It can be easily laminated to either roofing membrane materials or flexible thin film PV modules using commercially available lamination equipment, using industry accepted lamination techniques. Standard lamination conditions are to apply to clean, dry substrates at temperatures above +4°C for best results. Apply pressure to bond interface (1 bar) with roller or platen. Contact your KÖMMERLING technical representative for specific instructions.

Basic use

HelioBond® PVA 600 BT is used for bonding flexible thin film PV modules to roof membranes. **HelioBond® PVA 600 BT** can also be used to bond roofing membranes (TPO, EPDM, and other non-polar materials) to roofing substrates, such as metal or modified bitumen.

Precautions

Talc, dust oil, ice, snow, or wet conditions inhibit good adhesion. Clean and dry surfaces are a necessity. Check with your KÖMMERLING representative for a list of approved PV modules, back sheets and slip sheets, roofing membranes and other substrates prior to using the **HelioBond® PVA 600 BT** for any application.

Processing temperature

+4°C to +50°C

SPECIAL NOTES

Storage

Do not store below +15°C and over +25°C.
When stored in unopened containers, usable up to 12 months.

SAFETY

Please read our Safety-Data-Sheet and the labels of each product before use.
Pay particular attention to the directions given in the Dangerous Substance Regulations.
Make sure the safety data sheet is readily available as it gives valuable information regarding the safe usage and disposal of the product and what to do in the event of an accident involving the product.

PACKAGING UNITS

on request

For safety related data please refer to the safety data sheet!

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