SOLARSTONE

Solarstone® Solar Full Roof™

Technical Specifications & Installation Manual

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Disclaimer

This guide is intended to provide comprehensive instructions for installing the Solar Full Roof. If you have any questions or concerns that are not addressed in this document, please do not hesitate to reach out to the Solarstone technical support team at

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www.solarstone.com

This document is intended solely as a guidance resource and should not be considered an integral part of the building design and technical documentation. For any construction work, it is imperative to adhere to the local building codes, regulations, and safety precautions in place. This document is not a substitute for complying with all relevant legal and safety requirements.

Installation of the Solar Full Roof requires professional skills and knowledge, and should only be carried out by qualified personnel or by a qualified installation partner. If the latter is avoided, therefore the guarantee applies only to details with defects.

An inseparable part of Solarstone Technical Specifications & Installation Manual are Solarstone Warranty Terms. All installation works under this guide have to be performed in a manner that Warranty Terms are valid for the end customer. To ensure a successful installation, please read this manual and familiarize with warranty conditions in its entirety before beginning the installation process. It is essential that the installation personnel are familiar with the mechanical and electrical requirements of the system and conditions under which the warranty conditions may not be applicable.

Intellectual Property Notice

Trademarks

Solarstone® is a registered trademark of Solarstone OÜ. Solar Full Roof™, Click-on™, Solar Seamed Roof™, Solar Tiled Roof™, Solar Carport Modern™, Solar Carport Modern Plus™, Solar Carport Classic Single™ and Solar Carport Classic Duo™ are trademarks of Solarstone OÜ. Any unauthorized use or replication of the trademarks, or any confusingly similar marks, is expressly forbidden without prior written consent from Solarstone OÜ.

Patents & design protections

Our commitment to innovation is further exemplified by our patents, which protect our proprietary technologies and designs:

- Solar Tiled Roof™ (Patent nr EP 3 319 228)
- Click-on™ framing kit (Patent nr EE202000007)
- Solar Carport (Industrial design protection)

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Product Description

The Solarstone Solar Full Roof is an award-winning building-integrated photovoltaic (BIPV) product developed by Solarstone in Estonia, Europe. The solar roof generates electricity for self-consumption, and any surplus energy can be sold back to the grid, allowing the Solar Full Roof to pay for itself. The PV modules used in the product are designed for resource efficiency and an attractive appearance. All of the modules used are in compliance with 61215 and 61730 standards. Additionally, Solar Full Roof has been tested for wind uplift and fire safety - Broof(t1) and Broof(t2).

Solarstone's patented Click-on technology is designed to be used in combination with PV modules from tier-1 manufacturers, achieving high productivity and best performance. The Solar Full Roof has been developed to withstand a wide range of environmental conditions and can be installed on almost any type of sloped roof.

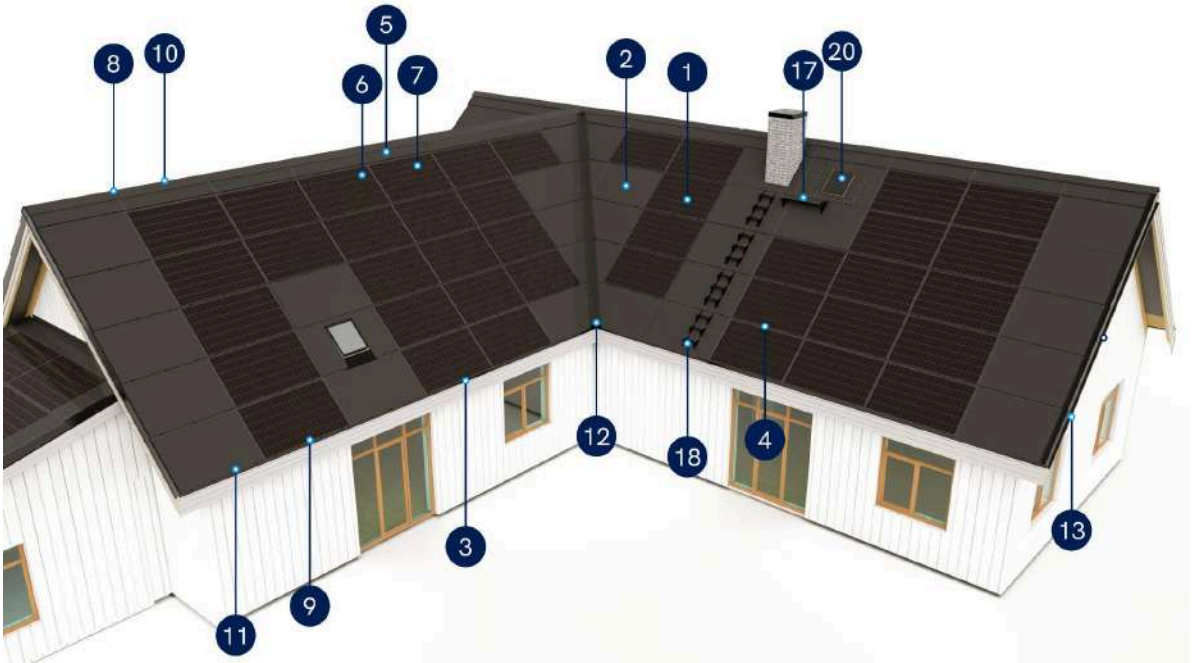
The Solar Full Roof BIPV-panels can be installed in either **landscape or portrait orientation**. Roof perimeter or obstacles will be covered with dummy panels that provide both safety and equal aesthetic appeal. The dummy panels are equally easy to assemble and can be cut on-site.

Why people choose Solar Full Roof:

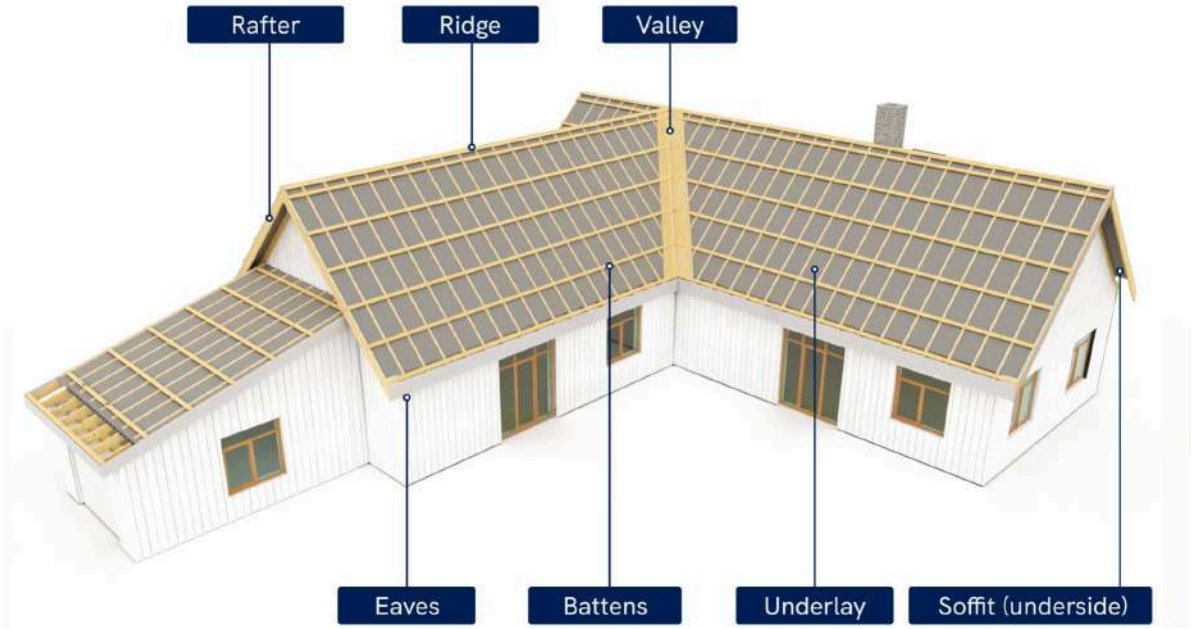
- Solar power for self-consumption.
- 2-in-1 system – technology and functionality.
- Streamlined aesthetics for building skins.
- Making the world a greener place.

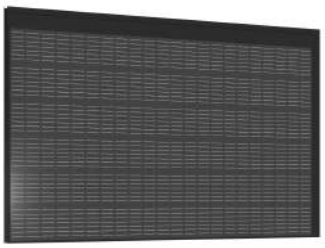
Solarstone advises using the following PV module models which are in accordance with its latest datasheet for Solar Full Roof. A Solarstone sales agent will provide the PV modules that are currently in stock.

Solar Full Roof Components



Roof Elements



Component List Specification					
ITEM	**SOLAR FULL ROOF COMPONENTS**	**PRODUCT**	**VARIATION**	**PRODUCT SKU CODE**	
1	PHOTOVOLTAIC (PV) MODULE 		**Solar Full Roof Plus**	Landscape	SFR-A32311.01
				Portrait	SFR-A32321.01
			Solar Full Roof Nordic	Landscape	SFR-A52911.01
				Portrait	SFR-A52921.01
			Solar Full Roof Bifacial	Landscape	SFR-A32811.01
				Portrait	SFR-A32821.01
2	DUMMY PANEL 		**Solar Full Roof Plus**	Landscape 1/1	SFR-232311.01A
				Landscape 1/2	SFR-232312.01A
				Portrait 1/1	SFR-232321.01A
				Portrait 1/2	SFR-232322.01A
			Solar Full Roof Nordic	Landscape 1/1	SFR-252911.V1
				Landscape 1/2	SFR-252912.V1
				Portrait 1/1	SFR-252921.V1
				Portrait 1/2	SFR-252922.V1
			Solar Full Roof Bifacial	Landscape 1/1	SFR-232811.V1
				Landscape 1/2	SFR-232812.V1
				Portrait 1/1	SFR-232821.V1
				Portrait 1/2	SFR-232822.V1

3	STARTER CLAMP 	**35 mm - frame**	SCO-412.3550S
		30 mm - frame	SCO-432.3050S
4	REGULAR CLAMP 	**35 mm - frame**	SCO-412.3550RR
		30 mm - frame	SCO-432.3050RR
5	CLICK-ON TOP PROFILE 	Consult with a Solarstone sales agent.	
6	CLICK-ON LEFT PROFILE 	Consult with a Solarstone sales agent.	
7	CLICK-ON RIGHT PROFILE 	Consult with a Solarstone sales agent.	

Component List Specification				
ITEM	**SOLAR FULL ROOF COMPONENTS**	**PRODUCT**	**VARIATION**	**PRODUCT SKU CODE**
8	RIDGE VENTILATION FLASHING 			SFR-502020.V1
9	EAVE VENTILATION FLASHING 			SFR-502000.V1
10	RIDGE FLASHING 			SFR-502000-RF.V1
11	DRIP EDGE FLASHING 			SFR-5020000-TP.V1
12	VALLEY FLASHING 			SFR-5000000

13	VERGE FLASHING 	**Solar Full Roof Plus**	Landscape Right	SFR-532310.01AP
			Landscape Left	SFR-532310.01AV
			Portrait Right	SFR-532320.01AP
			Portrait Left	SFR-532320.01AV
		Solar Full Roof Nordic	Landscape Right	SFR-552911.01AP
			Landscape Left	SFR-552911.01AV
			Portrait Right	SFR-552921.01AP
			Portrait Left	SFR-552921.01AV
		Solar Full Roof Bifacial	Landscape Right	SFR-532311.01AV
			Landscape Left	SFR-532311.01AP
			Portrait Right	SFR-532321.01AV
			Portrait Left	SFR-532321.01AP
14	HIP ROOF FASTENER 	Consult with a Solarstone sales agent.		
15	JOINT FLASHING 	**Landscape**	SFR-500021.LND	
		Portrait	SFR-500021.PRT	

Roof Accessories Component List Specification				
ITEM	**SOLAR FULL ROOF COMPONENTS**	**PRODUCT**	**VARIATION**	**PRODUCT SKU CODE**
16	SNOW GUARD 		SFR-502000-SG.V1	
17	ROOF WALKWAY 		**Landscape**	SFR-532010.V2
18	ROOF LADDER 		**Landscape 1/1** 30 mm	SFR-532010.V1
			Landscape 1/1 35 mm	SFR-512010.V1
			Portrait 1/1 30 mm	SFR-532020.V1
			Portrait 1/1 35 mm	SFR-512020.V1
19	VENTILATION OUTLET 		Consult with a Solarstone sales agent.	
20	ROOF HATCH ACCESS 		Consult with a Solarstone sales agent.	

Necessary Tools

Underlayment and marking out tools:

Circular saw

Sheet metal scissors

Chalk Line Tools

Measuring tape

Roofing blade or utility knife

Tacker or Stapler

Hammer

Roofing nail gun

Electrical Tools:

Digital Multimeter and Insulation Tester

Clamp Meter

MC4 Solar PV Cable Crimping Tool Kit with Stripper, Cutter, Spanner

Oxide inhibitor

Safety & Protective Equipment

We advise you to protect yourself with protective equipment at all times and abide by all safety precautions in this guide and local regulations. Nevertheless, it is mandatory to use safety harness equipment, helmet, gloves, safety glasses, etc.

Solarstone will not be held responsible for any safety or health concerns that arise during the installation process.

Protective equipment

General Roof Safety Harnesses

Safety glasses

Gloves

Safety shoes

Other personal protective equipment

Steps 1-6 | Roof Preparation

Step 1 | Structural Analysis Before Installation

Ensure that the method used for installing roofing materials and the supporting substructure is strong and able to properly support the chosen product and meet its weight requirements. Additionally, the supporting system should be installed in accordance with local, national, and international standards.

Factors to consider include the weight of the materials, the slope of the roof, the perpendicularity of the structure, the condition of the existing rafters, the suitability of the batten material, and applicable wind and snow load parameters.

Step 2 | Underlayment

The function of an underlayment is to ensure that water does not enter the building in case of wind-blown rain, condensation, due to solar roof construction, design and type or damage to the solar roof. Additionally, the underlayment must protect the insulation and roof structures from moisture generated inside the house. Roofs must be designed in a way that water has a possibility to be ventilated and drained away if the water has reached the underlayment.

- **No roofing material is 100% waterproof, therefore it is strongly recommended to choose a high-quality underlayment as a measure to prevent undesirable results.**

Solarstone recommends using the Riwega USB Protector Head FH 240 or Isola Iso-D Xtra Nordic or a similar underlay that conforms to the harmonized standard of EN 13859-1:2014. It should be installed according to the manufacturer's instructions and recommendations. An underlayment under any Solarstone's solar roof must be both breathable and water-resistant except if the roof angle is below 18° degrees, SBS/PVC underlays must be used. If roof construction is on hold, installers must install temporary coverings over the open roof area as a temporary measure to protect the underlay against UV radiation, snow, ice, hail, and other elements.

- **Solarstone holds no liability for issues that arise when the client chooses not to follow Solarstone's recommendations.**

Details to consider when choosing an underlayment.

- Water resistance test

Underlayment should have passed a water resistance test with a W1 result and be capable of holding a water column of at least 3 meters high, which should be indicated in the product documentation. For comparison, the water column on roofs typically does not exceed 2 meters in practice.

- Strength of the underlayment

The simplest way to assess the strength of an underlayment is by its weight, which should be at least 155 grams per square meter. The number of layers (at least 3-4) and the presence of reinforcement, which prevents stretching, are also indicators of strength. Underlayment may stretch, especially during roof installation when it is exposed to wind, rain, or snow, and when stepped on.

- Temperature

Solarstone recommends using underlays that withstand 120 °C operating temperature or more. As temperatures might rise over 100 °C on and under the roof in certain conditions, it is best to ensure functionality with higher temperature resistance underlays.

- UV resistance

Underlayment serves as a temporary roof covering during construction, protecting the house from water and snow for at least 4 weeks. While it may seem unnecessary since the underlayment is not exposed to sunlight, it still receives UV radiation during roof installation, which can degrade non-UV-resistant materials over time. The UV radiation damage could be detrimental for the house construction if the underlayment has been exposed to excess amounts of UV radiation. If roof construction is on hold, installers must install temporary coverings to the open roof area as a temporary measure for protecting the underlay against - UV radiation, snow, ice, hail etc.

Step 3 | Counter and Ventilation Battens

Battens must be fixed in place with two screws or nails. The length of the screw or nails must be sufficient to penetrate ventilation battens and counter-battens and enter rafters ⅓ of its length. Battens must comply with the Eurocode specifications according to the wind and snow zones in your region. For improved ventilation Solarstone recommends using following batten specifications.

- Ventilation battens

  45...53 x 45...53mm

- Counter battens

  45...53 x 95...103mm

Step 4 | Diagonals and Slope

- While measuring roof diagonals and angle, make sure that the diagonals align at the ends and the roof is at the correct angle.

- If the diagonal measurements of the roof area do not match, contact your roofing partner to fix or prepare to use custom size dummy panels or transitional flashings.

- Roof pitch must be greater or equal to 18°. In case of lower slopes full SBS or PVC underlay is required.

Step 5 | Eaves and Gutters

Eaves are essential elements in enhancing the visual appeal and utility of a home. Their primary purpose is to redirect rainwater away from the walls of the building. Furthermore, they provide shade to the windows and walls below, particularly beneficial in areas with intense sunlight.

- The design of the eave is influenced by both the roof angle and prevailing national construction practices. In Nordic countries, Versions 4 and 5 are more frequently employed.

- The selection of any of the five available eave types ensures compatibility with Solarstone's offered accessories for your roof.

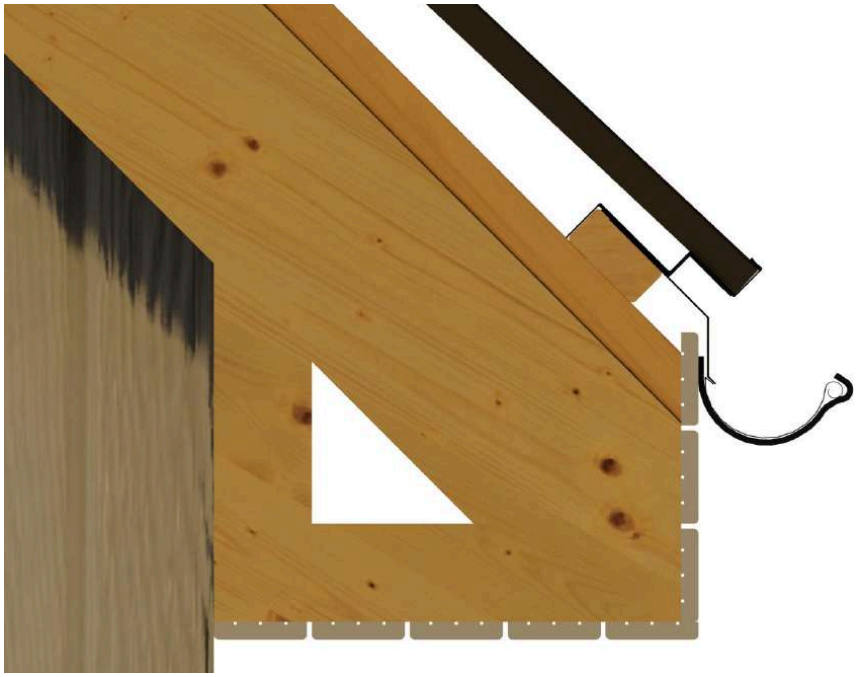
Roof angle	Ver 1	Ver 2	Ver 3	Ver 4	Ver 5	SBS/PVC underlay
<18 °						
>18 °						
< 25 °						
>25 °						
>30 °						

Disclaimer: Solarstone doesn't recommend installing Solar Full Roof on roofs with a slope angle below 18°. If one does decide to install SBS or PVC underlay must be used. The recommendation against installing Solar Full Roof on roofs with an angle below 18° stems from the increased risk of snow weight pressure and rain accumulation on top of the roof. This might lead to undesired results. Solarstone holds no liability for issues that arise when the client chooses not to follow Solarstone's recommendations.

Version 1: Soffited Eaves Without Drip/Anti-Ponding Flashing

- Condensed water is ventilated naturally and not diverted into the gutter. This solution includes components 3, 9 and 11.

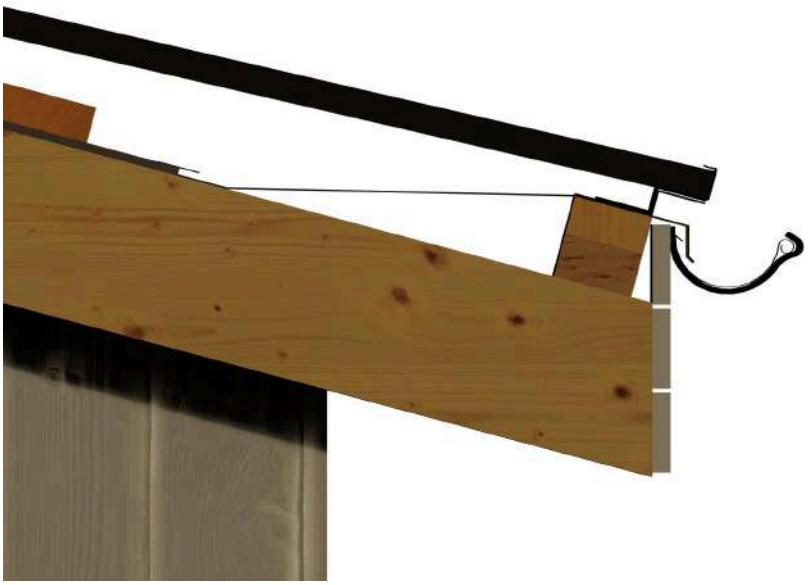
- Water must be diverted to the center of the gutter. For proper gutter installation follow the manufacturer's manual.



Version 2: Soffited Eaves With Drip/Anti-Ponding Flashing

- Design and place an anti-ponding flashing according to your project. Seal the joint parts with tape. This solution includes Solarstone components 3 and 9.

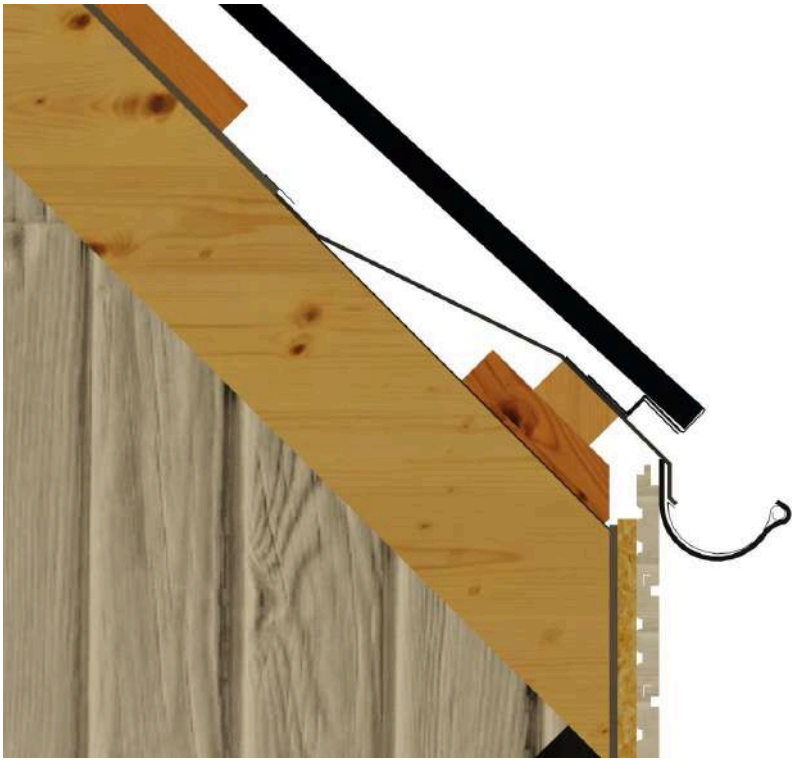
- Water must be diverted to the center of the gutter. For proper gutter installation follow the manufacturer manual.



Version 3: Modern Roofs Without Eaves

- Condensed water must be drained into the gutter using footplate and drip flashings (both hidden and exposed variation of gutter system). This solution includes Solarstone components 3, 9 and 11.

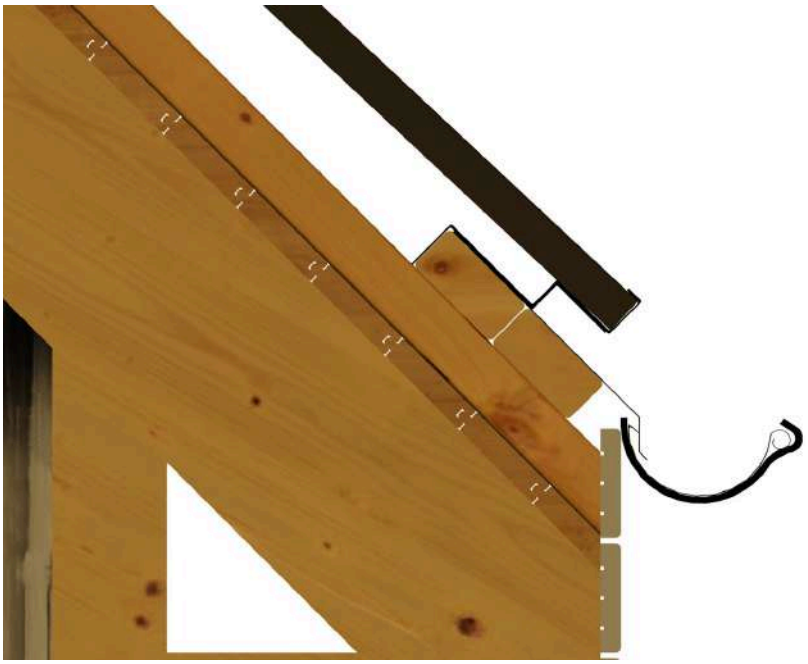
- Water must be diverted to the center of the gutter. For proper gutter installation follow the manufacturer manual.



Version 4: Double Batten Eave Solution

- Fasten the drip edge flashing over the double batten system. This solution includes Solarstone components 3, 9 and 11.

- Water must be diverted to the center of the gutter. For proper gutter installation follow the manufacturer manual.



Version 5: Double Batten Eave Solution

- Place an anti-ponding flashing over the double batten system. Starter clamps are without hooks. This solution includes Solarstone components 3, 9 and 11.

- Water must be diverted to the center of the gutter. For proper gutter installation follow the manufacturer manual.

Step 6 | Batten Step

Batten step depends whether PV modules will be installed in landscape or in portrait mode. Bear in mind that the first batten step gauge (Y) differs from the next steps (Z and X). Value C is the total height of the roof.

While considering roof design, it is possible to start the roof with a PV module and end with a custom size dummy panel (version 1) or vice versa (version 2). Depending on the version chosen, there is a different batten step. It is recommended to place modules with close batten step as possible to provide greater overlap on the modules.

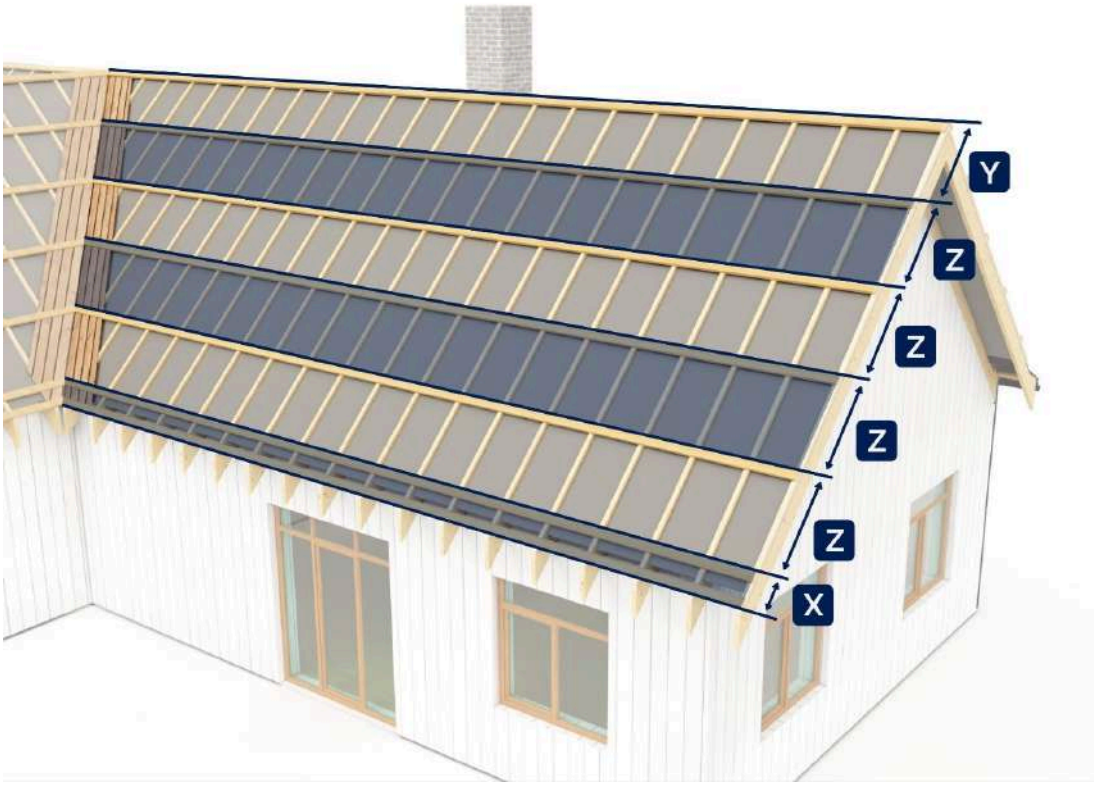
Always prepare the batten step design before installing it by your local architect. Consider also the placement of the starter clamp and that the water must be diverted into the gutter. The batten step design table is generated with Click-on Kit - A.

Batten step design		
Landscape orientation	**Solar Full Roof Nordic**	**Solar Full Roof Plus**
First row	1170 - 1205 mm	1150 - 1185 mm
Continuous rows	1145 - 1180 mm	1115 - 1140 mm
Portrait orientation	**Solar Full Roof Nordic**	**Solar Full Roof Plus**
First row	1785 - 1820 mm	1810 - 1845 mm
Continuous rows	1755 - 1790 mm	1775 - 1810 mm

Disclaimer: Solar Full Roof Nordic refers to Rec Alpha Pure-R Series 400-430 Wp and Solar Full Roof Plus to Risen Energy TitanS RSM 40-8-385-405MB. For more precise data refer to Solar Full Roof datasheet.

Version 1: Starting With a PV Module and Ending With a Custom Size Dummy Panel

Version 2: Starting With a Custom Size Dummy Panel and Ending a With PV Module



Steps 7 - 18 | BIPV Module Installation

Step 7 | Solar System Planning

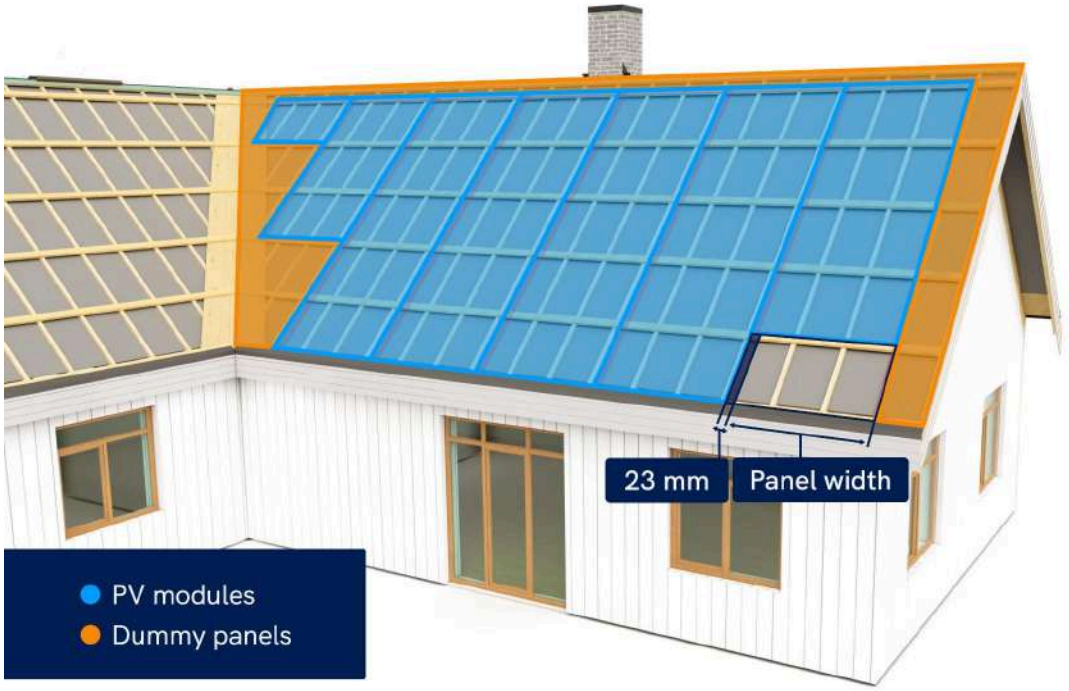
When installing Solarstone Solar Full Roof, it is essential to carefully consider all complex geometries on the roof, such as chimneys, roof windows, valleys, ventilation systems, and access hatches. Instructions for installing these specific elements can be found in the extras chapter of the installation guide. Furthermore, it is crucial to take into account any potential shading caused by the roof's geometries or surrounding objects such as trees or street light posts, as this may necessitate different design principles and the use of optimization tools. Additionally, the PV module should be placed at least 80 cm from the chimney due to common fire safety regulation. Installer or partner in the export markets is responsible for installing the Solar Full Roof in accordance with local, national and international laws.

Disclaimer: PV modules can be inherently of different color due to manufacturing processes. Every projected roof should be installed with PV modules from the same batch. Nevertheless, due to the raw materials and production process, monocrystalline silicon crystals might have a slightly different reflection on light, which may result in undesirable end-result. Additionally, PV modules and dummy panels have a different look due to different materials used.

Step 8 | Determining the Position of PV Modules and Dummy Panels

Mark the exact location of the PV modules and dummy panels.

- The label on the back of the PV module indicates the width of the module. To get the correct dimensions for marking, you need to add 23 mm, which is the width of the Click-on frame, to the original module width.
- The vertical gap of 5 mm added by the Click-on framing is already predefined in the design calculations.
- When marking out, consider that the vertical gap tolerance between PV modules is ±3mm.
- The width of the dummy panel must be selected according to the size of the roof.



Step 9 | BIPV Module Installation Methods

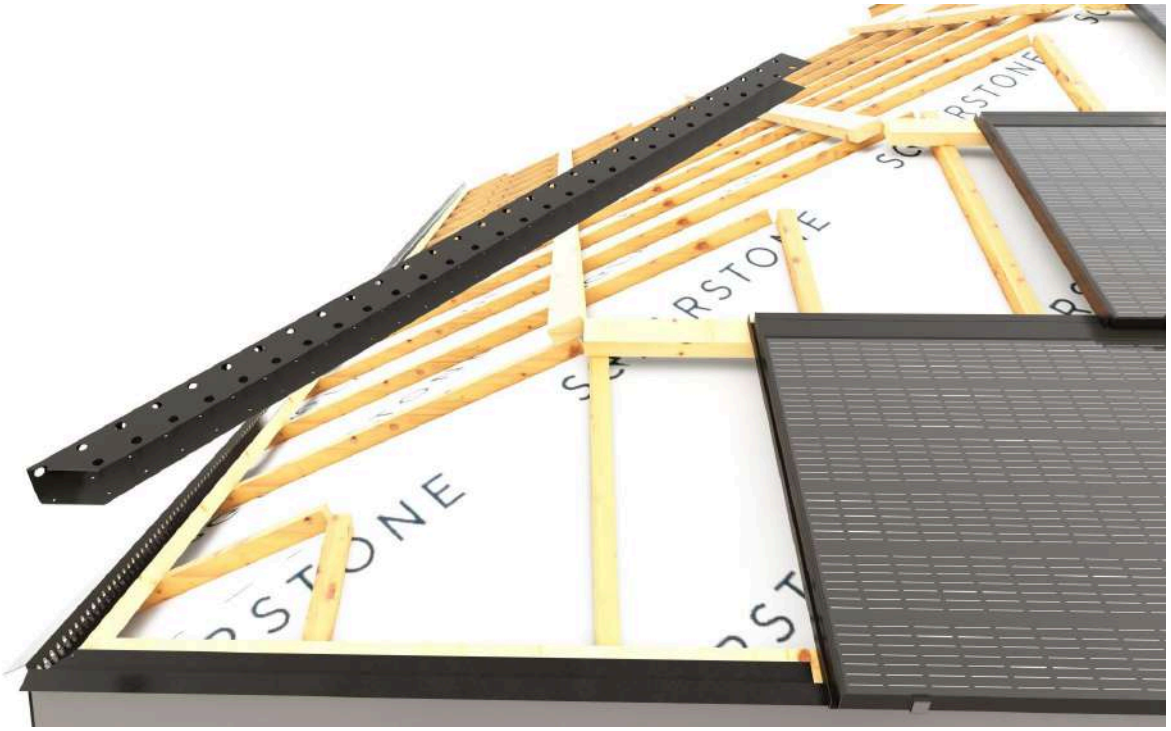
It is possible to install Solar Full Roof in landscape and in portrait orientation. The installation process can be executed in a column or in a row method. In order to minimize the amount of extension cables connecting rows and columns, the length of original cables and position of MC4 connectors must be evaluated in the design process.

Version 1: Installation in a Column

Version 2: Installation in a Row

Version 3: Installation on a Hip Roof (Off-Centered Layout)

- Start by placing the hip roof fastener on top of the battens. Make sure the dummy panels will fit with the placement of other components.



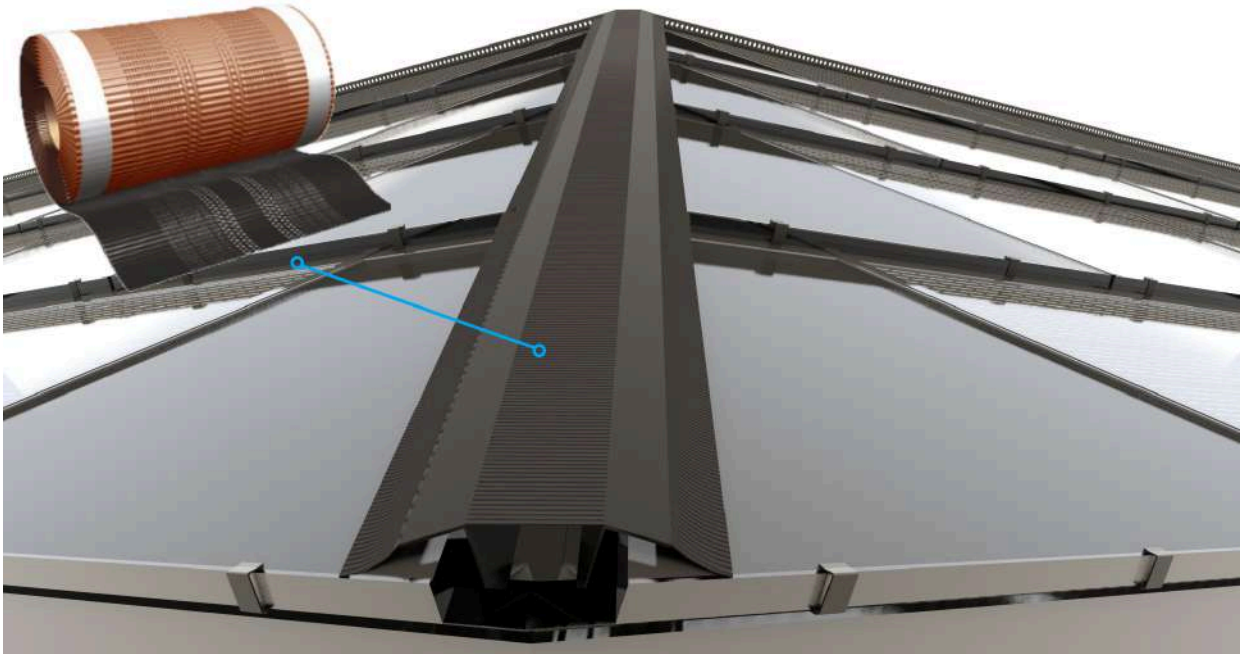
- Fasten the hip roof fastener (component 14) to the aluminum batten.

- Repeat the process with both sides of the hip roof edge.

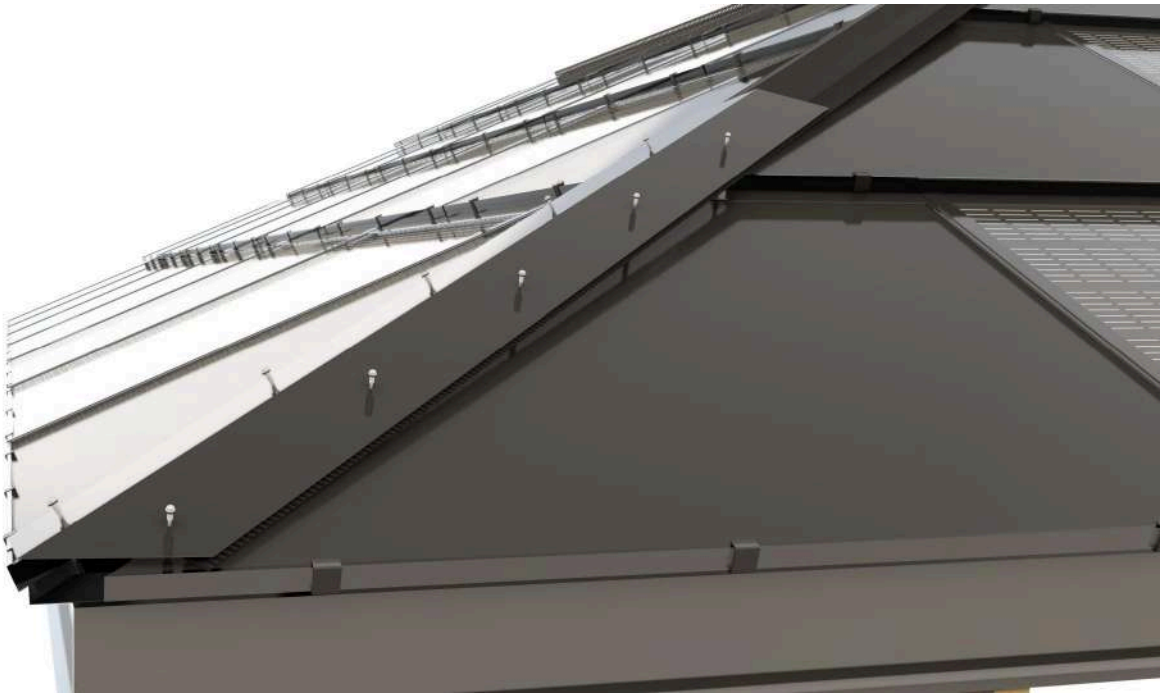
- Install the dummy panel between the hip roof fastener, fasten the clamps, and then continue with the next rows.

- Continue installing dummy panels up to the ridge.

- Install wakaflex on top of the hip roof fastener to provide adhesivity for the flashing.



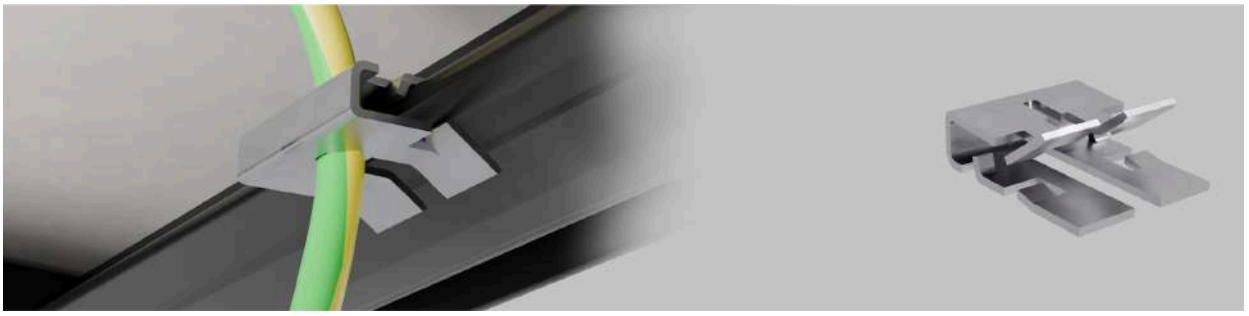
- Install the flashing on top of the wakaflex and fasten it with screws.

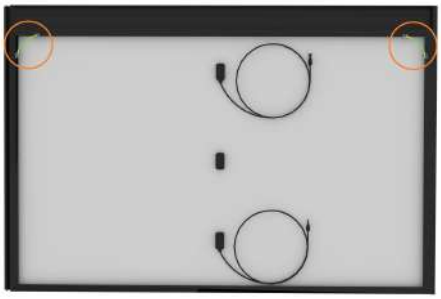
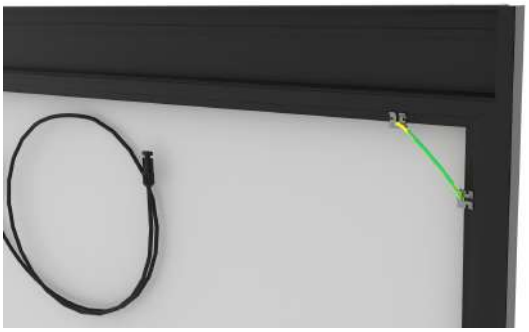
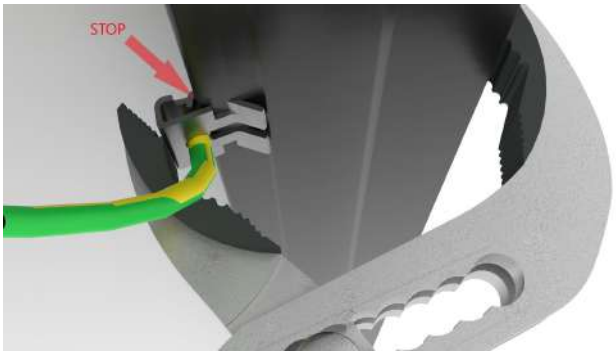
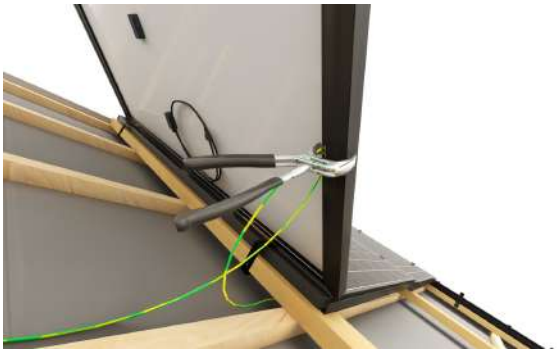


- Finished look of hip roof.

Step 10 | Grounding

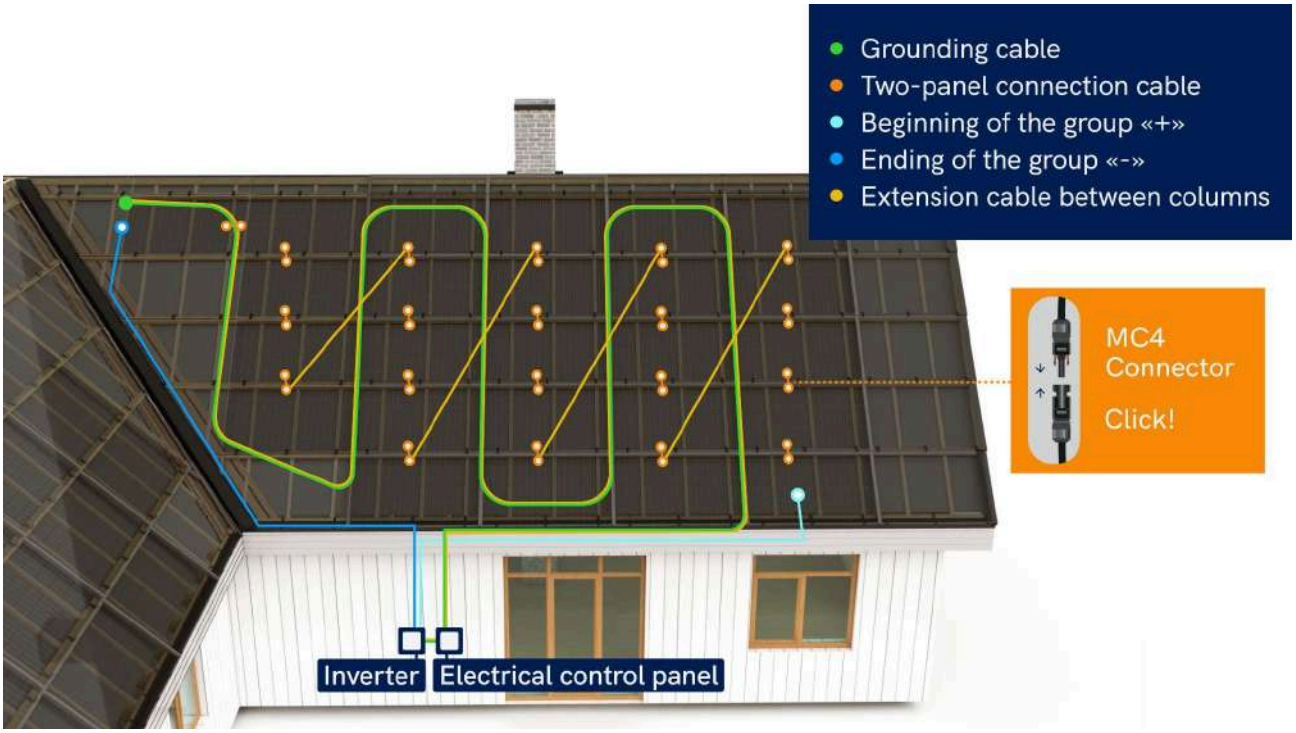
Solarstone recommends using RayVolt grounding clips. It can accommodate aluminum frame thicknesses from 1.5 mm to 2.5 mm and multi-strand flexible cable diameters of 6 mm^2 (h07v-k6 mm^2). RayVolt grounding clips are compliant with IEC 61730-2:2007, IEC 60947-1:2007 EN 60068-2-11: 1999 within the scope of use.



Grounding	
Step 1: Grounding clip must be connected to each side of the PV module frame and Click-on kit with a grounding clip.	**Step 2:** Grounding clip teeth will damage the color of the profile. This will provide conductivity which is needed for grounding. Connect PV module's Click-on frame with a grounding clip.
	
Step 3: Start by adding grounding clips to the aluminum frame and Click-on Kit. Press the grounding clip until it is not possible to press any further. Grounding wire with a surface area of 6 mm^2 is expected to be used	**Step 4:** Add an extra grounding clip to the PV module with grounding/earth wire. Repeat the process with the rest of the PV modules.
	

Step 5: Make sure that the grounding wire is safely apart from objects that may harm the cable and its functionality.

- Grounding must cover the entire area of the roof.

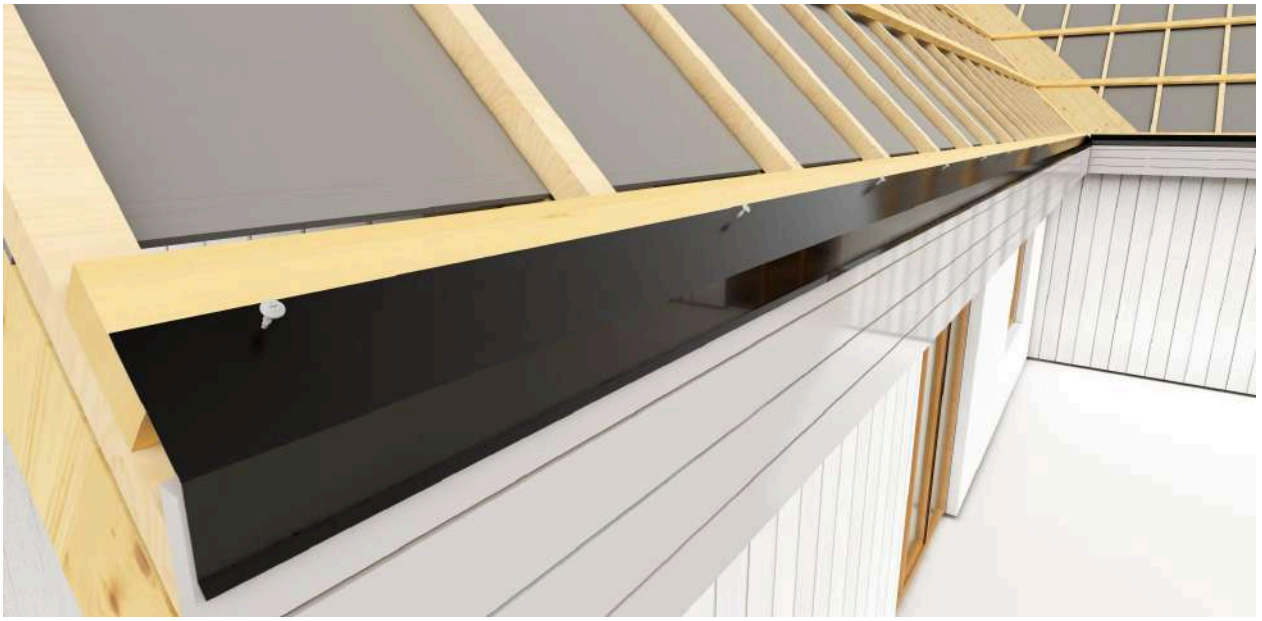


- Bring the earth wire down to the ground. Make sure that the grounding wire is safely apart from objects that may harm the cable and its functionality.

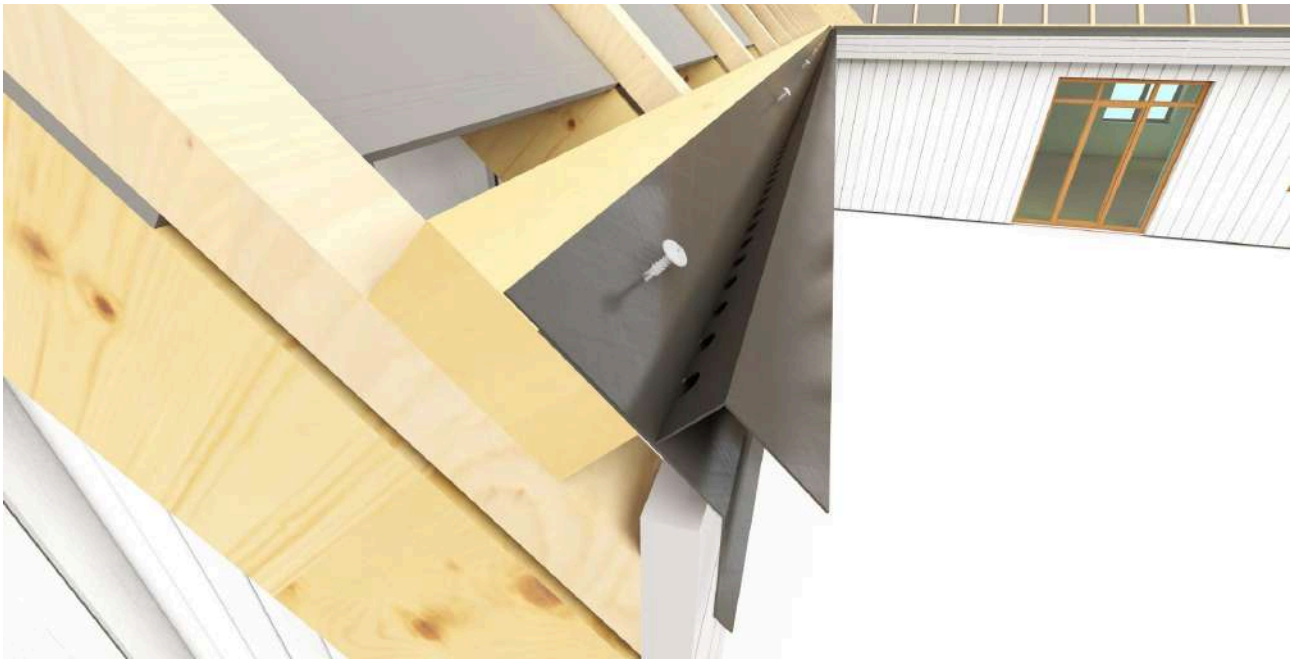
Step 11 | Drip Edge and Ventilation Flashing Installation

In the following installation interpretations have been used the most common eave solution - soffited eaves without drip/anti-ponding flashing above 30° degrees. Version 1, in Step 5 | Eaves and Gutters.

- Install drip edge flashing (Component 11), assuring the water from the PV modules is always diverted into the gutter. Each roof pitch needs a different angle of drip edge, therefore each roof must be considered individually. Therefore, plan the gutter installation with the drip edge and ventilation flashing simultaneously.

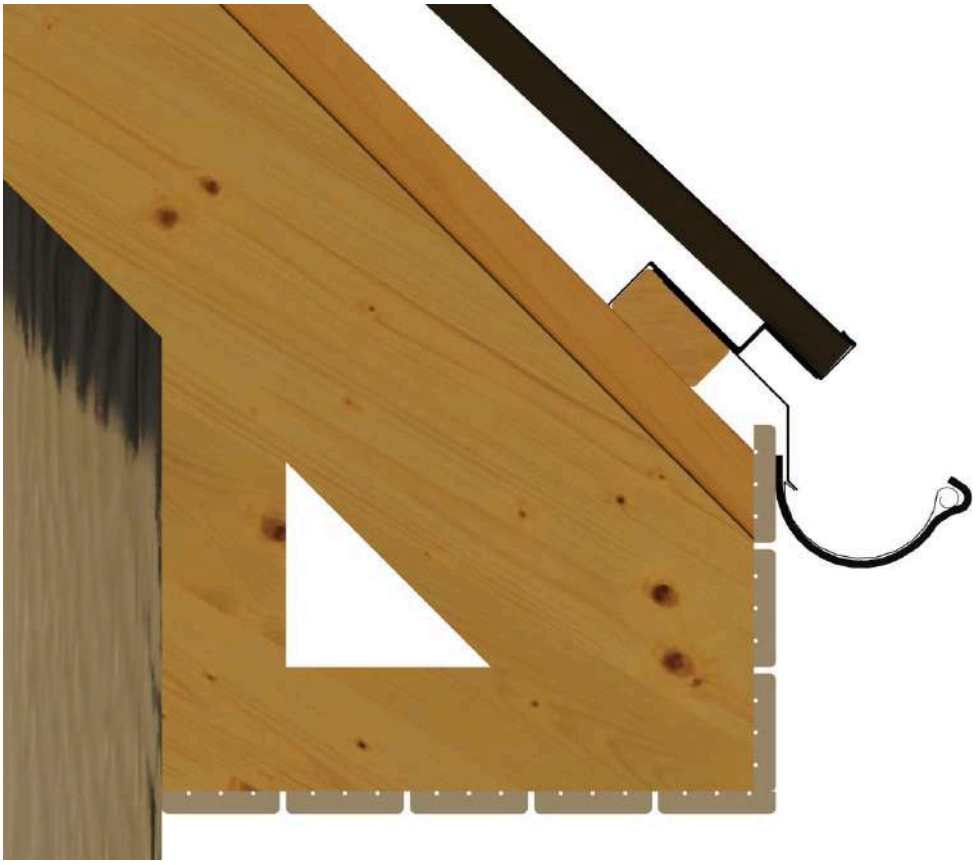


- Place ventilation flashing on top of ventilation flashing (Component 9) and fasten it with screws.



- The panel and the gutter must be aligned correctly to ensure that water does not run over the gutter.

Proper placement guidelines can be found in the gutter installation manual.

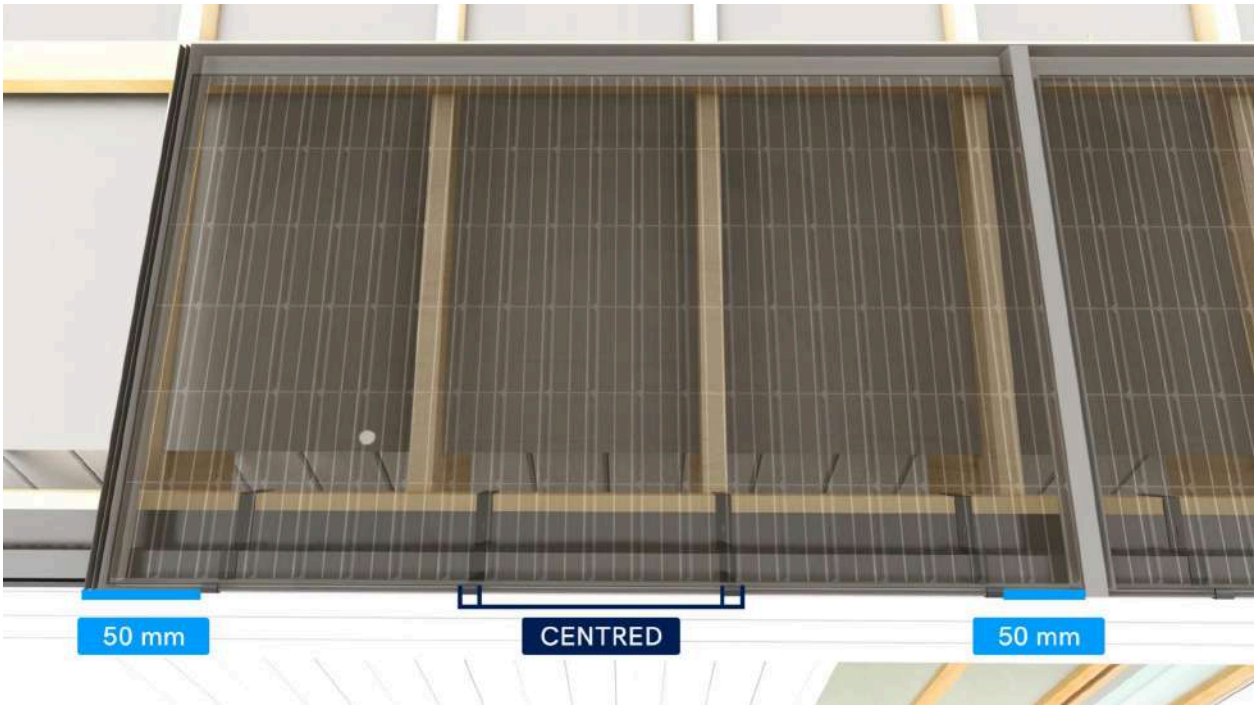


Step 12 | Installation of Starter Clamps

This chapter contains illustrations of installation methods in both landscape and portrait orientations. The standard solution is shown below:

- Each dummy panel and PV module in the first row requires **four clamps in landscape and three in portrait orientation.**
- Starter clamps (component 3) are positioned 50 mm inwards from both sides of the module. Maximum spacing between clamps is 45 cm but two clamps in the middle shall be equally spaced.
- If a dummy panel is smaller than 50% of a full-size module, it requires a minimum of two clamps. The minimum height of a dummy panel must be at least 300mm, in accordance with the batten step.
- Solarstone uses a 5,0X50 ESSDRIVE PP model screw for fastening the clamps. The manufacturer recommends using a rate of 400-1200 revolutions per minute while fastening the screw.

Installation Method 1: Landscape Orientation



Installation Method 2: Portrait Orientation

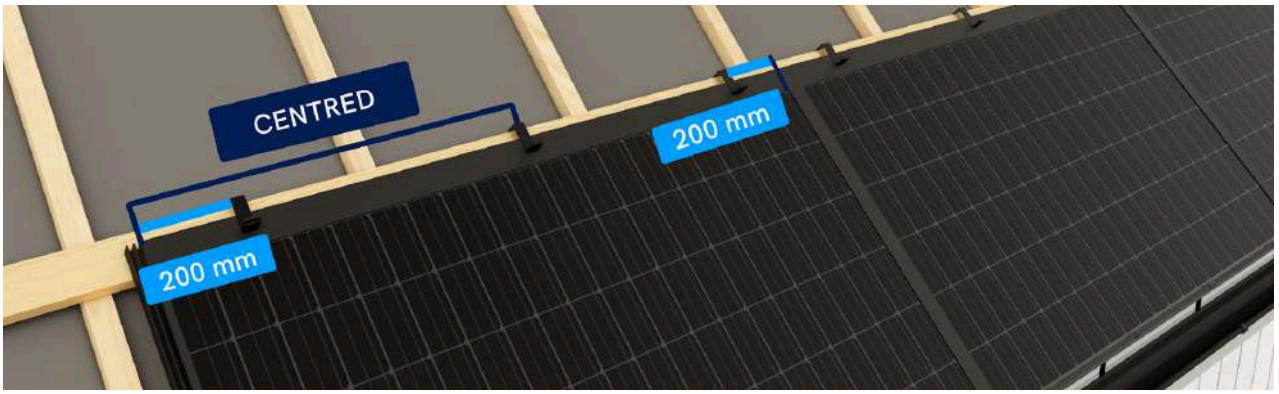
Step 13 | Installation of Regular Clamps

This chapter contains illustrations of installation methods in both landscape and portrait orientations. Apply the method that is applicable to your project.

- Regular clamps are used for (component 4) continuous rows. They shall be used to install photovoltaic modules and dummy panels.
- For a standard installation, **three regular clamps** are required. In locations with extreme weather conditions, Solarstone recommends using **four regular clamps**. Additionally, for optimization, Solarstone advises adding four clamps to the roof's perimeter, where wind forces are typically the strongest.
- If a dummy panel is smaller than 50% of a full-size module, it requires a minimum of two clamps. The minimum height of a dummy panel must be at least 300mm, in accordance with the batten step.
- Solarstone uses a 5,0X50 ESSDRIVE PP model screw for fastening the clamps. The manufacturer recommends using a rate of 400-1200 revolutions per minute while fastening the screw

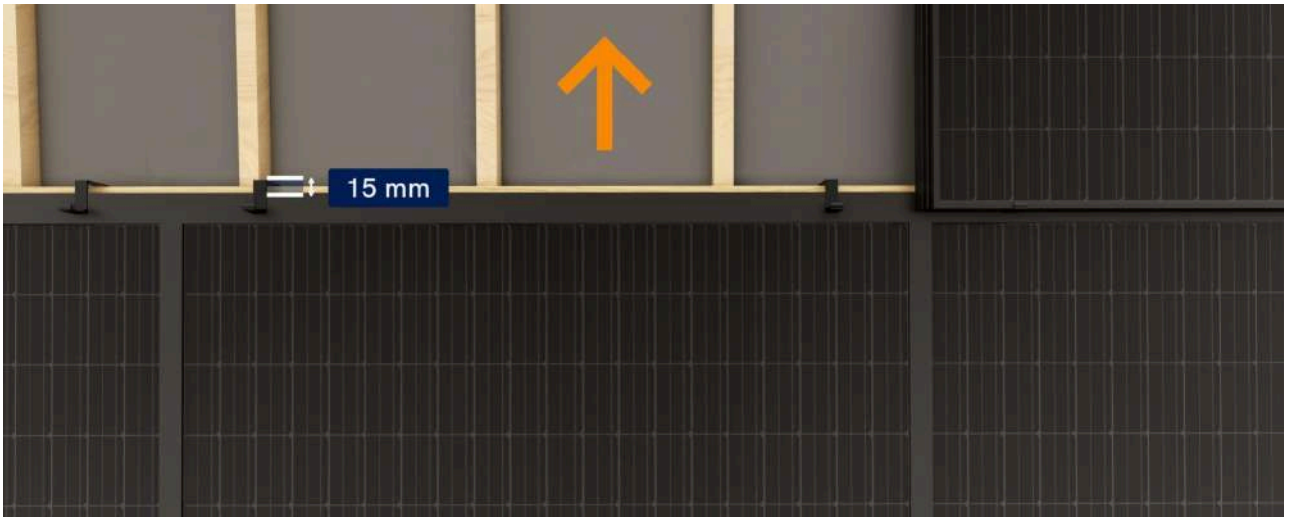
Installation Method 1: Landscape Orientation

- While installing regular clamps in landscape orientation, leave 200 mm from each side and keep one clamp centered.



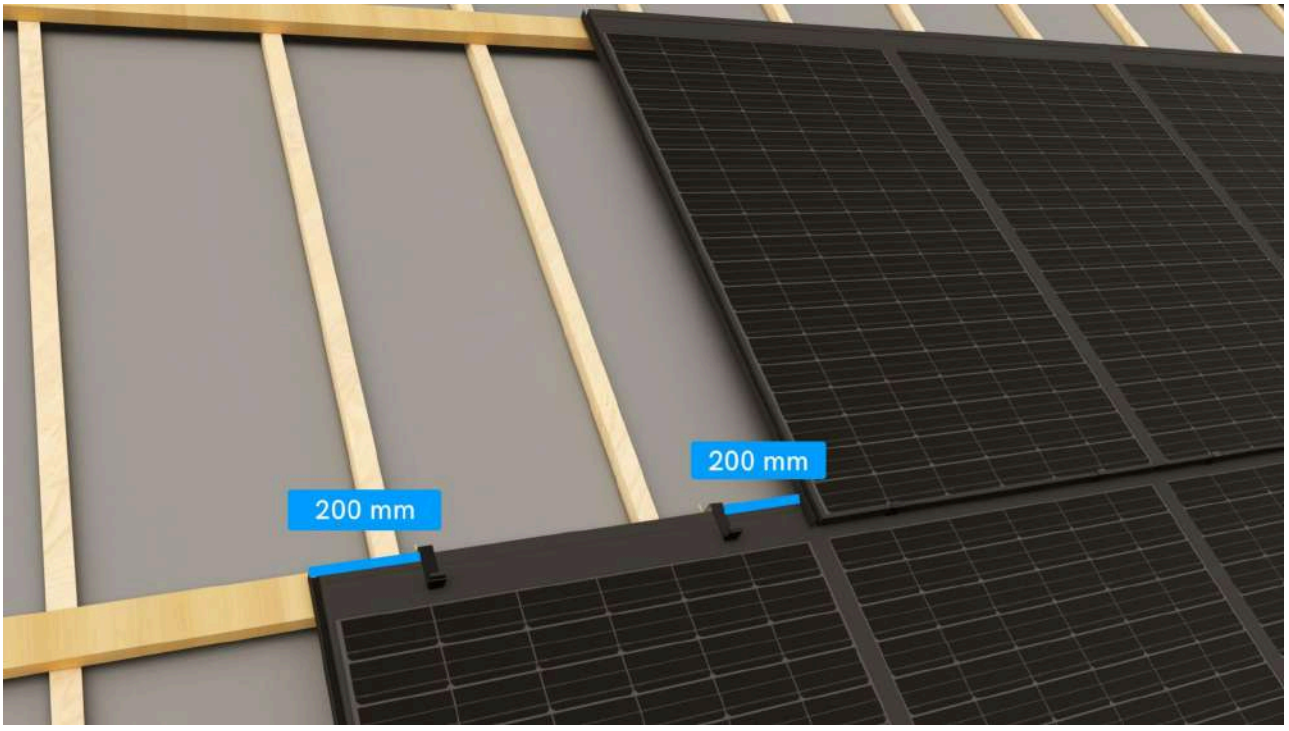
- Drive screws through the hole in the clamp into the batten.

- A gap of 15 mm should be maintained between the bracket and the PV module to allow for the removal of the modules later if necessary.

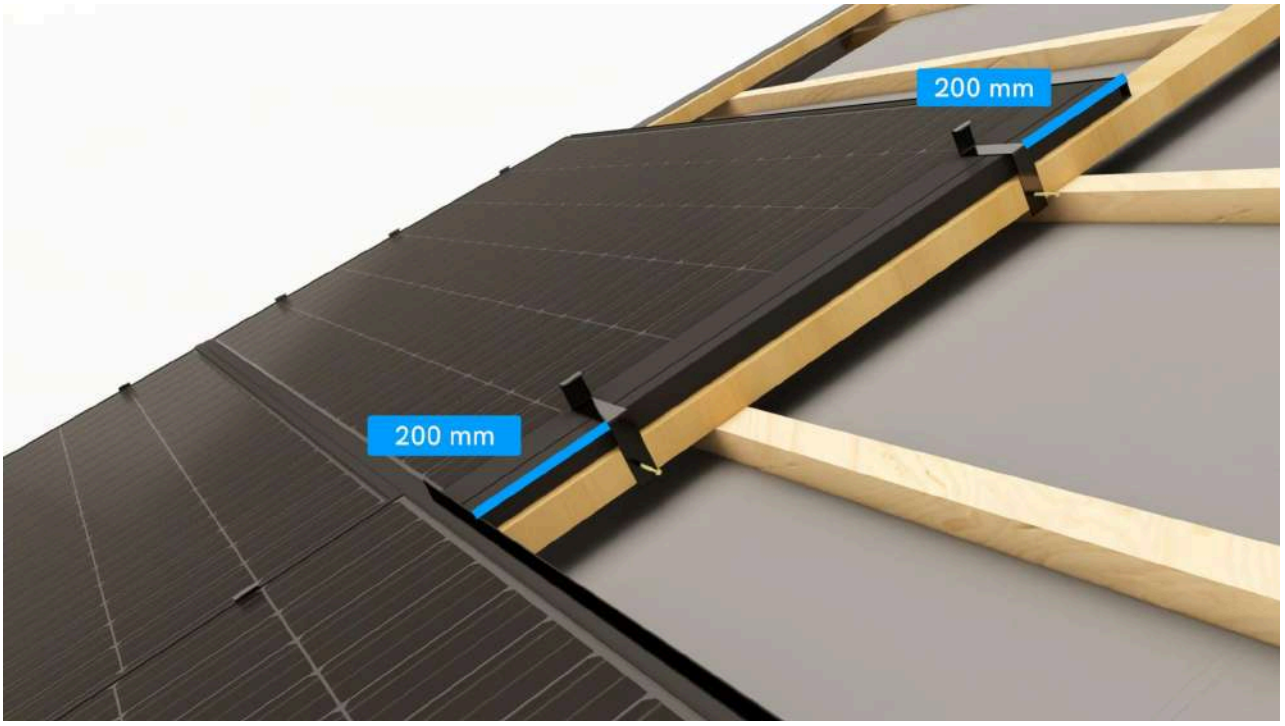


Installation Method 2: Portrait Orientation

- Leave a 200 mm gap from each side of the photovoltaic module or dummy panel.



- Drive screws through the hole in the clamp into the batten.

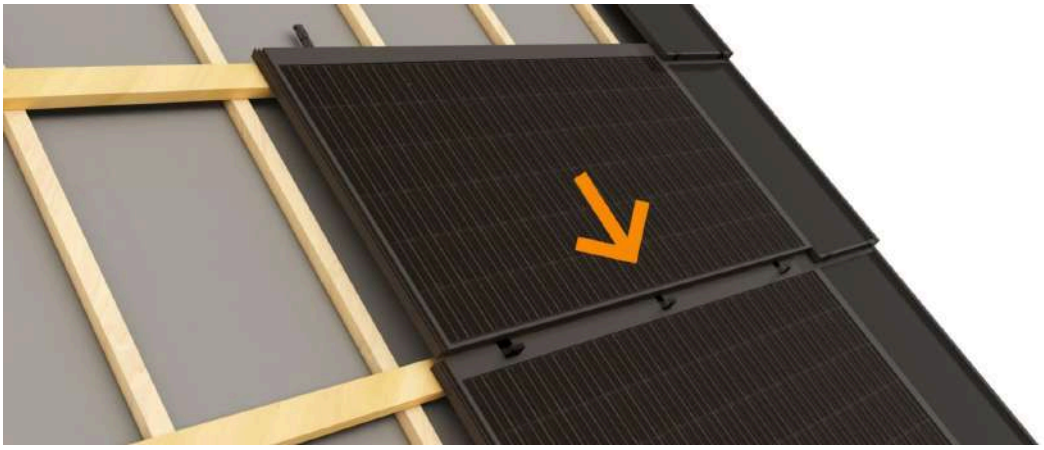


Step 14 | Mechanical Installation of PV Modules

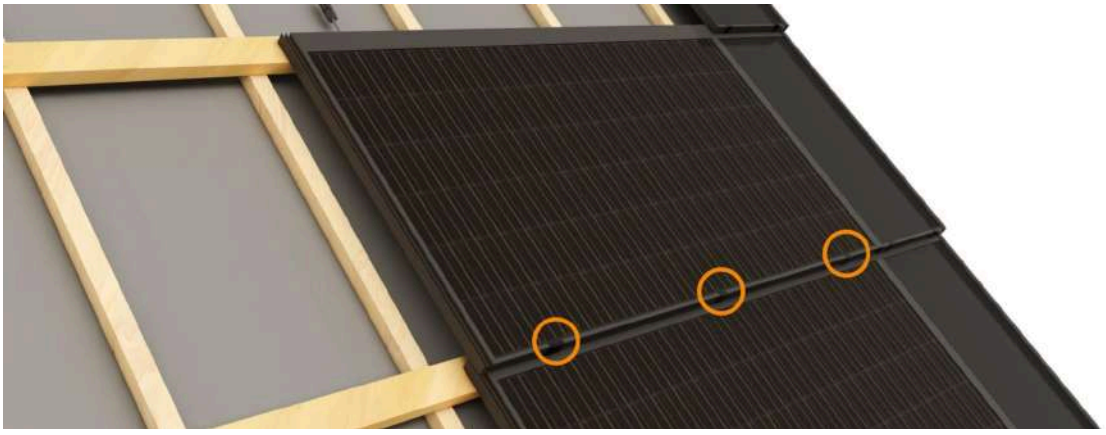
Step 12 and 13 are performed simultaneously, therefore consider working through these two steps before installing the modules. PV modules are installed in landscape mode from right to left, progressing with full columns. Follow the regular solar installation principles and manufacturer's instructions when connecting the solar cables.

- Push the upper right corner of the module under the lower corner of the upper module.

- Drop the lower part of the module into the clamp slot.



- Press the module into the clamps until it clicks into them. Make sure the clamps are entirely locked in with the module.

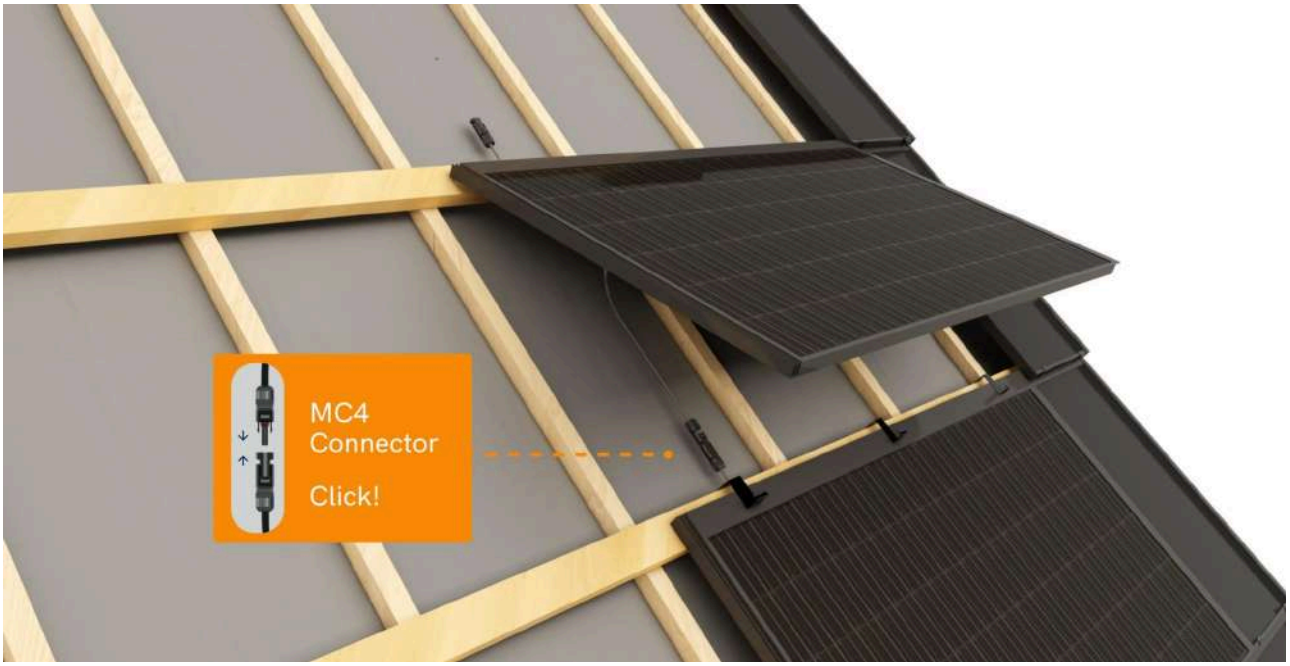


Step 15 | Cable Connections

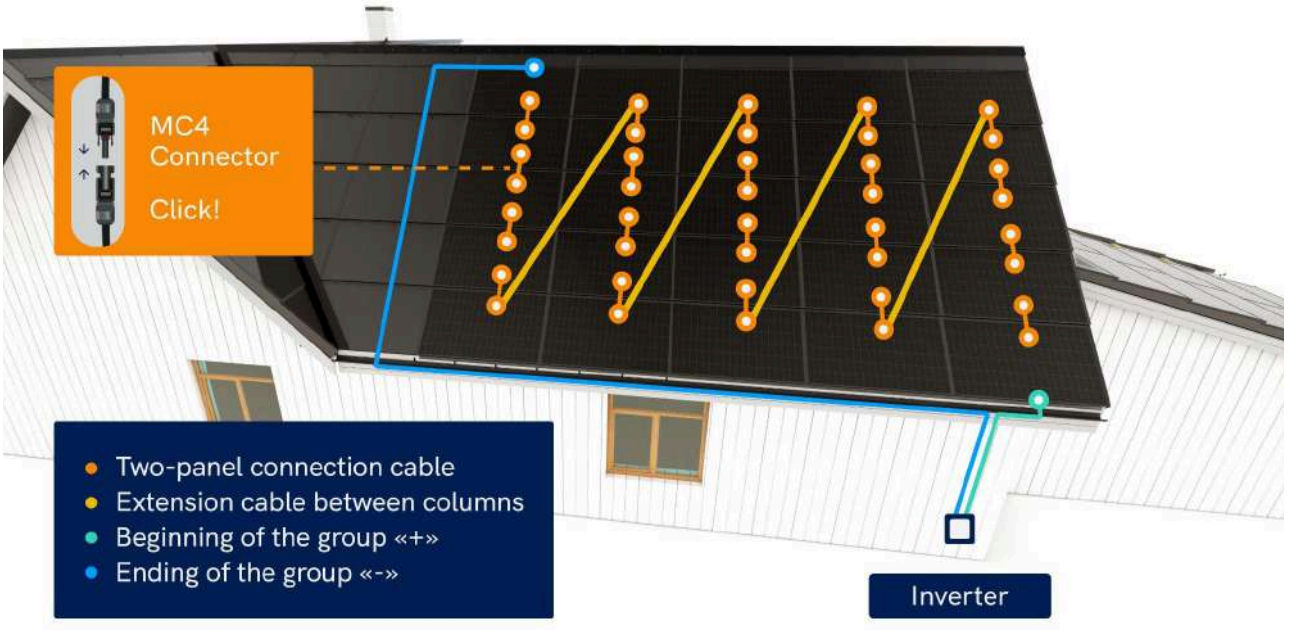
Cable connections of PV arrays are a crucial component of the secure installation and operation of PV systems. Below are important guidelines to follow when installing the Solar Full Roof.

- Check the compatibility of MC4 connectors when field and PV module cables are mated. Connectors made by different manufacturers may be sometimes described as "MC compatible", but may not conform to the requirements for a safe electrical connection with long term stability. Use only MC4 connectors recommended by the PV module manufacturers that are being used for the installation.
- Consider local weather conditions, particularly temperature change, and ensure that the system's maximum limits are capable of withstanding these changes. Improper string voltage and current can lead to a malfunctioning system.
- Connected MC4 connectors should be lifted and not left lying on the underlay.
- The use of electrical contact grease, applied to the male MC4 connector, is permissible only when validated by the module producer and/or the MC4 manufacturer.
- Only a certified electrician is allowed to perform electrical operations.
- Always refer to international, national and local solar installation guidelines, PV module manuals and best practices.

- MC4 connectors are connected correctly if both connectors click together. Proper installation of MC4 connectors is very important, as faulty connections may lead to undesired results.



- Recommended cable routing method.



Disclaimer: It is mandatory to use only inverters with arc fault detection features.

Step 16 | Verge Flashing

Specific architectural appeal must be considered to match the flashing type used on other inactive roof facets. This is equally important in renovation and new-builds. Verge flashings are designed to cover the barge boards, however custom design options are permitted. It is important to keep in mind that different PV modules may require different length of verge flashings. Flashings are fastened with roofing screws for flashings with ESSVE 4,8 X 28 mm RR33 screws. The manufacturer advises using a rate of 1800-2400 revolutions per minute while fastening the screw with a drill driver.

- Install verge flashing (component 13) and fasten it with screws. The screw should only be installed into the profile that is added to the PV module. There must not be any screws in solar or dummy panels.

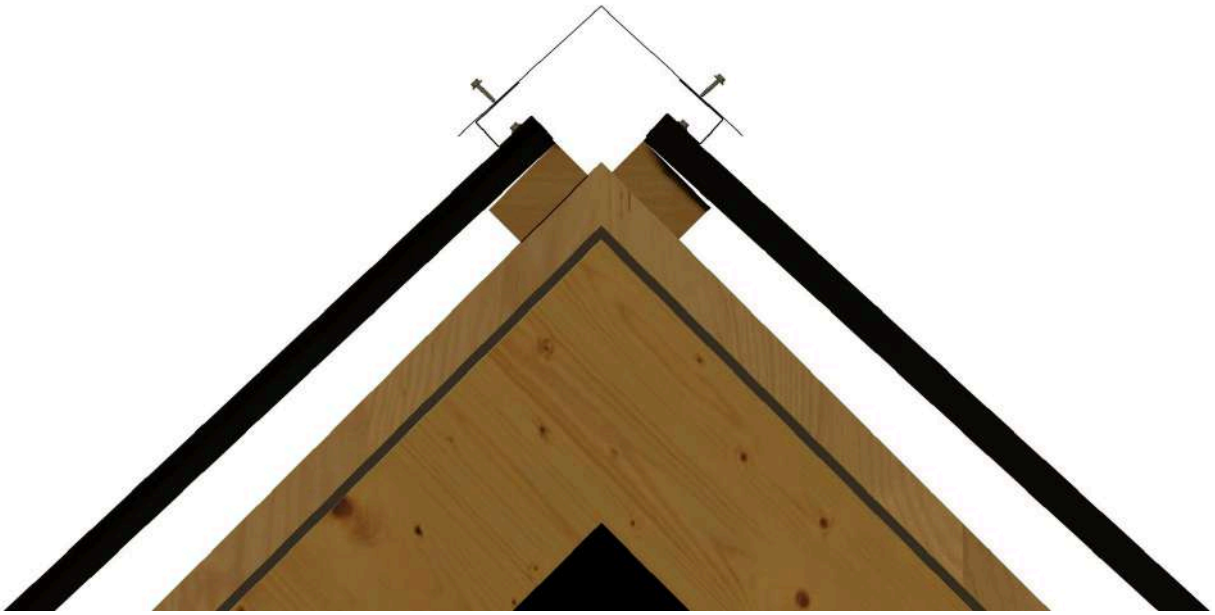
Step 17 | Ridge Ventilation and Ridge Flashing

Installing ventilation flashing is always mandatory on the side with the PV module. If the other side does not have PV modules, it is advisable to order specially sized ridge flashing. Note that the fastenings for ridge ventilation and ridge flashing are different.

- Install ridge ventilation flashing (component 8).

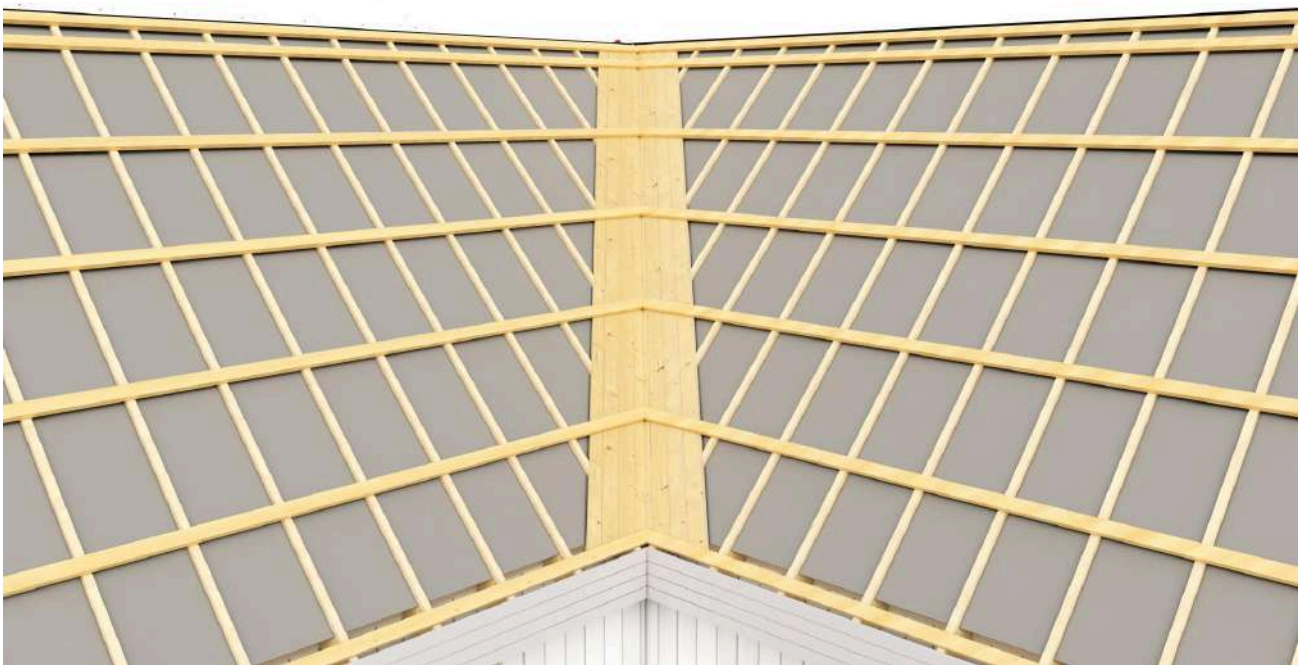
- Install ridge flashing.

- Final result.



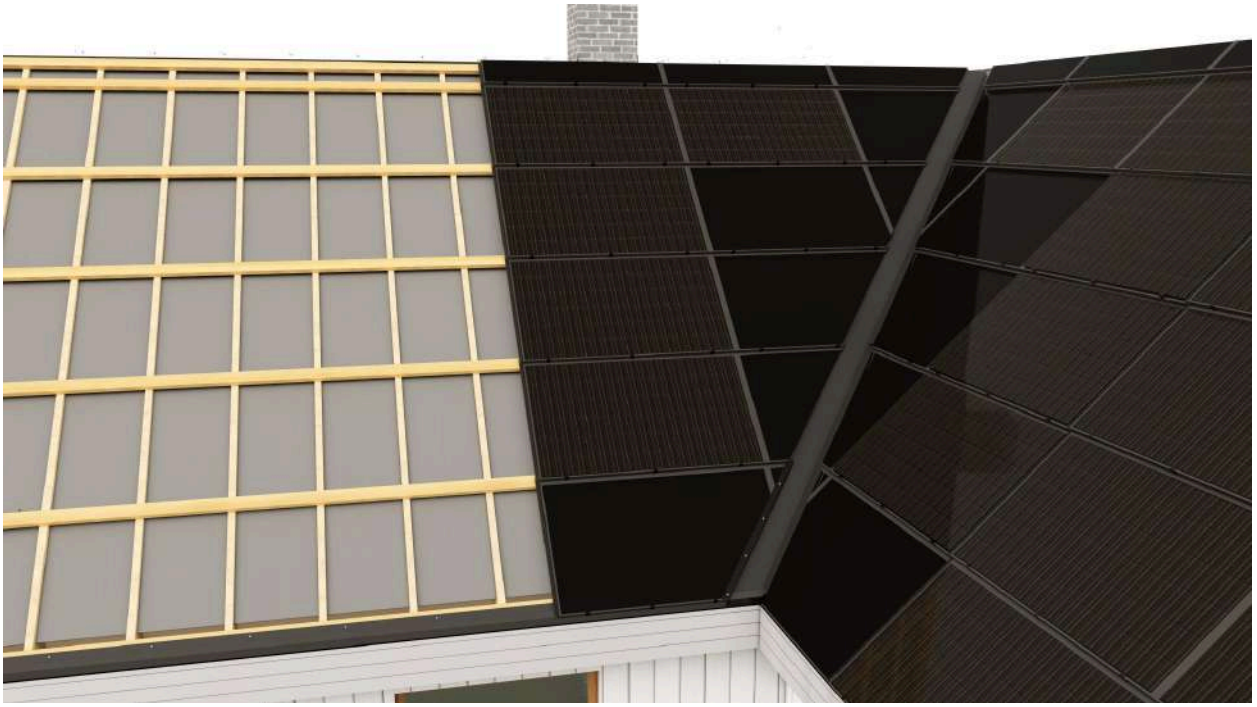
Step 18 | Valley Installation

When beginning the installation of valley flashing, consider that flashings come in various sizes and positions depending on the side of the valley installation. For a complete valley, having a proper valley deck is important.



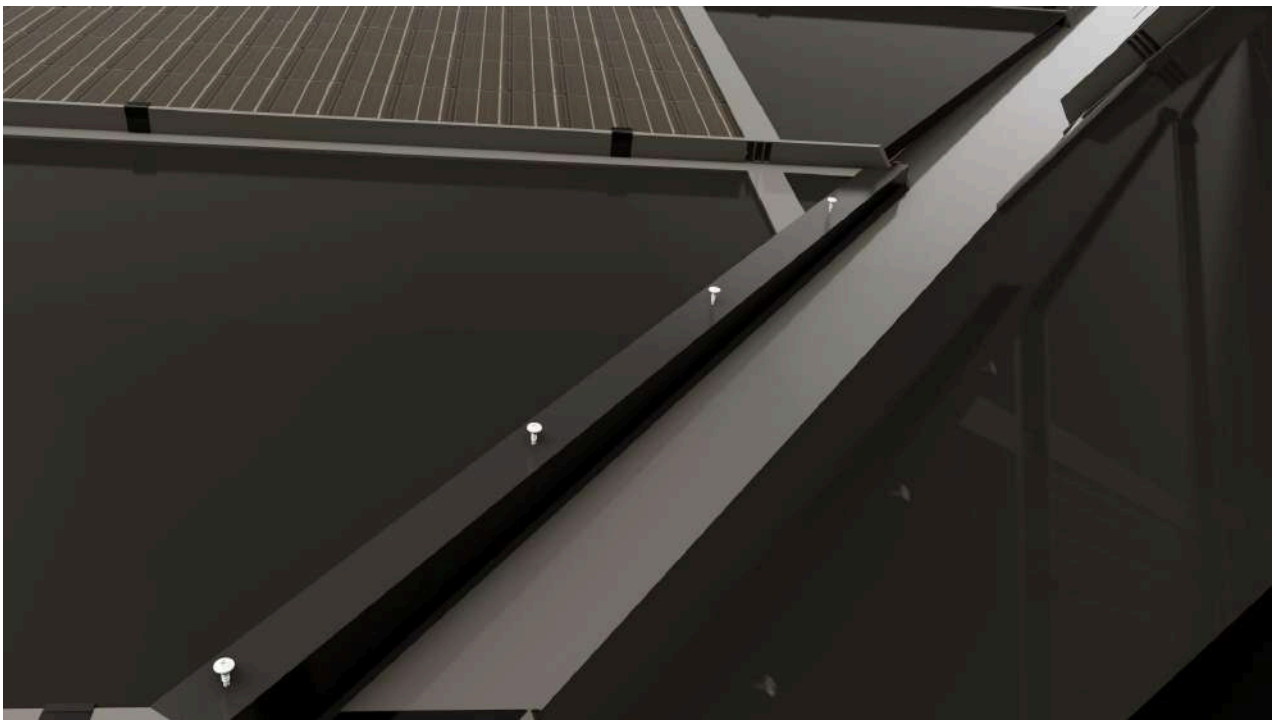
- Install the valley flashing (component 12).

- Once the valley flashing is fastened, dummy panels and PV modules can be fitted.



- If small triangular pieces are required to complete the roof space where clamps cannot be installed, the dummy panel can be screwed directly into the batten through the top part. Drive a 5x70 mm screw into the top click to fasten it to the flashing.

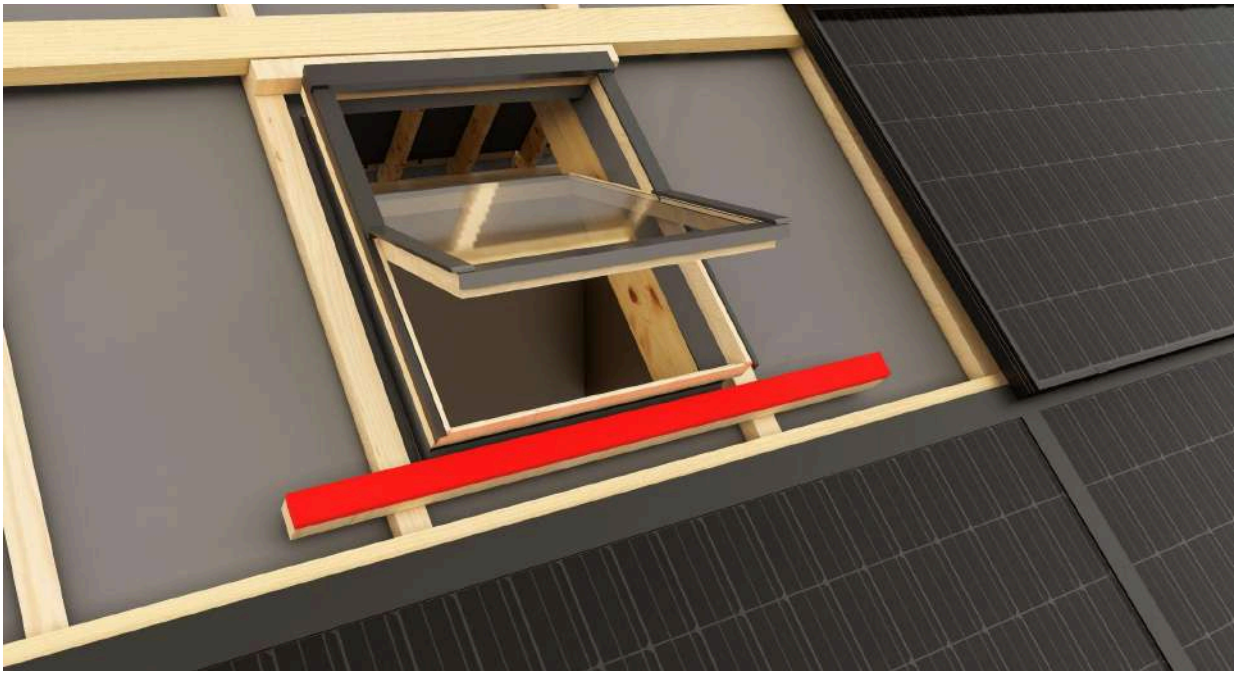
- Add cover flashing to seal the cut section of the dummy panel. Fasten it with self-tapping screws.



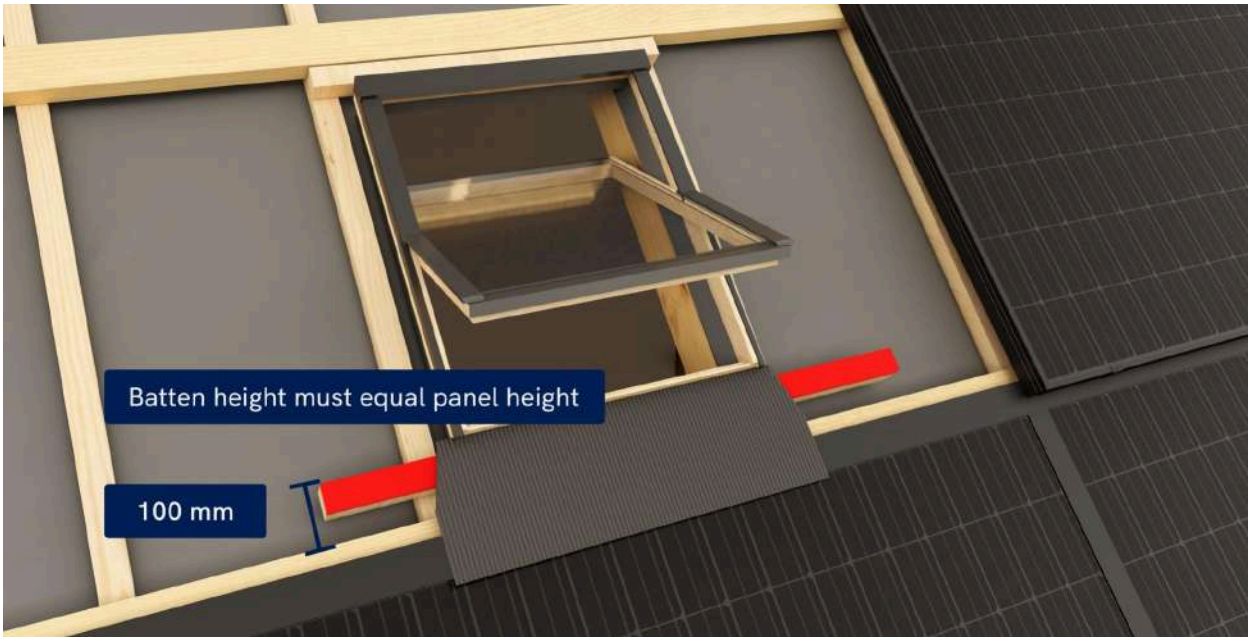
Extras

Extra 1 | Roof Window

To accommodate a roof window, a custom dummy panel is needed. Begin by taking precise measurements and adding the batten below the roof window. The extra batten added should lift the height to a level where it is even with the row where the PV module is being installed.



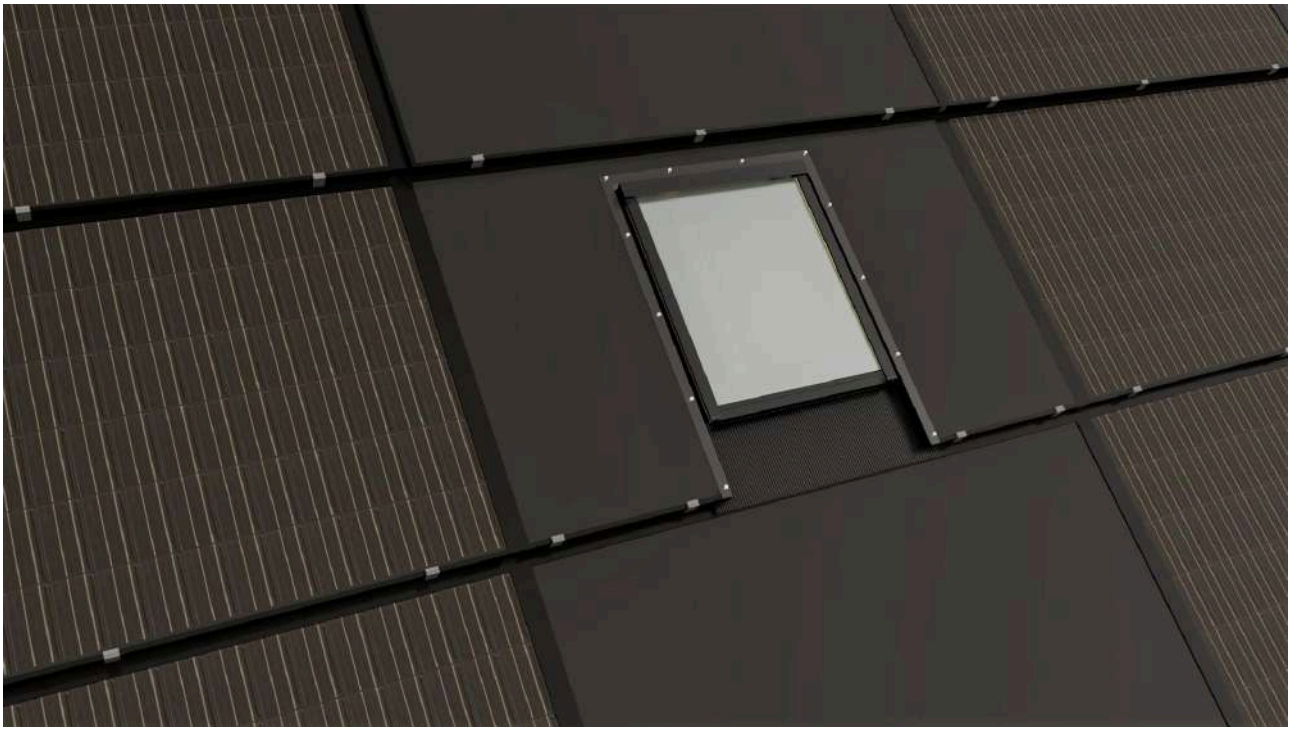
- After adding the batten, it is necessary to add the flashing in front of the roof window.



- If the dummy panel is cut, start by applying silicone to seal the roof window and the frame of the dummy panel.

- Once the frame is sealed with silicone, attach it to the dummy panel using screws.

- Install the dummy panel onto the roof.



Disclaimer: The bottom roof window flashing must extend to another PV module. It should not lay between battens or be positioned on battens.

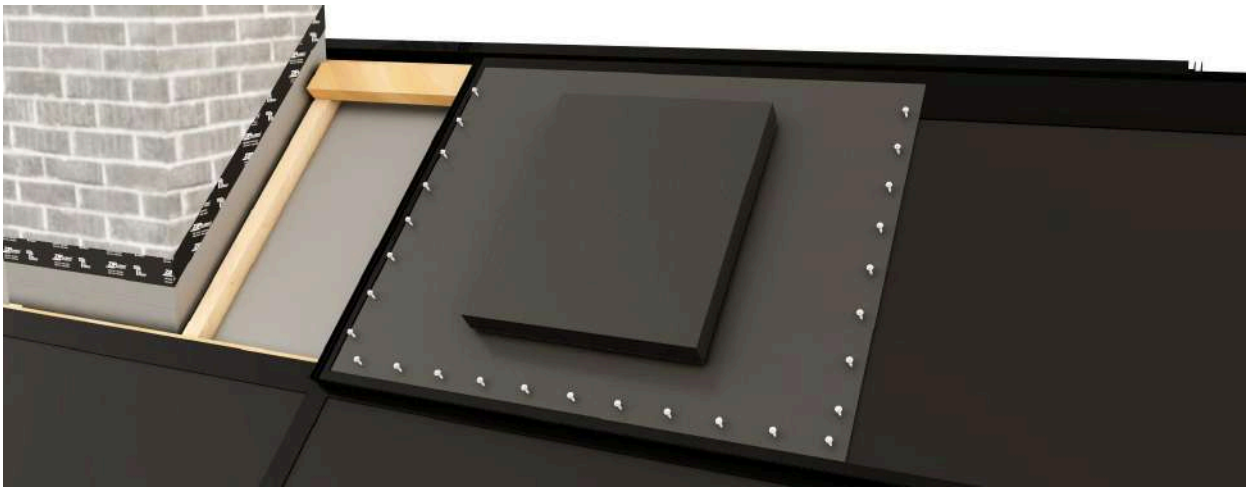
Extra 2 | Roof Access Hatch

A roof access hatch can be implemented only with a dummy panel. For advice on the most suitable access hatches for our product, contact a Solarstone Sales Agent.

- If the dummy panel is cut to size, begin by sealing the outer perimeter of the roof access hatch with silicone.

- Add the bottom cover of the roof access hatch.

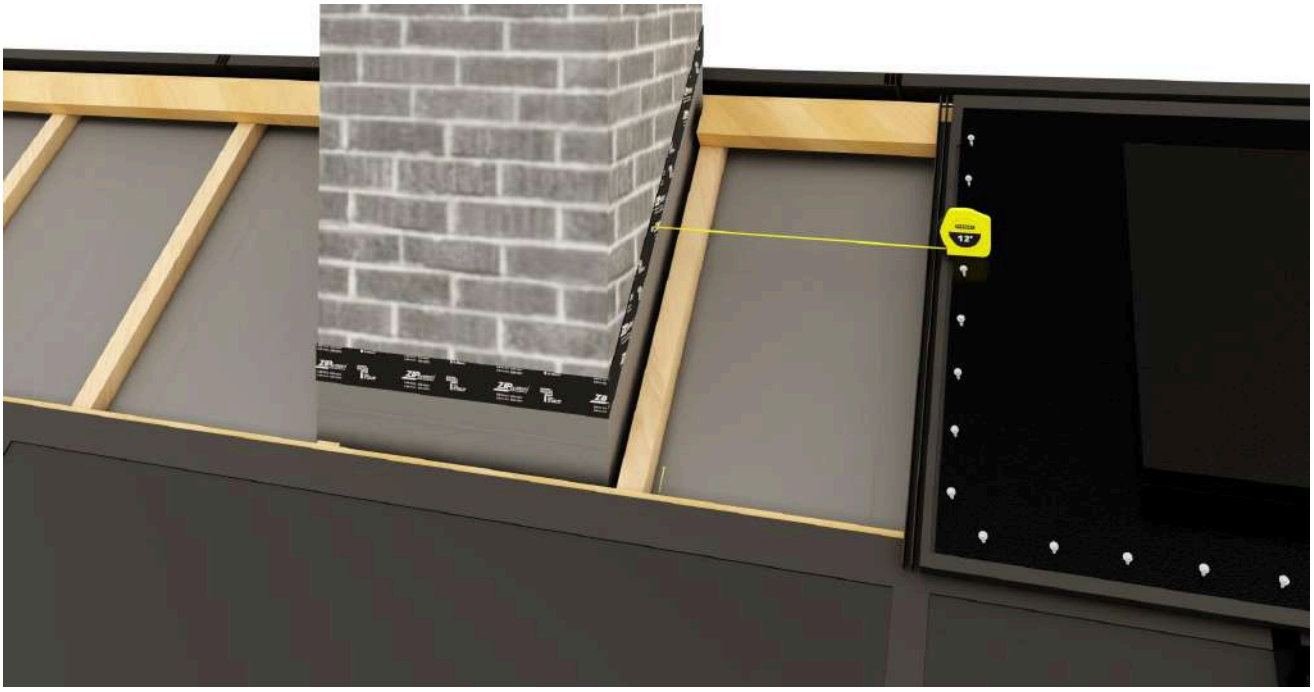
- Add the top cover of the roof access hatch.



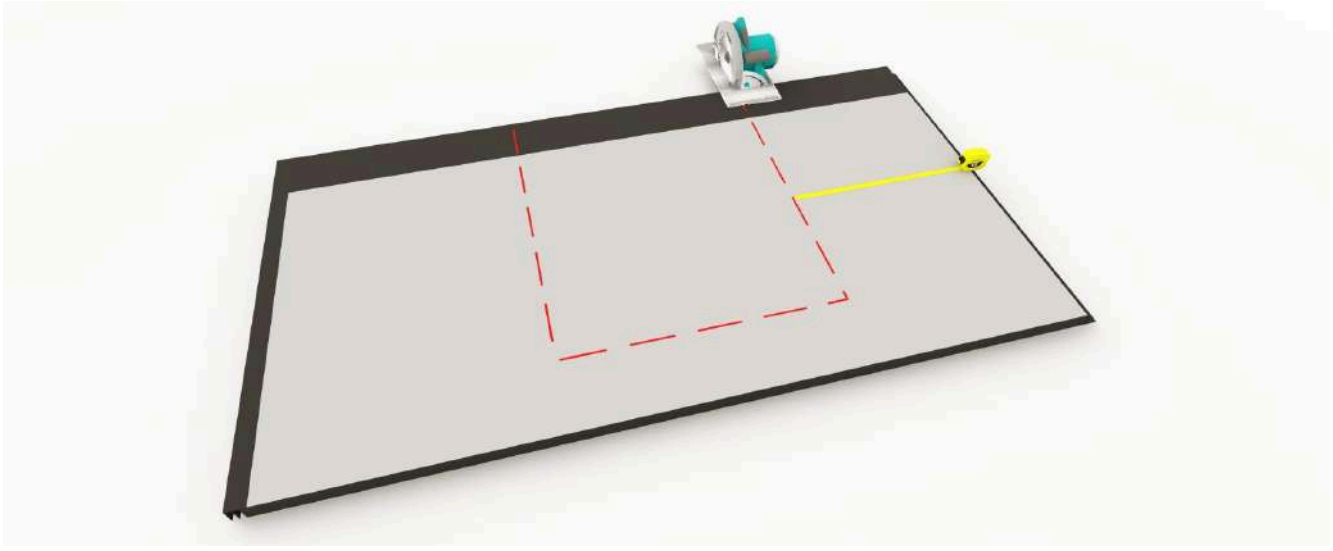
Extra 3 | Chimney

In Estonia, according to EVS 812-3:2018, the distance from the chimney to the dummy panel must be 20 mm, and it is not permissible to install it any closer. Always abide by the local, national and international laws.

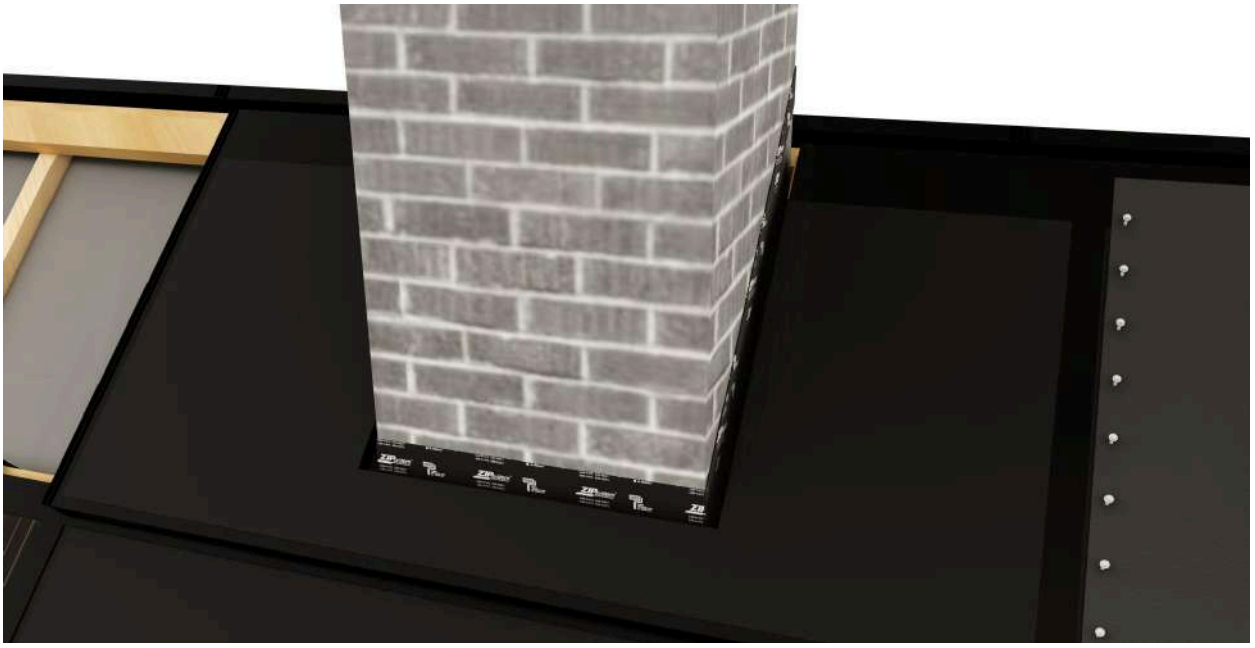
- Always make sure that the distance between the chimney and the PV module is 80 cm. In addition, as previously stated, maintain a 20 mm distance from the chimney to the dummy panel.



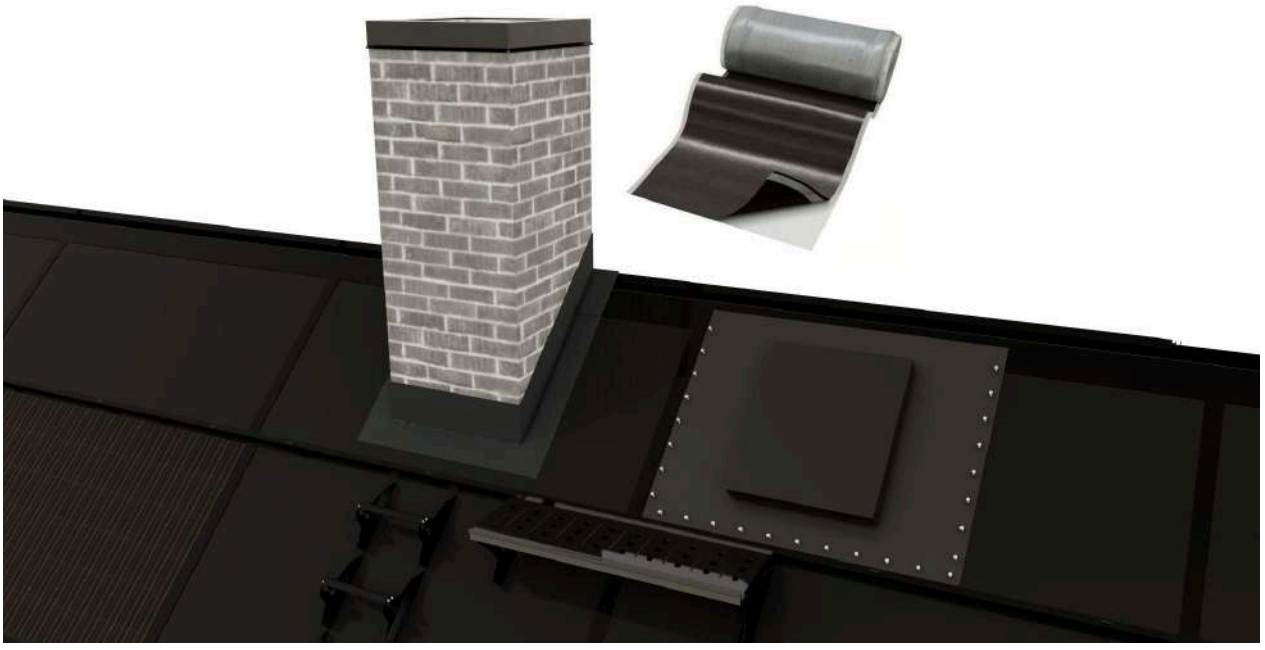
- Cut the dummy panel to the correct size, always performing the cut from the back side to protect the front side from damaging the top coat layer.



- Install the dummy panel.



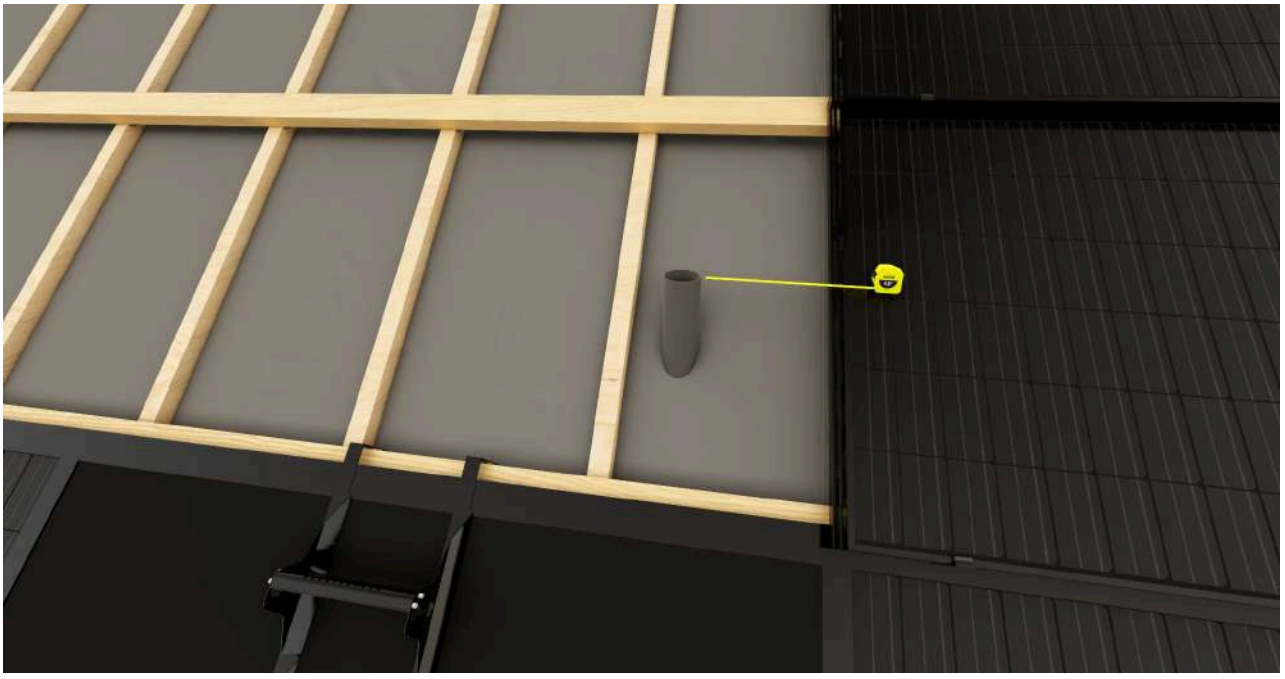
- Add the chimney wakaflex overlay.



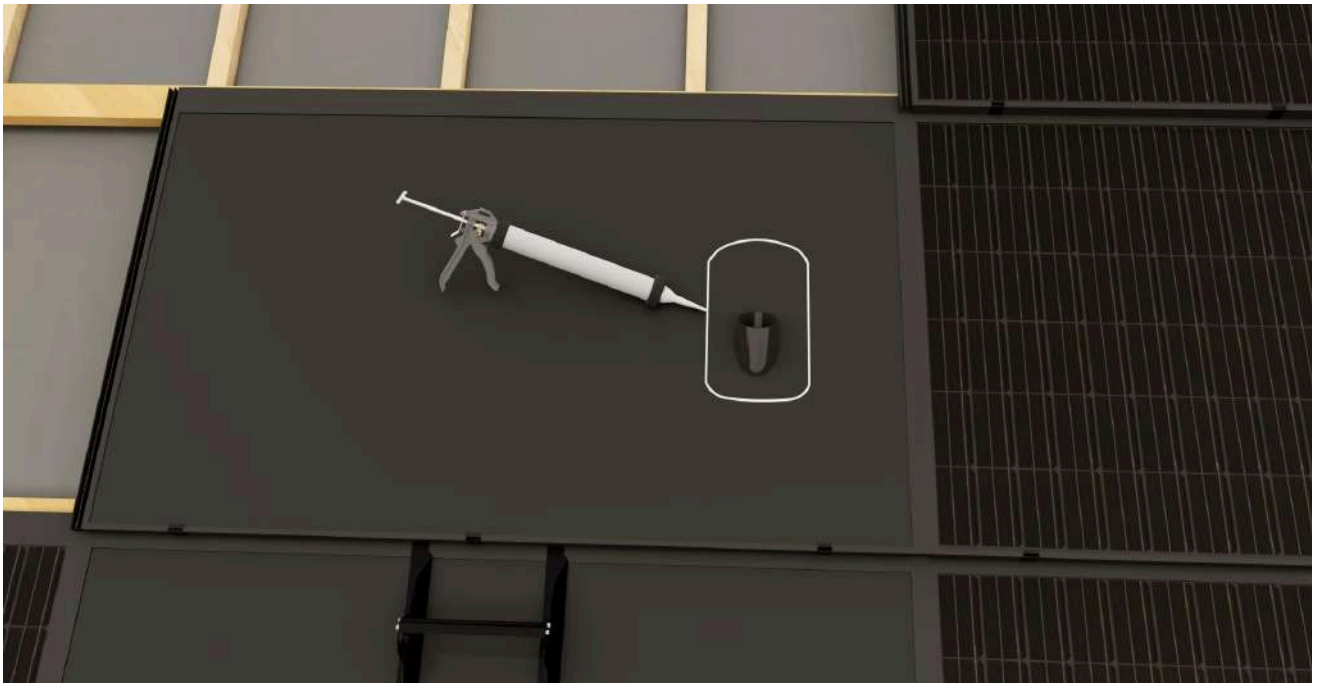
Extra 4 | Ventilation Outlets

Ventilation outlets must have 0.8 m distance from the PV modules. Always abide by the local, national and international laws.

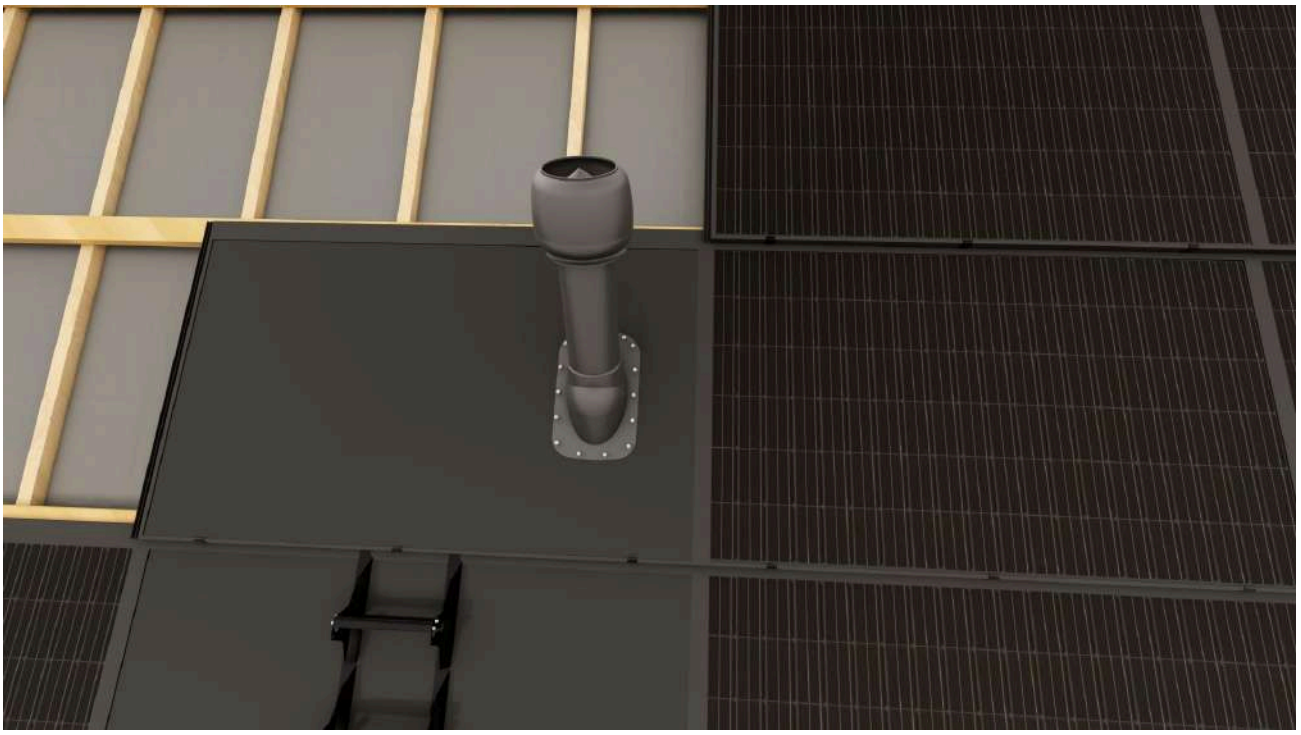
- Begin by measuring to ensure the ventilation outlet is at a safe distance from the PV modules.



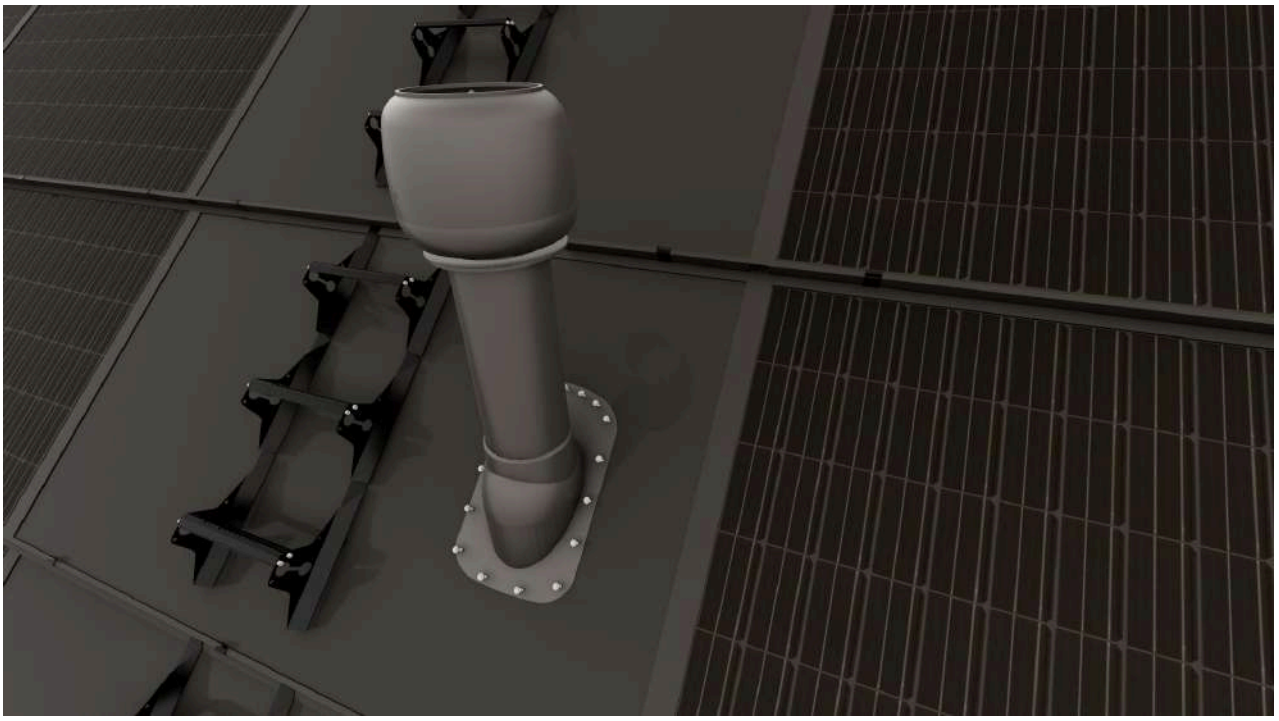
- Prepare the dummy panel for the ventilation outlet. Use silicone to seal it against weather conditions.



- Install the ventilation outlet and bolts to the dummy panel.



- Final result



Extra 5 | Installation of Roof Accessories

Installation of roof accessories is only permitted on dummy panels. Never install roof accessories on PV modules. For fastening roof accessories Solarstone advises using fastening bolts 8 x 50, which are included in the roof accessories package if not agreed otherwise. All the components are made of high-strength steel which gives the best performance in the harshest conditions.

Installation of Snow Guard

Snow Guard Components		
The start hook is a component with which every Solar Full Roof accessory begins. Place the hook around the batten and dummy panel.	The LP3 Snow Guard, which slides through start hooks as shown in step 1 below, has a profile that stops snow more effectively and weighs almost 30% less than a two-pipe snow guard.	The LP3 Snow Guard slides between start hooks and keeps the snow from sliding off the roof.
		

- **Step 1:** Start by adding 2 start hooks per 1 full-size dummy panel and fasten them with 8 x 50 screws.

- **Step 2:** Slide the LP3 through the start hooks.

- **Step 3:** Install stoppers.

- Finished look of correctly installed snow guard.

Assembly and Installation of Roof Walkway

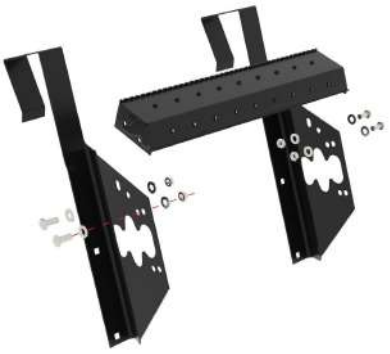
Assembly of Roof Walkway		
Start fastening the bracket and walkway carrier together with M8x20 bolt, nuts and washers. Be attentive and fasten it through the correct holes.	Walkway, brackets and walkway carrier can be now attached together. Use M8x20 bolts with nuts and washers.	You have now attached the walkway system together and it can be mounted to the roof.
		

- **Step 1:** Start hook and walkway brackets should be fastened together on the ground. Then, fasten the hooks to the battens using 8 x 50 screws.

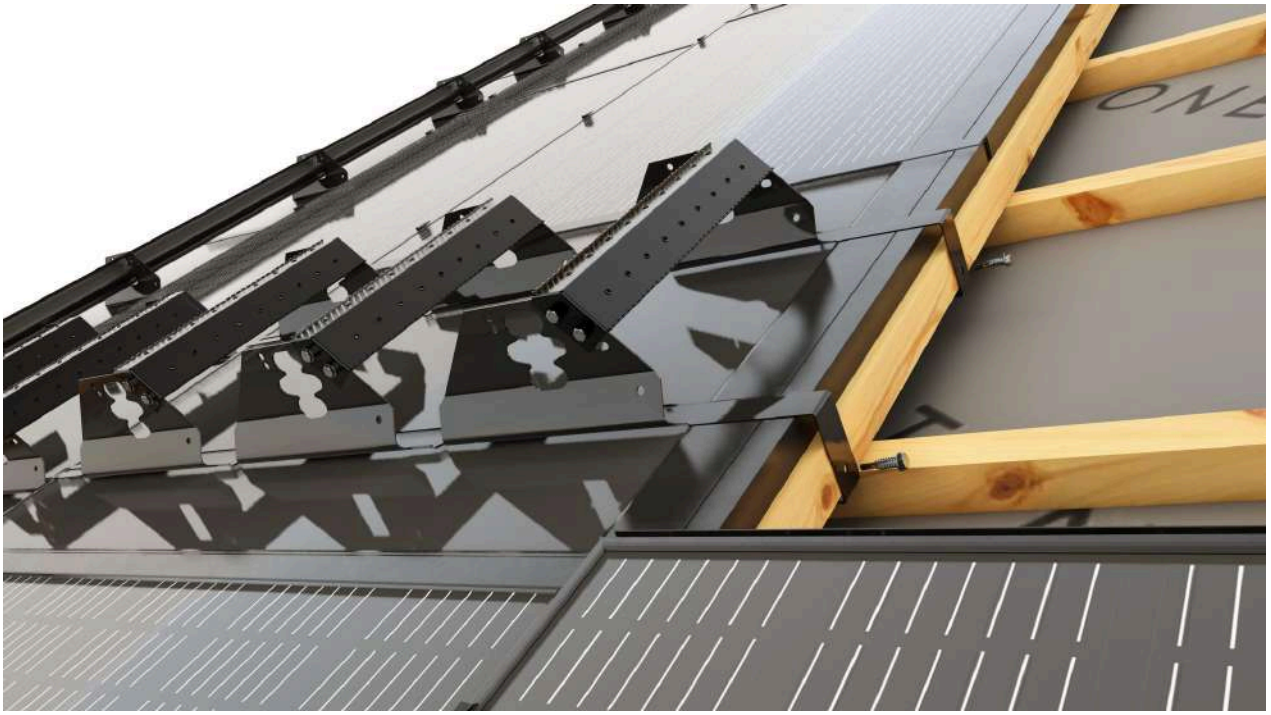
- **Step 2:** Add walkway on top of the brackets and fasten it with M8x20 bolts nuts and washers.

Assembly and Installation of Roof Ladder

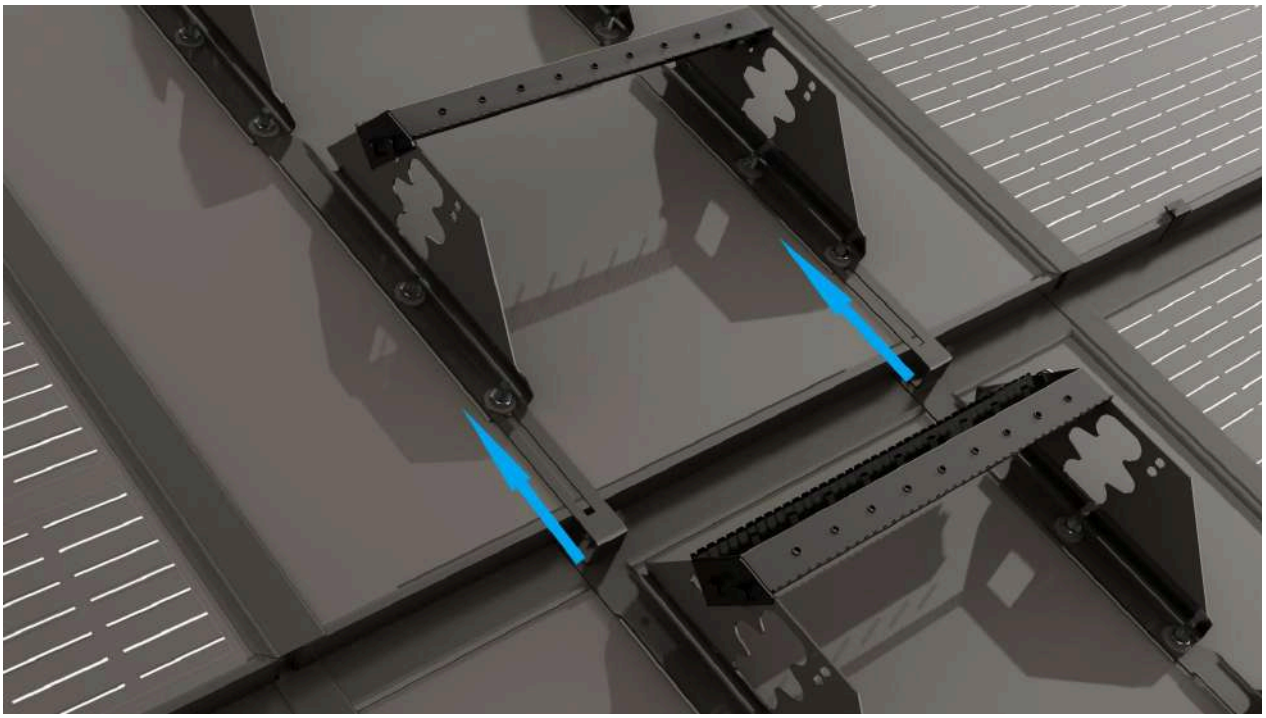
The roof ladder is compatible with all the PV module sizes offered by Solarstone. Consult with a Solarstone sales agent to ensure you receive the right combination of roof ladder.

Assembly of Roof Ladder	
Step 1: Begin by fastening the roof step to the brackets using an M8x20 bolt, nuts, and washers. Pay attention to fastening it through the correct holes.	**Step 2:** Once the roof steps are fastened to the brackets, begin fastening the brackets together. The ladder can be extended to the necessary length.
	
Step 3: Brackets can be attached together with M8x20 bolts, nuts and washers that are equipped with the system. Note that brackets are connected with round head square neck bolts.	**Step 4:** When the sufficient length of the ladder is reached, the final step is to add the end hook.
	
Step 5: Fastening of end hooks can be completed again with M8 round head square neck bolts, nuts and washers.	

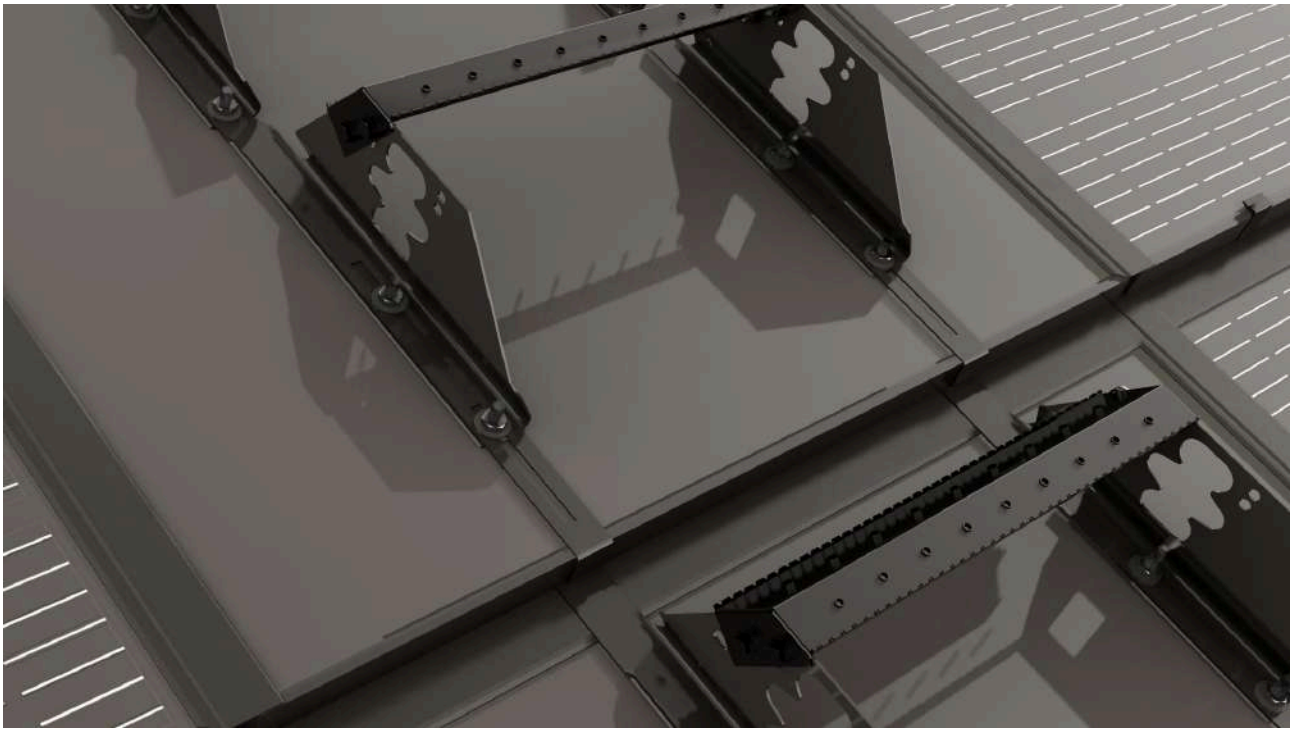
- Once the ladder is assembled, attach the roof steps over the batten to the roof and fasten it with 8 x 50 screws.



- Adjust the position of the end hook as needed to find the best fit, and once found, fasten the bolts for a tight fit.



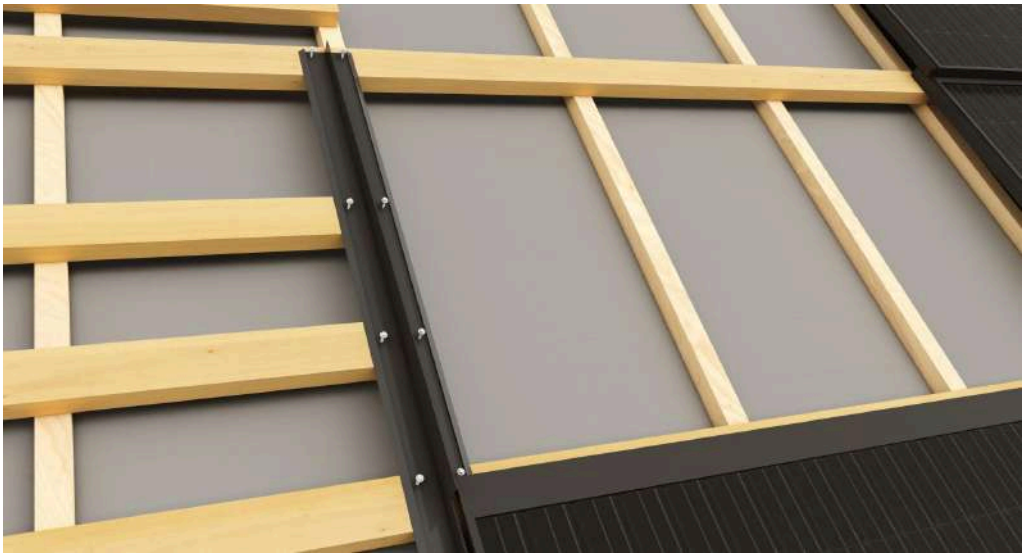
- Congratulations, you have completed the installation of the Solarstone roof ladder system.



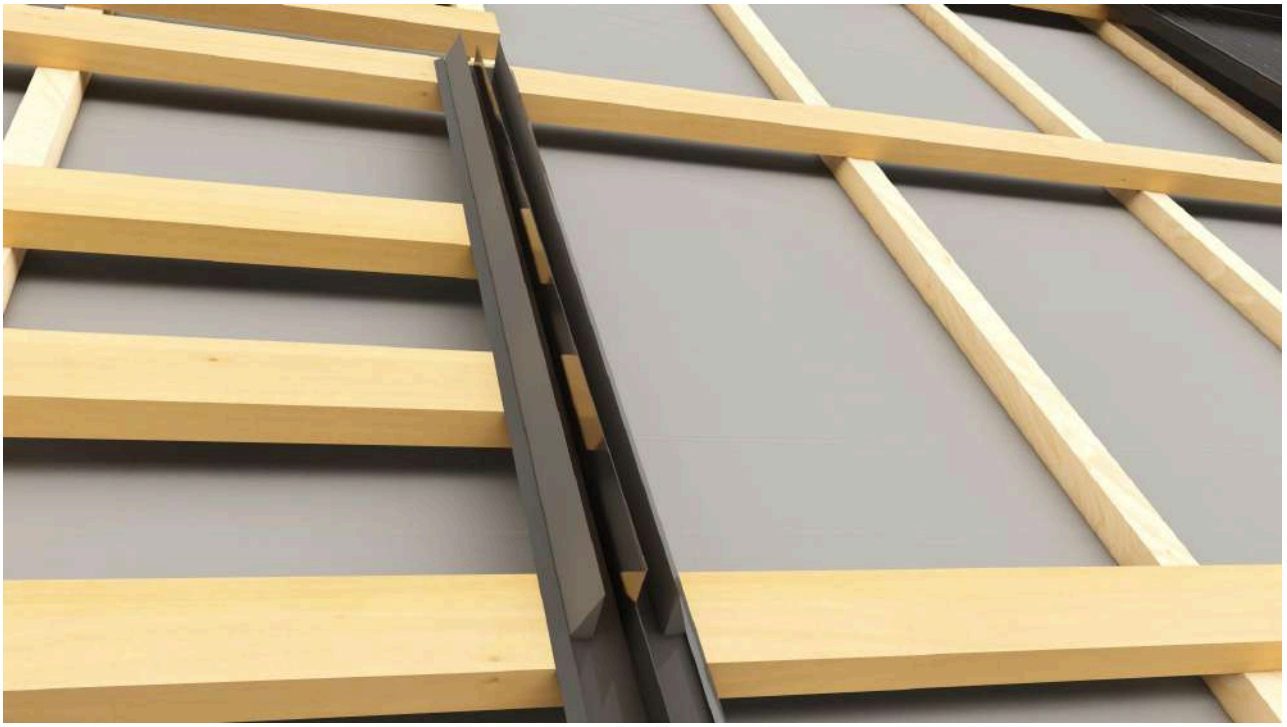
Extra 6 | Installation of Joint Flashing

Joint flashing (reversed T-shape) (component 15) is used when dummy panels are entirely excluded from the Solar Full Roof project design. Joint flashing enables functional transition to conventional roofing materials (tiles, standing seam, shingles, etc) providing necessary water-tightness and anticipated functionality of the solar roof. Relevant battening layout plan must be followed to accommodate other roofing materials outside the Solar Full Roof module array.

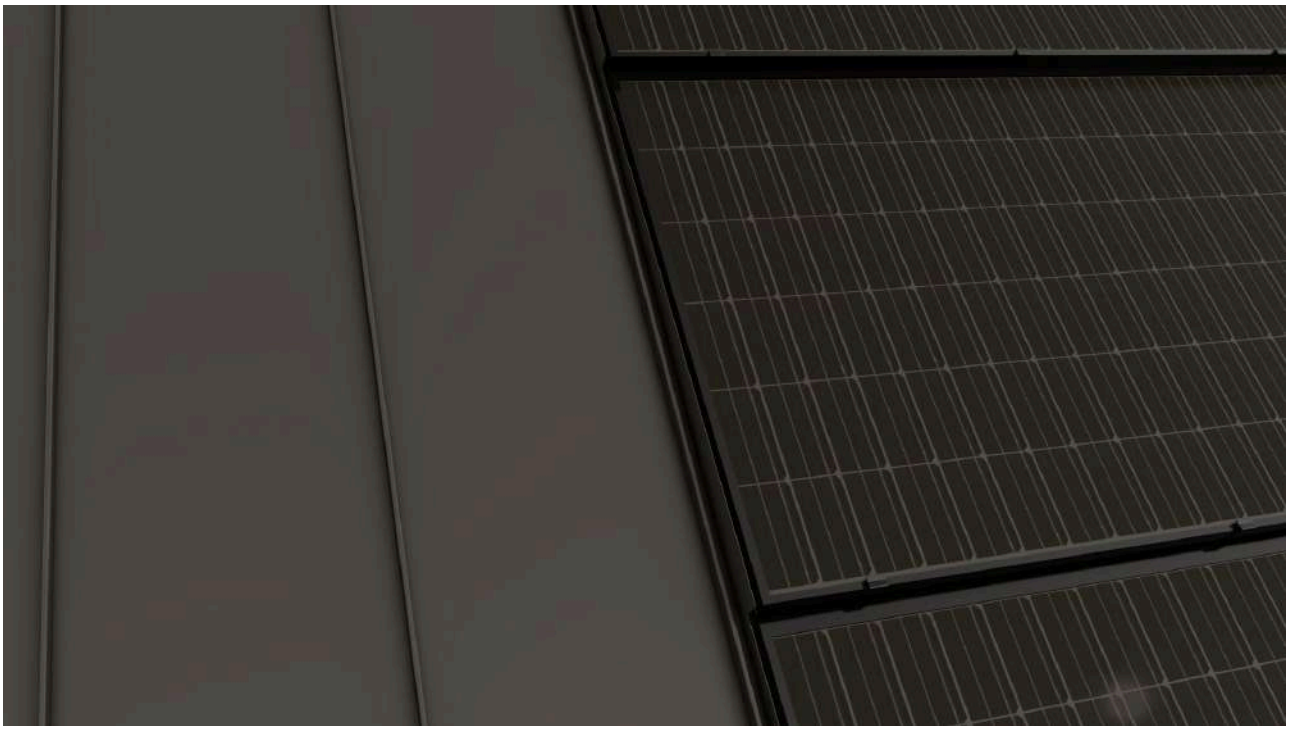
- Install joint flashing between the modules and secure it with screws.



- Foam sealing tape is added on top of the joint flashing to provide water-tightness. Apply it on both sides.



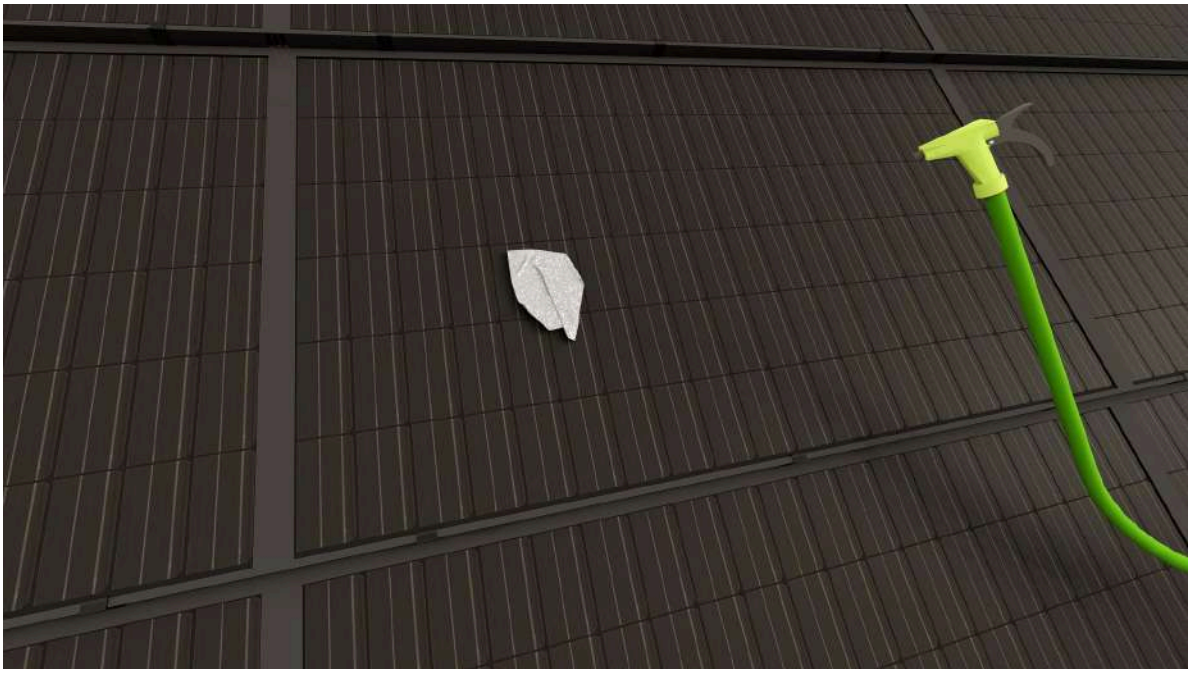
- The final result shows seamless compatibility between two roofing types.



Extra 7 | Maintenance of the BIPV Modules

Maintaining the modules ensures better efficiency of the Solar Full Roof. In regions with a high amount of dust, plant or tree pollination, or other types of pollution, regular washing should be executed.

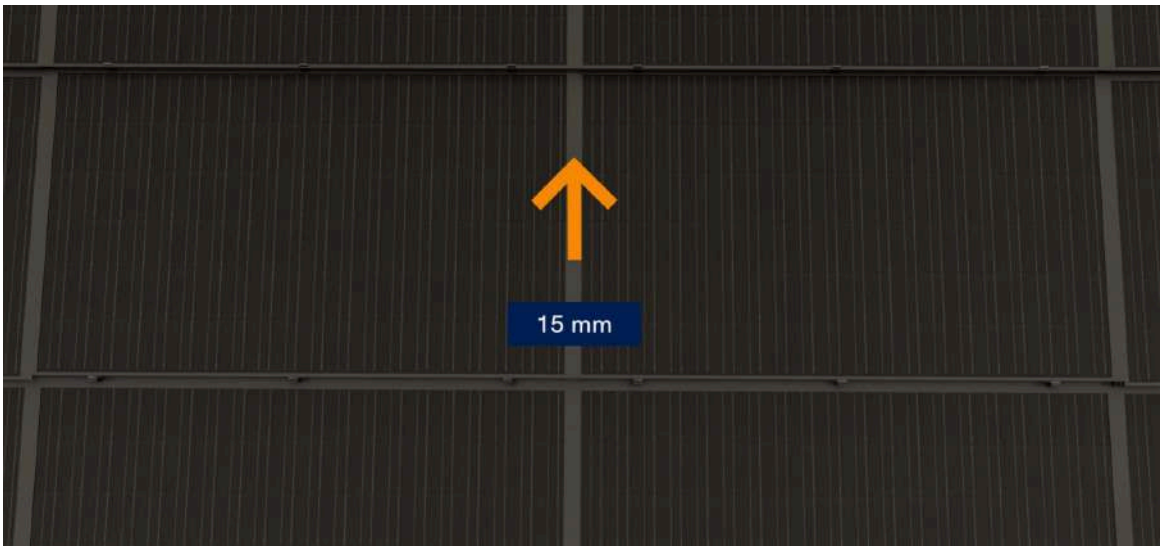
- Modules can be cleaned with the help of the simplest means such as water and a cloth.
- Cleaning should take place only in the morning, evening or on a rainy day when the irradiance isn't high.
- It is not permitted to step on a module whilst cleaning (during installation or once installed). Use a ladder or a remotely operated boom lift instead.
- Perform a visual inspection once a year to check if the panel mounting brackets have come loose.
- Do not use metal tools such as spades, knives or abrasive sponges for cleaning.
- Make sure that all visible cables and plugs in the technical room are properly secured and not loose.
- When cleaning with a pressure washer, the pressure must be less than 690 KPa.
- Do not use steam or corrosive chemicals to speed up cleaning.



Extra 8 | Replacing BIPV Modules

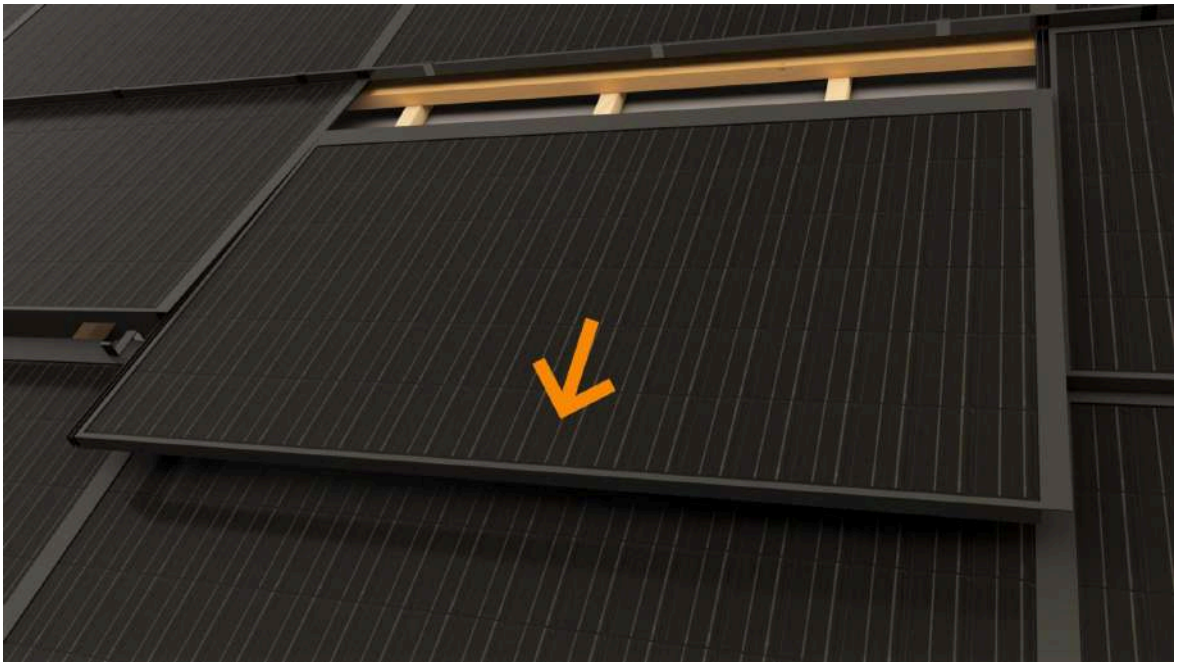
In order to change the module (either visibly damaged or non-functional), access the module carefully (by not stepping on the adjacent modules using a ladder or remotely operated boom lift) and push the damaged module 15 millimeters upwards so that module would click out from the clamps. Also release the clamps of the adjacent module on the left, which disengages the interlocking properties of the modules for easy removal.

- First, push the module upwards by approximately 15 millimeters, which should be enough to start lifting it.



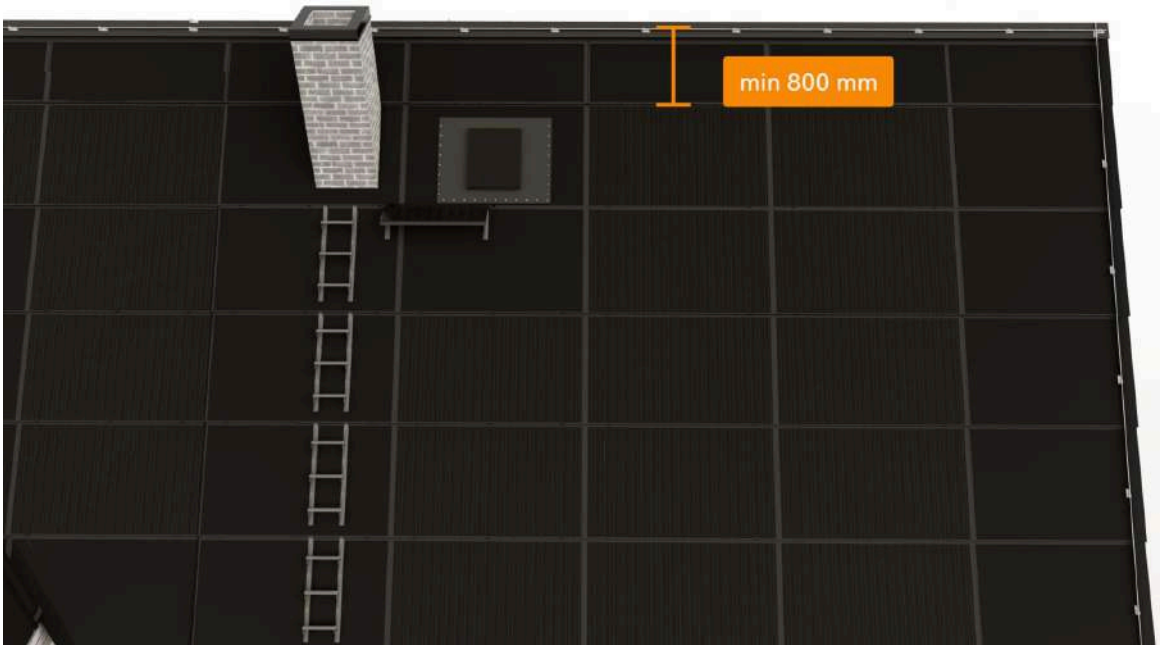
- Attempt to lift the module up and disengage it from the array. Pay particular attention to the left module, which should also be opened to allow for better access.

- Once the module has been freed from the clamps, pull it downward. All the cabling and the previous cabling system must be restored to their original state if a new module is being installed.



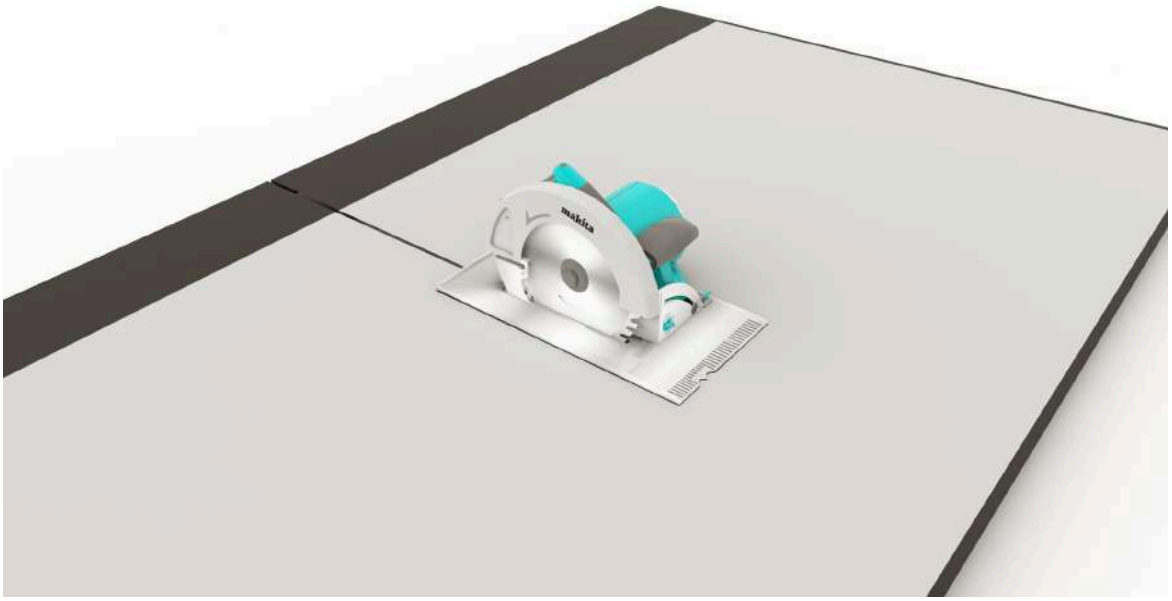
Extra 9 | Lightning Protection

Ring earth electrodes must be in contact with the ground. It must be installed as a closed ring with a depth of 0.8m according to DIN 18014 around the external foundation of the building. PV modules must be installed a minimum of 0.8m away from the ring earth electrode. Always abide by your local, national and international regulations.



Extra 10 | Dummy Panel Cutting

- Dummy panels can be cut with a circular saw.
- Perform the cut from the back side of the panel. This will not damage the top paint coat.
- Take safety precautions and use protective equipment.
- Before installing, blunt the edges of the panel if they are sharp after cutting. Safety measures must be taken.

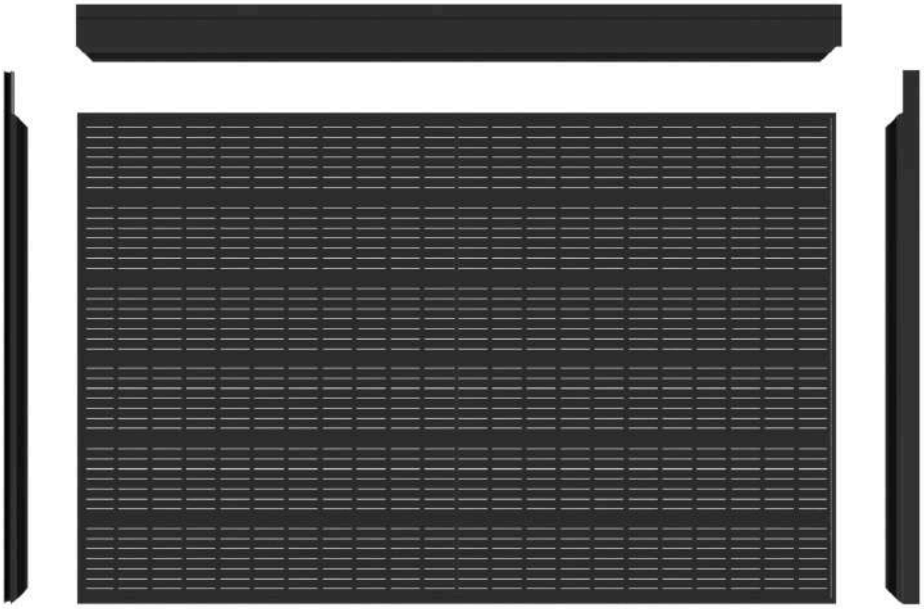


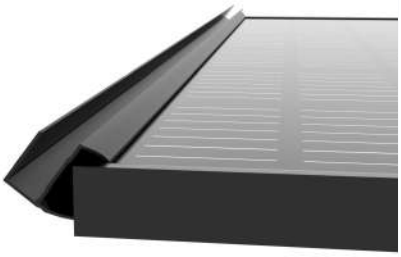
Extra 10 | Assembly of Click-on Kit

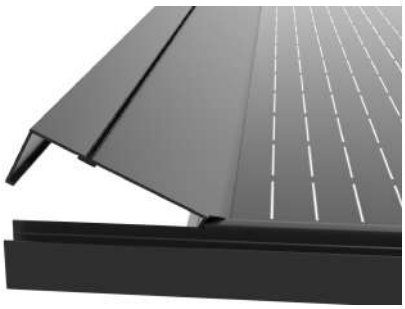
Once the Click-on kit is clicked/assembled to the module it is not permitted to disassemble components anymore as it may lose its original properties and result in undesirable outcome. Always start clicking the next module in the same order and position as the previous module to ensure the male and female MC4 port connectors stay on the same side. Following instructions apply both for landscape and portrait configurations.

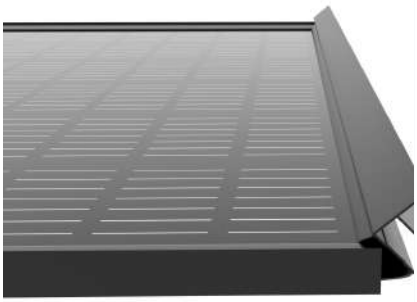
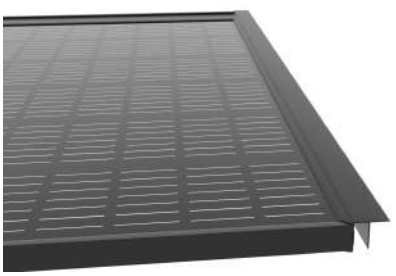
- Use the location of a barcode for easy reference to make sure the clicking sequence is correct.

- Click-on kit consists of 3 profiles - left, right and top profile.

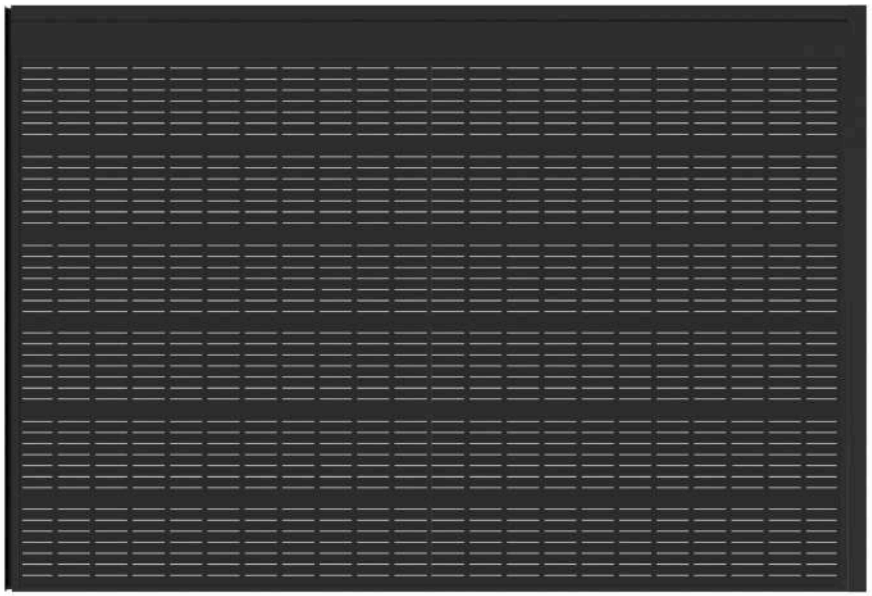


Left Click profile		
Step 1: In the production phase, silicon is added for extra tightness of the frame. Silicone must be added in full length of the click.	**Step 2:** Always start the clicking process with the left profile by connecting the upper side over the PV module frame.	**Step 3:** Firmly push the lower side of the profile under the PV module frame. "Clicking" sound ensures the profile is fully wrapped around the module's frame. Check visually if the profiles are fully aligned.
		

Top Click profile		
Step 1: Repeat the process by adding silicone to the top profile's upper side to the PV module.	**Step 2:** Continue clicking the top profile to the PV module frame.	**Step 3:** Firmly push the lower side of the profile under the PV module frame.
		

Right Click profile		
Step 1: Make addition to the right Click-on profile by adding silicone.	**Step 2:** Repeat the process with the right profile by connecting the upper side of the profile to the PV module.	**Step 3:** Firmly push the lower side of the profile under the PV module frame.
		

- Congratulations! You have successfully clicked a Solar Full Roof BIPV panel and the installation may commence!



Version

NO	DATE	DESCRIPTION	WHO
1.0	11.01.2023	Released version	Mattis Jürimäe, Alari Merbach, Henri Lass
1.01	16.03.2023	Revised batten step formula	Alari Merbach, Kevor Reva, Henri Lass
1.02	01.07.2023	Appendix A, B	Henri Lass, Mattis Jürimäe
2.0	15.01.2024	Updates to 1.0 versions. • Specifications, Underlayment, Eaves and Gutters, Batten Step, Grounding, Installation of First and Regular Clamps, Cable Connections, Roof Accessories, Click-on Kit, Appendix A, B. • Modifications include rewriting content and updating graphical representations in named chapters.	Henri Lass, Alari Merbach, Mattis Jürimäe.

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Appendix A - Checklist For Installation of Solarstone Solar Full Roof

	Activity	Yes/No	Deviation	Date completed	Completed by (initials)
Roof preparation					
1	Roofing underlay can withstand heat up to 120° degrees Celsius				
2	Battens and counter battens are dimensioned according to the manual from the manufacturer of the fastening system				
3	If applicable, safety zone (all obstacles and perimeter) with dummy panels has been marked and secured in the design				
4	The technical specifications and installation manual for the fastening system has been examined reviewed by installer(s) before installation and the installer has confirmed comprehension of the manual content with signature				
5	The technical specifications and installation manual for PV modules has been examined reviewed by the installer and electrician before installation and the installer has confirmed comprehension of the manual content with signature				
6	The technical specification and installation manual for the inverter has been examined reviewed by an electrician before installation and the installer has confirmed comprehension of the manual content with signature				
Electrical installation					
7	Electrical engineering is carried out and fully understood by an electrician before installation, the existence of required educational level and competence of employees is confirmed by installer.				
8	Installer(s) has undergone internal training before installing PV systems. Inverter data must be shared to Solarstone for monitoring.				
9	Electricians have undergone and passed internal training of Solarstone products before installing PV systems				
10	Suitable and approved tools are used for terminating MC4 plugs				
11	On reception of goods, the items are checked against the contents of the packing slip and Order Confirmation sent by the Supplier. Everything is correct.				
12	Sufficient ventilation of the PV system are ensured				
13	Sufficient grounding / earthing of the PV system are ensured				
14	MC4 plugs on string cables and PV modules (in a connection point) are from the same manufacturer				
15	Each connection point for string cables are documented (picture)				
16	The connection point for MC4 plugs is properly attached/clamped/stripped to the batten/counter-batten.				
17	Only MC4 plugs supplied together with the inverter are used for connecting DC strings in the inverter				
18	Marking of installation is carried out in accordance with local regulations (eg. NEK400) (pictures)				

19	Concealed DC cables on ceilings and elsewhere in the installation are mechanically protected				
20	Concealed DC cables are marked (picture)				
21	AFCI function on inverter is activated and documented (picture)				
22	If the regulation demands, (positive and negative) cables must be aligned in the same cable rails. Documentation is needed by pictures.				
Mechanical installation					
22	All the details are checked before installation for physical damage that may damage the functionality of the system.				
23	All mechanical details are fastened and attached to the roof as the installation manual states.				
24	Adhere to all local, national, international guidelines, rules and norms regulating safe installation of BIPV, and conventional roofing principles, mechanical and electrical installations.				

This checklist is intended as an aid to ensure the correct installation of building integrated solar panels (BIPV). This checklist must be filled in throughout the course of any Solarstone installation (plan, start, execution and completion stage) in writing or digitally and added to the project documentation.

Revision 1.0 03.07.23

*If deviations please describe the reason in the field below.

Deviations

Appendix B - System Error

If any system error has occurred in terms of electrical or mechanical installation wise. We ask you to provide us with the **faulty report form** which can be received from our website or support team.

Contact our support team at:

support.tech@solarstone.com
+372 5631 6666