

Solar Energy Systems by Schweizer: Installation Manual – Photovoltaic In-Roof Mounting System Solrif®.



Art. No: 19591e

The following applies when processing the Solrif® System:

Ernst Schweizer AG sells the Solrif® System through specialty retailers and module manufacturers. The contractual partner and thus the warranty provider for project developers, installers, and the like is exclusively the specialty retailer or the module manufacturer. Any and all liability of Schweizer vis-à-vis project developers, installers and the like is excluded.

These installation instructions are provided by Ernst Schweizer AG solely for documentation purposes and were prepared with the greatest possible care. Ernst Schweizer AG is not liable for damages due to missing or incorrect statements in these instructions.

The specialty retailers or module manufacturers are solely responsible for proper instruction and documentation relating to installation.

Solar Energy Systems by Schweizer:

Installation Manual – Contents.

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Solar Energy Systems by Schweizer:

Installation Manual – General Information.

1. General Information

1.1 Information on this Manual

This manual describes the procedure for the in-roof mounting of photovoltaic systems with Solrif® modules as well as for replacing defective Solrif® modules.

With in-roof mounting, the PV array substitutes any existing tile roofing. However, tile roofing remains around the PV array.

In addition, this manual provides instructions on the maintenance of Solrif® modules and their disposal.

Supplementary Documents

Delivery note with article numbers and description of all components delivered.

Limit

- The installation of full-roof PV systems (the roof is covered completely with photovoltaic modules or dummy modules, no tiles are left on the roof) is possible, but is not the subject of this installation manual.
- For connection of the PV array to the inverter, please refer to the inverter supplier's documentation.

This manual is intended for craftspeople who have completed their vocational training in the roofing trade.

Furthermore, the craftsman must also have acquired either an additional qualification for the installation of photovoltaic systems or have many years of experience in the installation of photovoltaic systems.

With regard to adhering to maintenance procedures, this manual is also directed at the operator of the photovoltaic system.

Before carrying out any work, the implementing or supervising person must:

- Read this manual carefully and understand it, or clarify any ambiguity with the system's planners.
- Instruct assisting personnel according to this manual and supervise them during the entire work process.

The installation company must:

- Keep this manual to hand during the entire work procedure on the building site.
- After the installation work has been completed: hand over this manual to the system operator.

The system operator must:

- Store this manual and the delivery note with the rest of the system documentation.
- Observe the instructions on system maintenance.
- Make this manual and any further relevant documentation available to the specialist personnel who have been commissioned to carry out the maintenance, repair or deinstallation work and enclose them with the documentation for the photovoltaic system again after the work has been completed.

The seller of the system or of the building on which it is installed must:

- Pass on this manual to the new operator as part of the system documentation.

Further applicable documents, regulations and provisions

- Apart from this manual, please observe the module pitch plan and the string plan, the relevant safety regulations, particularly those for working on a roof and for handling electrical currents, as well as the documentation for the other components in the photovoltaic system.

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- In the event of discrepancies or other ambiguity, clarify these through the system's planners.

Diagrams in this manual are intended to aid fundamental understanding and show the example of a 3x3 array. The implementation for the actual design must be analogous to this example portrayed here.

1.2 Explanation of Symbols

The safety instructions in Chapter 2 of this manual and the warning notices in other parts of this manual are indicated by symbols. The safety instructions are introduced with signal words which indicate the extent of the danger.

- Be sure to observe safety instructions and warning notices and proceed with caution to avoid accidents and damage to persons or property.



DANGER

... indicates an imminently hazardous situation that will lead to death or serious injuries if it is not avoided.



WARNING

... indicates a possibly hazardous situation that can lead to death or serious injuries.



CAUTION

... indicates a possibly hazardous situation that can lead to minor injuries.

ATTENTION

... indicates a possibly hazardous situation that can lead to damage to property.



NOTICE

... highlights useful tips and recommendations, as well as information for efficient and trouble-free operation.

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1.3 Glossary

Module

Laminate comprising a pane of glass with solar cells encapsulated and double glazed or foil backsheet, with a junction box and cables, with Solrif® frame, ready for in-roof installation.

String

Series connection of several modules to generate electrical voltage that is compatible with the inverter. Strings are connected to the inverter individually.

PV Array

The aggregate of the modules installed on a roof. Can comprise several strings. Is sometimes known as a module array.

Roof Plan

Plan which contains at least the following information:

- Description of the system as well as of the snow and wind load assumed for the system
- Positioning of the PV array within the roof area
- Positioning, number and type of mounting clamps
- Specification of all module mounting pitches measured from a reference point

Inverter

Device for converting the direct-current generated by the PV array into alternating-current for feeding into the electrical grid.

Photovoltaic System

The aggregate of the PV array, inverter, cabling and other accessories.

Rain-Proof Roof Underlay

On rain-proof roof underlays, the counter battens do not have to be integrated. Intersections, mounting parts and connections must all be fitted to be rain-proof. The fixing of the underlay film should be carried out in the upper third of the horizontal overlap. Collection of drifting snow and rain through ventilation openings is unavoidable in ventilated systems.

Watertight roof underlay

Roof underlay with watertight design of the area including the seams and butt joints.

Intersections, mounting parts and connections must all be fitted to be watertight. The fixing of the underlay film should be carried out in the upper third of the horizontal overlap. The waterproofing must be trained over the counter battens so that by the mounting of the bearing battens through the counter battens the waterproofing is only penetrated in the area of the highest point. The greater the expected load on the roof underlay is, the higher counter battens should be selected. Wood should not be covered on all sides by diffusion-resistant films, because humidity that has seeped in and is enclosed cannot be guaranteed to dry out. Alternatively, humidity-resistant materials can be used for the counter battens.

1.4 Exclusion of Liability

The information and safety instructions in this manual have been compiled taking into account the currently applicable norms, guidelines and regulations, the latest technology and the long years of experience gathered by Ernst Schweizer AG.

Solar Energy Systems by Schweizer:

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The shipment contents, or the design of the system, can deviate from the descriptions and diagrams specified in this manual because of optional items ordered, manufacture of customised designs or the latest technological changes.

Apart from the contractually agreed obligations, the manufacturer's General Terms and Delivery Conditions apply. These are subject to the laws that were valid at the time when the contract was concluded.

This manual's publication date shall apply. Ernst Schweizer AG reserves the right to make technical changes to the system as part of further development to improve performance characteristics and safety.

Ernst Schweizer AG accepts no liability for damages and accidents arising from the following causes:

- Inappropriate use of the mounting system
- Non-observance of the information and instructions in this manual
- Work carried out on or with the system by non-qualified or unauthorised personnel
- Mounting of non-original spare parts
- Unauthorised modifications

1.5 Warranty Conditions

Please observe the supplier's General Delivery Conditions.

1.6 Customer Service and Product Monitoring

For problems and questions that cannot be solved with the aid of this manual and/or on consultation with the planner, as well as for technical information:

- Please contact the customer service of the module manufacturer or of Ernst Schweizer AG.
Above and beyond customer service, Ernst Schweizer AG is interested in experiences that arise from dealing with the system with the objective of constantly improving the system.
- In the event of problems when dealing with the system, interruptions in operation and any errors that occur, please contact Ernst Schweizer AG using the contact data in the footer.

Solar Energy Systems by Schweizer:

Installation Manual – Safety Requirements.

2. Safety Requirements

2.1 Introduction

This section gives an overview of all major safety aspects to ensure optimum protection of personnel as well as for safe and trouble-free operation.

Non-observance of the instructions and safety and warning notices specified in this manual can lead to considerable dangers.

2.2 Responsibility

As customer/operator:

- Only commission specialist firms which offer guarantees for the professional and safety-oriented execution of the work with the planning of the system and the execution of the installation, maintenance, repair and deinstallation work.

As employer of the firm executing the work:

- Ensure that all work is carried out or supervised by sufficiently qualified specialist personnel, see Chapter „**Qualifications**“ on page 9, i.e. roofing jobs by roofers, AC/DC cabling by electricians.
- Ensure that at least two persons are present on the construction site at all times while work is being conducted.
- Ensure that instructed personnel/assistant personnel was instructed sufficiently on safety-oriented work on the roof and is supervised during the entire work process. Also observe the country-specific accident prevention regulations of the respective trade associations (in Germany: BGV A1 – Principles of Prevention BGV A3 – Electrical Plant and Equipment, BGV C22 – Construction Work).
- Ensure collective protection (scaffoldings, roof guard rails) in accordance with the current regulations (installation of photovoltaic systems on roofs is only permissible with collective protection).
- Ensure
 - that all personnel that carries out work on the photovoltaic system or supervises such work has read and understood this manual,
 - that assistant personnel was instructed sufficiently and is supervised during the entire work process.
- Supply your personnel with personal protective equipment (PPE) in accordance with the current regulations for roof work and enforce the correct use of PPE.
- Before installing the system, ensure that the roof substructure (rafters, roof battens) corresponds to national regulations in terms of both quality and load-bearing capacity.

As the person executing or supervising the work:

- Only tread onto the roof if the conditions for working safely are fulfilled.
- Instruct assisting personnel on all safety-relevant aspects and supervise them during the entire work process.

The employer in the firm executing the work must ensure that the requisite safety measures have been taken to prevent falls.

The system operator must:

- Observe the maintenance intervals stipulated in this manual.

Solar Energy Systems by Schweizer:

Installation Manual – Safety Requirements.

2.3 Personnel Requirements

2.3.1 General Personnel Requirements

Persons are only permissible as personnel if they can execute their work reliably and their reactions are not impaired, e.g. by drugs, alcohol or medication.

When selecting personnel, the local labour law and regulations must be met.

2.3.2 Qualifications



WARNING

Incorrect handling as a result of insufficient qualifications and expertise can lead to considerable damage to persons and property.

Risk of injury through insufficient qualification!

- Only allow personnel qualified for particular tasks to carry out those tasks.
- Keep unqualified personnel away from danger zones.

The following qualifications are stipulated in the operating instructions for various activities:

Specialist Personnel

Because of their specialist training, expertise and experience as well as knowledge of the relevant norms and regulations, specialist personnel are capable of carrying out the work they are enjoined to perform and recognise and avoid possible dangers independently.

Typically, specialist personnel for carrying out work on roof-mounted photovoltaic systems are craftsmen who have completed professional training in the roofing business. Furthermore, the craftsman must also have acquired either an additional qualification for the installation of photovoltaic systems or dispose of many years of experience in the installation of photovoltaic systems.

Electrician

Because of their specialist training, expertise and experience as well as knowledge of the relevant norms and regulations, the electrician is capable of carrying out work on electrical equipment and recognise and avoid possible dangers independently.

The electrician is trained for the specific work location where they are working and knows the relevant guidelines, norms and regulations.

Instructed Person (Helper)

The instructed person (helper) was instructed in a tutorial by the specialist personnel about the tasks he was enjoined to perform and possible dangers in the event of incorrect behaviour.

Solar Energy Systems by Schweizer: Installation Manual – Safety Requirements.

2.3.3 Unauthorised Persons



Unauthorised persons who do not fulfil the requirements described in this manual do not know the dangers of the work area.

Danger of severe injuries!

- Keep unauthorised persons away from the work area.
- In case of doubt, address these persons and instruct them to leave the work area.
- Interrupt all work as long as unauthorised persons remain in the work area.

2.4 Correct Use

This system has been designed solely for the generation of electricity from solar energy and as weather protection.

Solrif® modules are solely designed for in-roof mounting in accordance with this manual.

Correct use also includes observing all the information in this manual.

Every use of the system that exceeds the correct use or every different use of the system or of the Solrif® modules counts as incorrect use and can lead to dangerous situations.

2.4.1 Limit of Application

The system may not be operated in explosive atmospheres or in areas where explosive materials are worked with.

The system may not be installed or operated outside the values stipulated under „**Technical Data/Limit of Application**“ on page 31.

All national and regional regulations concerning to fire hazards must be observed. In Germany this includes VDS 2023 - Electrical plant in construction plants with predominantly flammable materials - Guidelines on damage prevention and DIN 4102 - Fire behaviour of construction materials and components.

2.4.2 Incorrect Use



Explosive atmospheres

Risk of explosion!

- The system is not approved for operation in explosive atmospheres.

ATTENTION

Incorrect use

Risk of damage to property!

- Do not operate the plant outside the values specified in the technical data, see Chapter „**Technical Data/Limit of Application**“ on page 31.

Claims of any nature for damages arising from use other than for that intended are excluded.

Solar Energy Systems by Schweizer:

Installation Manual – Safety Requirements.

2.5 Personal Protective Equipment

Personal protective equipment is required for all work in accordance with current regulations.

As employer of the company executing the work:

- Provide your personnel with personal protective equipment (PPE) in accordance with current regulations for roof work and enforce the correct use of PPE.

2.6 Special Risks

The safety notices specified here and the warning notices in other chapters of this manual must be observed in order to reduce health risks and avoid dangerous situations.

2.6.1 Mechanical Dangers



WARNING

Suspended loads

Mortal danger!

- Never walk underneath suspended loads
- Use only suitable lifting equipment
- Only move loads under supervision
- Set down the load before leaving the workplace



WARNING

Tipping loads

Danger of severe injuries!

- Always secure construction components sufficiently against tipping
- Use only suitable lifting equipment
- Only move loads under supervision

2.6.2 Dangers from Electricity



DANGER

Touching live parts

Damaging the cable insulation

Damaging modules

Mortal danger!

- In the event of damage to the insulation, switch off the current supply immediately and instigate repairs.
- Only allow electricians to carry out work on the electrical system, see „**Personnel Requirements**“ on **page 9**
- Observe the current regulations at the installation location.
- If modules are damaged: Contact the supplier of the modules.

Solar Energy Systems by Schweizer: Installation Manual – Safety Requirements.



DANGER

Electric arcs when disconnecting cables under load

Mortal danger!

- Do not connect or disconnect any cables if they are generating electricity.

2.6.3 Dangers in the Work Area



WARNING

Falls due to working without personal protective equipment against falls (PPEAF)

Mortal danger!

The installation of the photovoltaic system is only permitted with collective protection. However, certain work may also be carried out before the installation with PPEAF (checking the existing building and roof structure, taking measurements), and likewise maintenance work on the installed photovoltaic system.

When work is carried out using PPEAF:

- Only allow personnel who are trained in its use to carry out work using PPEAF.
- Only use regulation PPEAF including energy absorbers in the lanyard.
- Permit no personnel to work alone using PPEAF
- The persons present in the workplace must always be able to rescue persons using PPEAF with their own equipment (even hanging for only a few minutes in the safety harness carries the risk of permanent injury!).
- Installation work is only permissible with collective protection (scaffoldings, roof guard rails) in accordance with local regulations.



WARNING

Falls from insufficiently secured roofs

Mortal danger!

- Installation work is only permissible with collective protection (scaffoldings, roof guard rails) in accordance with local regulations.



CAUTION

Slipping on damp roofs that are covered with algae, moss or soiled by other means

Danger of injury!

- Before treading on roofs that are covered with dew, allow them to dry off
- Descend immediately from roofs that are soiled if it starts to rain



CAUTION

Insufficient lighting in the work area

Danger of injury!

- Do not work in the dark

Solar Energy Systems by Schweizer:

Installation Manual – Safety Requirements.



WARNING

Dirt and objects left lying around can cause people to trip.

Danger of severe injuries!

- Always keep the work area clean
- Remove objects that are no longer required
- Mark obstacles that could cause people to trip with yellow and black marking tape

2.6.4 Dangers from Explosive Atmospheres



WARNING

Explosive atmospheres

Risk of explosion!

- The system is not approved for operation in explosive atmospheres.

2.7 Behaviour in Danger and Accident Situations

2.7.1 Preventative Measures

- Always be prepared for accidents or fire
- Keep first-aid equipment (first-aid box, covers, etc.) and fire extinguishers to hand
- Familiarise personnel with accident reporting, first-aid and rescue equipment
- Keep access routes clear for emergency vehicles

2.7.2 Accident Measures

- Start administering first aid
- Rescue people from the danger zone
- Inform those responsible at the building site
- Alert emergency services
- Clear access routes for emergency vehicles

2.8 Symbols and Pictograms



WARNING

Soiled, covered, damaged or lacking stickers and signs

Danger of severe injuries!

- All safety, warning and operating notices must always be kept in legible condition.
- Replace damaged signs or stickers immediately.
- Never cover or block the view of safety, warning or operating notices.

In some cases, there are pictograms on the machine. They refer to the immediate vicinity of where they have been affixed and indicate dangers or measures to be taken.



The following pictograms are affixed to the system:

Warning of hazardous electrical current.

The pictogram is located on components that could be live.

There is a risk of electric shock.

Solar Energy Systems by Schweizer: Installation Manual – Description of the Solrif® System.

3. Installation Manual – Description of the Solrif® System

3.1 Overview

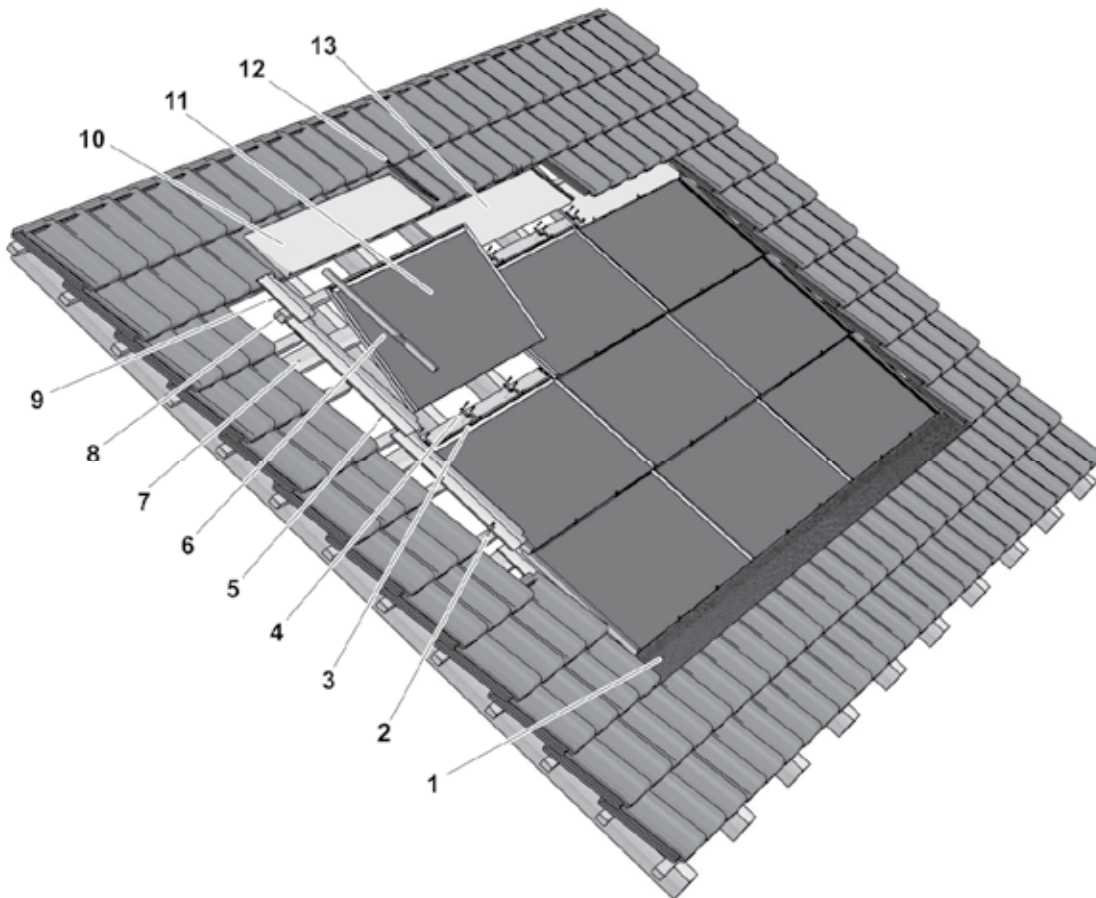


Fig. 1: Overview

| | |
|----|--|
| 1 | Lead flashing, wedge plank, sealing tape strip |
| 2 | Fixing for flashing |
| 3 | Mounting Clamp (Profile/Glass) |
| 4 | Wood screws with pan head 4.5×35 |
| 5 | Flashing side left |
| 6 | Flashing profile left |
| 7 | Solrif® batten 120×30 mm ² |
| 8 | Tiling battens |
| 9 | Flashing side top left |
| 10 | Flashing top left |
| 11 | Photovoltaic module with Solrif® frame |
| 12 | Protective profile |
| 13 | Flashing top middle |

Solar Energy Systems by Schweizer:

Installation Manual – Description of the Solrif® System.

3.2 Components

NOTICE

Measurements that are taken from the left-hand edge of the PV array towards the right, meaning horizontally, parallel to the eaves or to the roof ridge, will henceforth be referred to as "width."

Measurements that are taken from the eaves towards the roof ridge, parallel to the verge, will henceforth be referred to as "height."

Measurements that are taken perpendicular to the roof surface will be referred to as "thickness."

The largest measurement of a component before installation will be referred to as "length" irrespective of its orientation after installation.

These descriptions can deviate from those in your supplier's data sheet, for example, the measurement of the longer side of the module can be described as "length" and that of the shorter side as "width," irrespective of the module's orientation after installation.

3.2.1 Solrif®-Framed Photovoltaic Modules

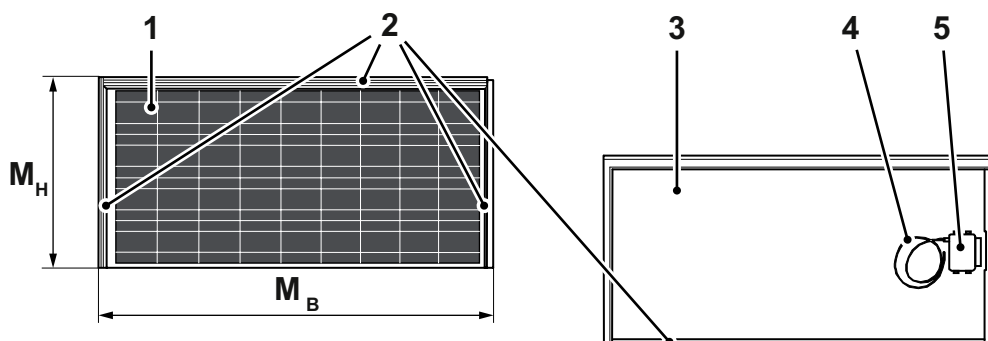


Fig. 2: Module Overview

| | |
|---|-----------------------------------|
| 1 | Laminate |
| 2 | Solrif® frame profiles |
| 3 | Backsheet or glass |
| 4 | Connection cables with connectors |
| 5 | Junction box |

Solrif®-framed photovoltaic modules comprise standard laminates that are fitted with the special Solrif® profile frames and glued to be watertight.

The frames of modules placed side by side interlock. The modules that are installed above overlap the modules below them (like roof tiles). A rubber lip in the upper profile seals between the two modules. Thus the photovoltaic modules form the water-proofing layer on the roof.

Hence for roof slopes > 10°, rainproof integration into the roofing is possible in accordance to ZVDH regulations (Central German Roofing Industry Association).

– Only use a single type of photovoltaic module within one PV array.

NOTICE

You will find the measurements of the modules supplied in the data sheet enclosed with the modules.

Solar Energy Systems by Schweizer: Installation Manual – Description of the Solrif® System.

3.2.2 Dimension of PV Array and Module Mounting Pitches

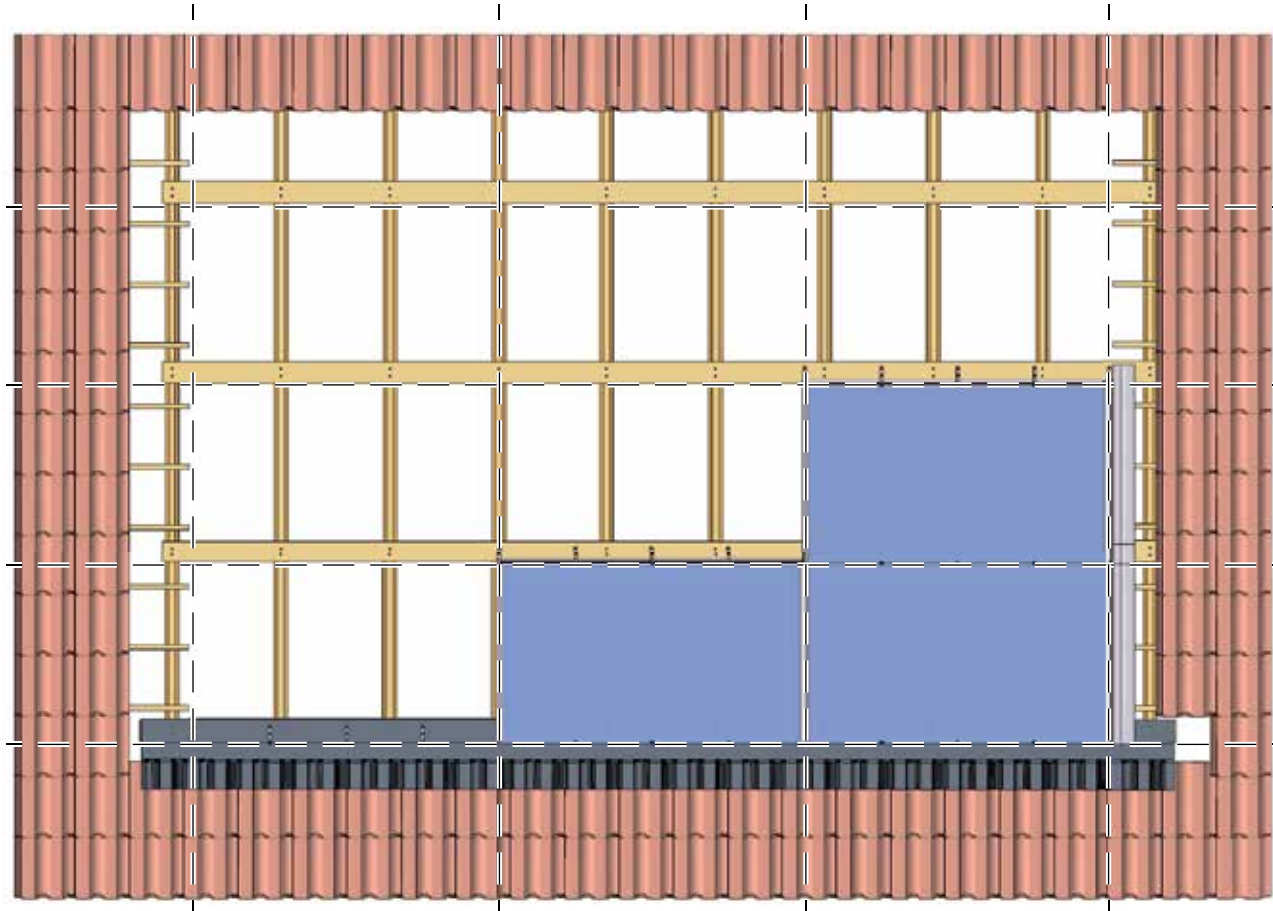


Fig. 3: Layout of the module pitch (3 modules inserted)

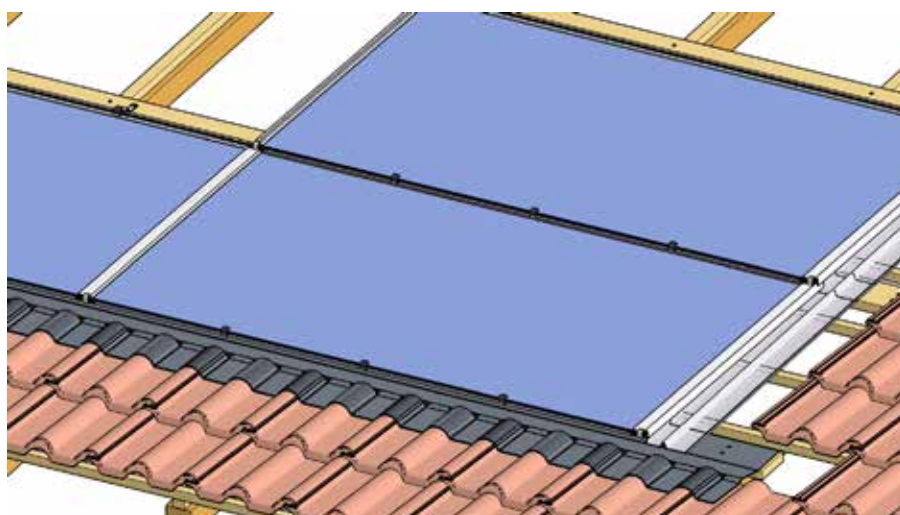


Fig. 4: Details

Solar Energy Systems by Schweizer:

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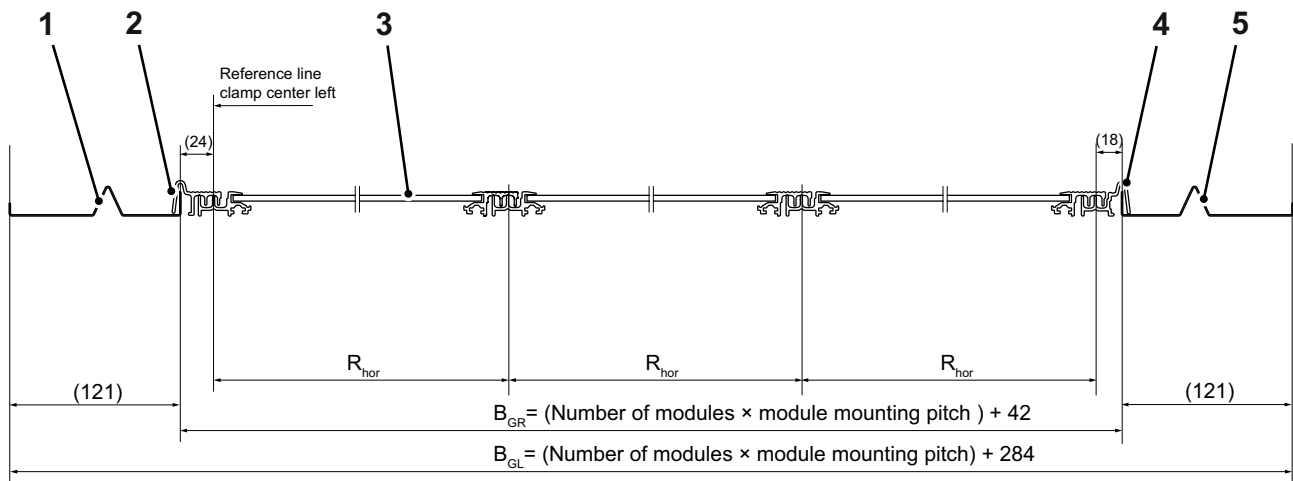


Fig. 5: Horizontal cross-section

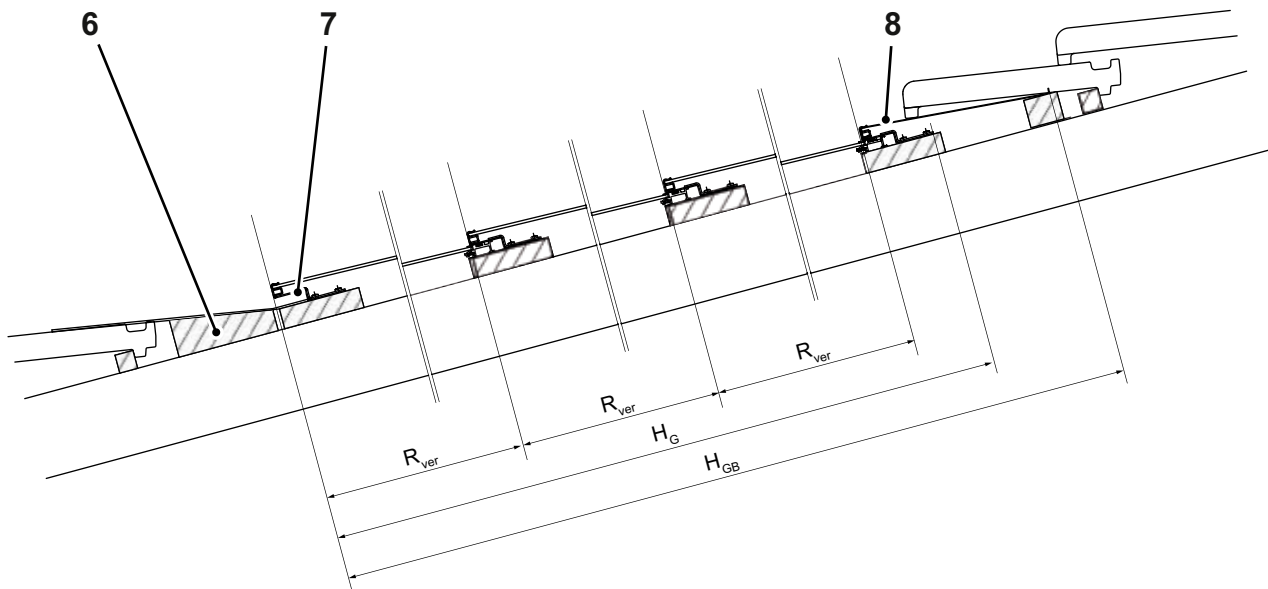


Fig. 6: Vertical cross-section

| | | |
|-------|----------------------------------|--------------|
| 1 | Flashing side left | |
| 2 | Flashing profile left | |
| 3 | Module | |
| 4 | Flashing profile right | |
| 5 | Flashing side right | |
| 6 | Wedge plank | |
| 7 | Mounting Clamp Profile | |
| 8 | Flashing top | |
| L_B | Width of the laminate | |
| L_H | Height of the laminate | |
| M_B | Width of a single framed module | $= L_B + 50$ |
| M_H | Height of a single framed module | $= L_H + 32$ |

Solar Energy Systems by Schweizer:

Installation Manual – Description of the Solrif® System.

| | | |
|-----------|---|------------------------------------|
| R_{hor} | Horizontal module mounting pitch (distance of any reference point on the module to the same point on the module mounted beside it to the right or left) | $= M_B - 18$ |
| R_{ver} | Vertical module mounting pitch (distance of any reference point on the module to the same point on the module mounted above or below it) | $= M_H - 32$ |
| N_{hor} | Number of modules laid out side by side in the PV array | |
| N_{ver} | Number of modules laid out above each other in the PV array | |
| B_{GR} | Width of the PV array between the flashing sides | $= (N_{hor} \times R_{hor}) + 42$ |
| B_{GL} | Width of the PV array including the flashing sides | $= (N_{hor} \times R_{hor}) + 284$ |
| H_G | Height of the PV array between the lower edge of the bottom mounting clamp and the upper edge of the top mounting clamp | $= (N_{ver} \times R_{ver}) + 104$ |
| H_{GB} | Height of the PV array between the lower edge of the bottom mounting clamp and the upper edge of the flashing tops | $= (N_{ver} \times R_{ver}) + 283$ |

3.2.3 Substructure

Solrif® battens measuring 120 mm × 30 mm are used as a substructure, which are screwed onto the existing roof construction instead of or in-between the roof battens to which the tiles were attached.

Minimum requirements for wood quality: Strength category C24



NOTICE

Plan an extra 10 % for cutting losses compared to the batten plan.

In addition, keep some spare wood to hand to equalize out any unevenness in the roof construction or to be able to implement connections or linings.

A wedge plank is necessary for the bottom gutter of the PV array, see Chapter „Wedge Plank“ on page 24.

The bottom row of Solrif® battens must extend beyond the flashing sides by at least 150 mm respectively as an overlay for the lead flashing, i. e. the length of the bottom row of Solrif® battens must be at least $B_{GL} + 300$ mm.

All other rows of Solrif® battens must extend beyond the flashing sides by at least 50 mm respectively, i. e. the length of the other rows of Solrif® battens must be at least $B_{GL} + 100$ mm respectively.

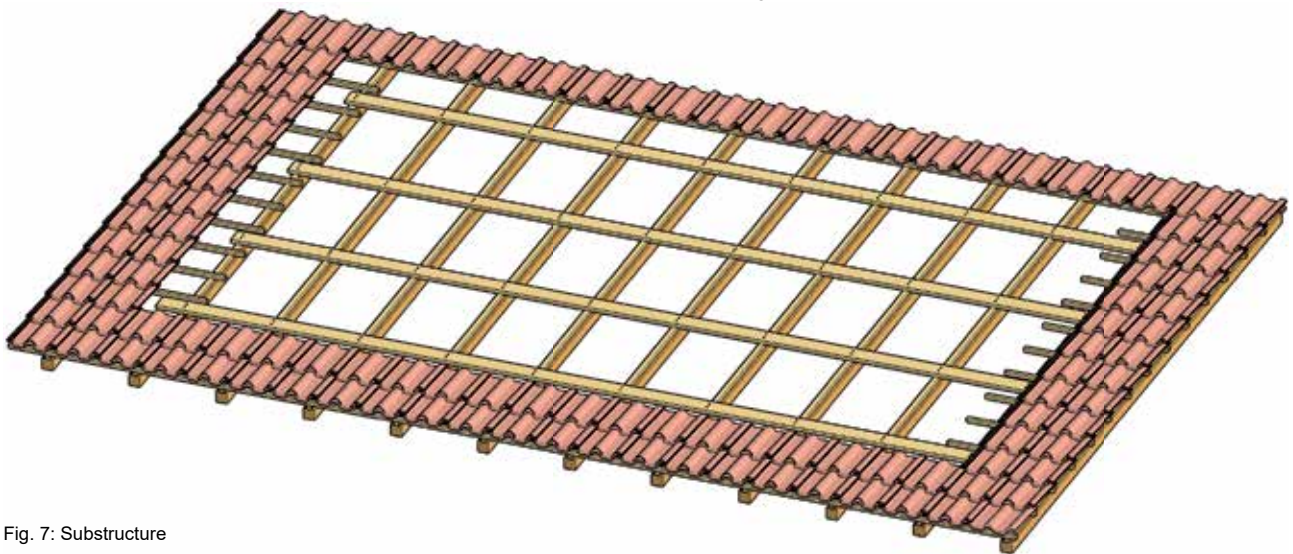


Fig. 7: Substructure

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Installation Manual – Description of the Solrif® System.

3.2.4 Mounting Clamps

Solrif® framed modules are attached to the substructure with mounting clamps. There are three different types of clamps:

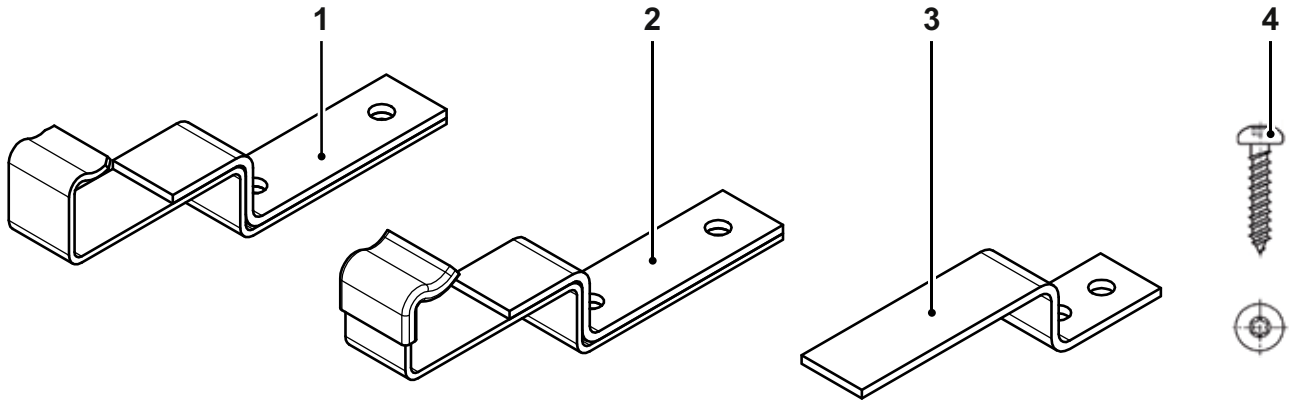


Fig. 8: Mounting clamps

| | | Art.No. | Application |
|---|--|-------------------------|--|
| 1 | Mounting Clamp Profile - raw, 1.4310 - black/browned, 1.4310 - raw seawater-resistant, 1.4404 | 13318 06497 13995 | fastens overlapping modules in the area of the profiles left/right or flashing tops; always required |
| 2 | Mounting Clamp Glass with protective shrink tubing - raw, 1.4310 - black/browned, 1.4310 - raw seawater-resistant, 1.4404 | 13319 06500 13996 | fastens overlapping modules in the area of the open glass edge; number according to structural analysis requirements |
| 3 | Mounting Clamp Top - raw, 1.4310 - raw seawater-resistant, 1.4404 | 33954 13997 | for fastening the top row of modules when not using regular flashings top |
| 4 | Wood screw with pan head 4.5×35 SST, with general building inspectorate approval ETA/DIBt (countersunk bolts may not be used) | 61831 | |



NOTICE

Danger of confusion!

- Please be aware that the different types of clamps must be used positioned and in quantities as required according to the roof plan.

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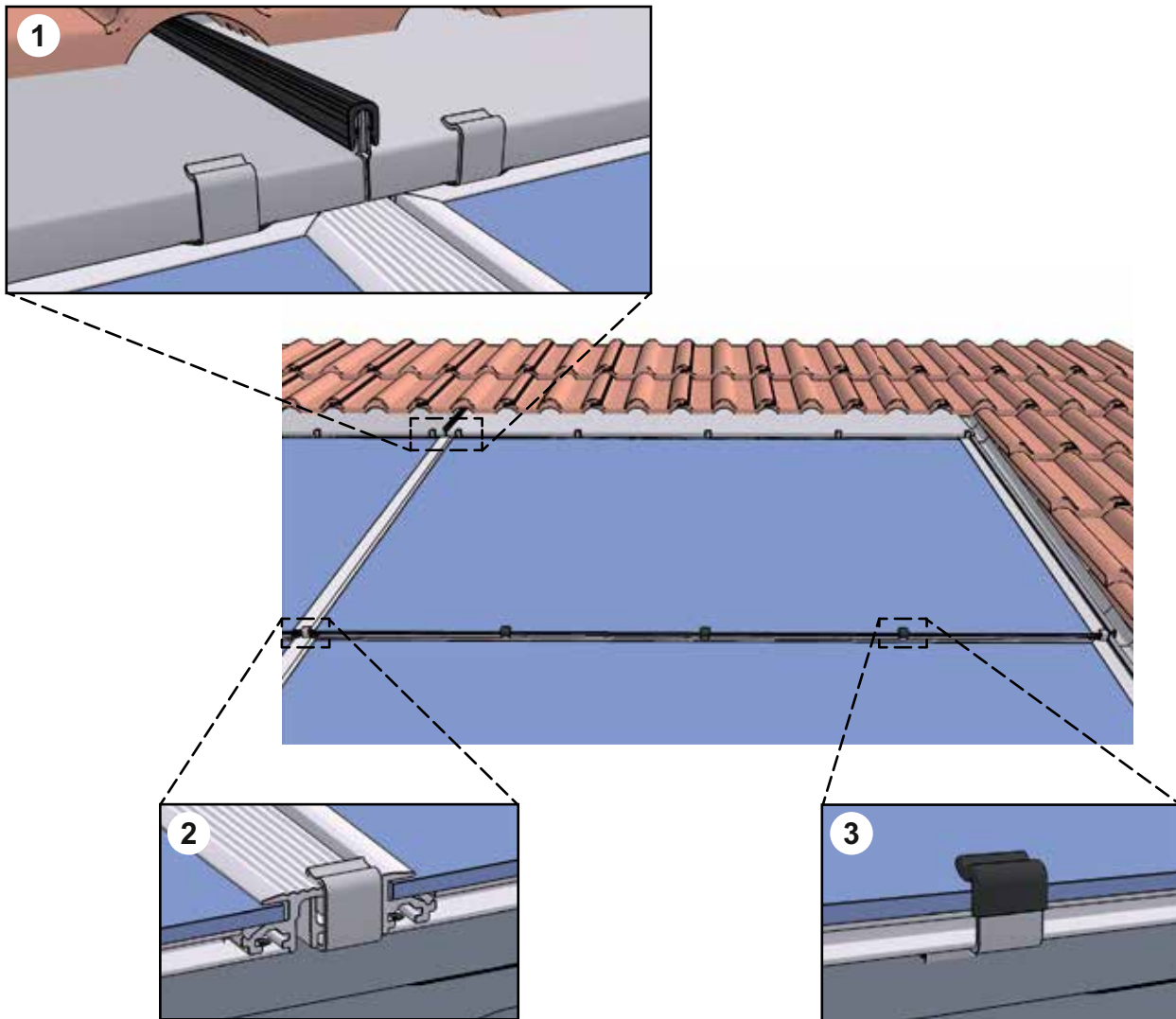


Fig. 9: Mounting clamps mounted

| | |
|---|--|
| 1 | Mounting Clamp Profile mounted with the flashing tops |
| 2 | Mounting Clamp Profile for securing the module overlap or the overlap with flashing profiles |
| 3 | Mounting Clamp Glass for securing the bottom module edge |

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3.2.5 Flashing Profiles

Flashing profiles form a rainproof transition from the modules to the flashing sides.

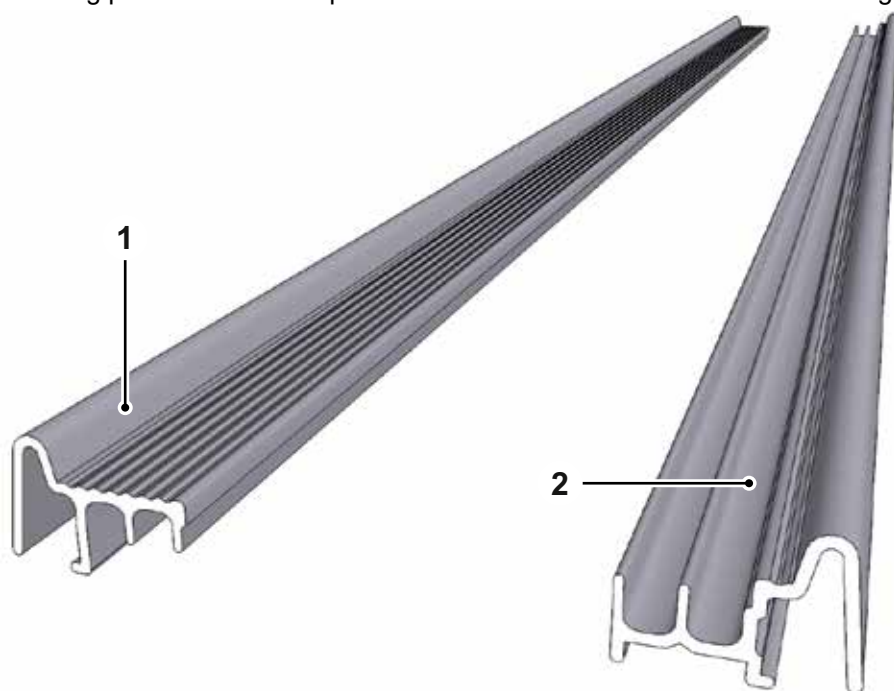


Fig. 10: Flashing profiles

| | |
|---|------------------------|
| 1 | Flashing profile left |
| 2 | Flashing profile right |

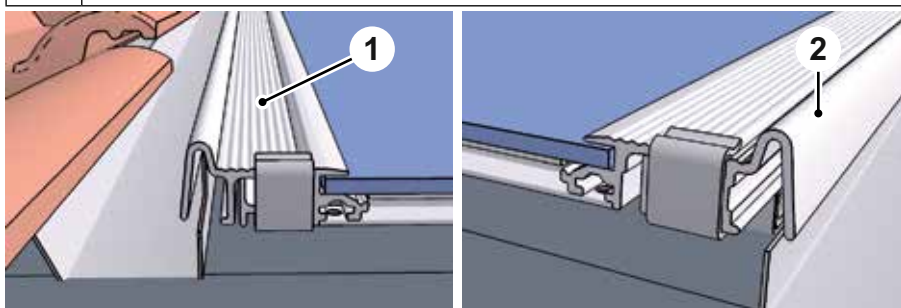


Fig. 11: Flashing profiles mounted

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3.2.6 Side Flashings

The flashing sides create a link between flashing profiles and roof tiles. The flashing tops ensure a transition between the top module edge and the row of tiles that lies above it. They are designed in such a way that they are suitable for many conventional types of roof tiles. In the event of other requirements (e. g. tiling battens and Solrif® battens at different levels, special types of tiles, like slate, etc.) please contact the Solrif® manufacturer.

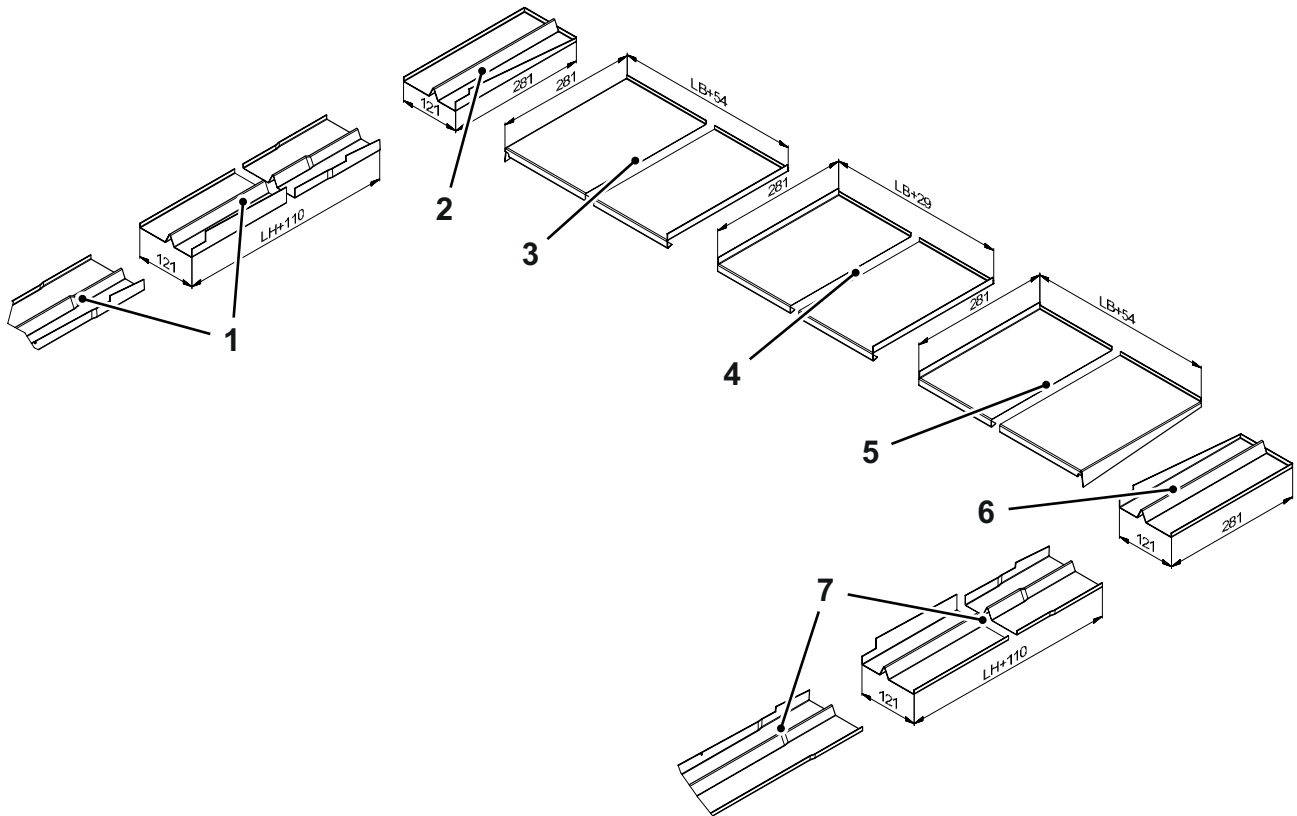


Fig. 12: Side flashings

| | | Measurements height × width L_H = laminate height, L_B = laminate width |
|---|-------------------------|--|
| 1 | Flashing side left | $(L_H + 110) \times 121$ |
| 2 | Flashing side top left | 281×121 |
| 3 | Flashing top left | $281 \times (L_B + 54)$ |
| 4 | Flashing top middle | $281 \times (L_B + 32)$ |
| 5 | Flashing top right | $281 \times (L_B + 54)$ |
| 6 | Flashing side top right | 281×121 |
| 7 | Flashing side right | $(L_H + 110) \times 121$ |

NOTICE

When using side flashings other than the original Solrif® side flashings, it must be checked whether galvanic separation is necessary.

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3.2.7 Bottom of PV-Array: Lead Flashing, Wedge Plank, Sealing Tape Strip

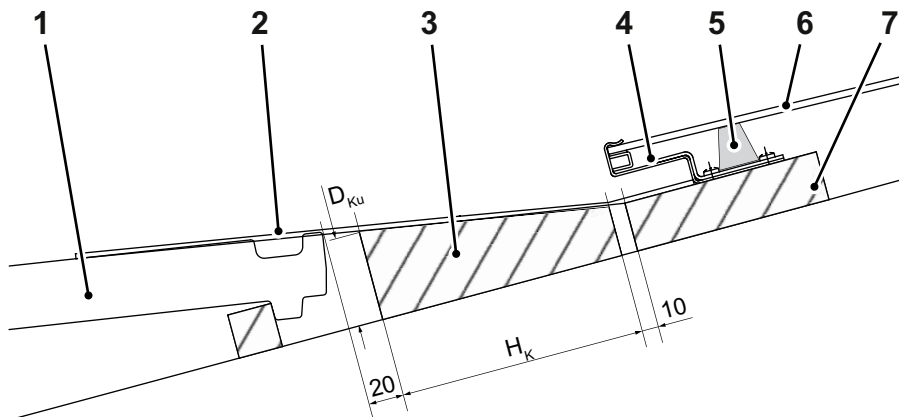


Fig. 13: Bottom gutter

| | |
|----------|--|
| 1 | Roof tile |
| 2 | Lead flashing |
| 3 | Wedge plank |
| 4 | Mounting clamps |
| 5 | Sealing tape strip |
| 6 | Solrif® module |
| 7 | Solrif® batten |
| D_{Ku} | Thickness of the wedge plank at the bottom |
| H_K | Height of the wedge plank |

The modules can be mounted either down to the eaves or with tile roofing between PV array and eaves. Observe the tech note about the application limits (snow loads) in the instruction sheet under your customer login at www.ernstschweizer.ch.

When tile roofing is used between PV array and eaves, the transition should be executed using lead flashing and wedge plank.

3.2.7.1 Lead Flashing

For the transition from the bottom edge of the array to the tiles, lead flashing is used as is customary for other roof inserts, for example skylights (lead foil roll 300 mm or black aluminium Mage Flex flashing tape 280 mm or 450 mm available as accessories, roll length 5 m or 7.5 m). The required height of the lead flashing depends on the roof slope and the tile arch and must be determined in combination with the height of the wedge plank, see Chapter „**Wedge Plank**“ on page 24.

NOTICE

If the lead flashing is to be comprised of several sections of Mage Flex flashing tape, the sections must overlap by at least 100 mm.

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3.2.7.2 Wedge Plank

The wedge plank is mounted underneath the bottom Solrif® batten. It supports the lead flashing, ensuring that no trough forms in the lead flashing and thus no water can remain there.

Minimum requirements for wood quality: Strength category C24

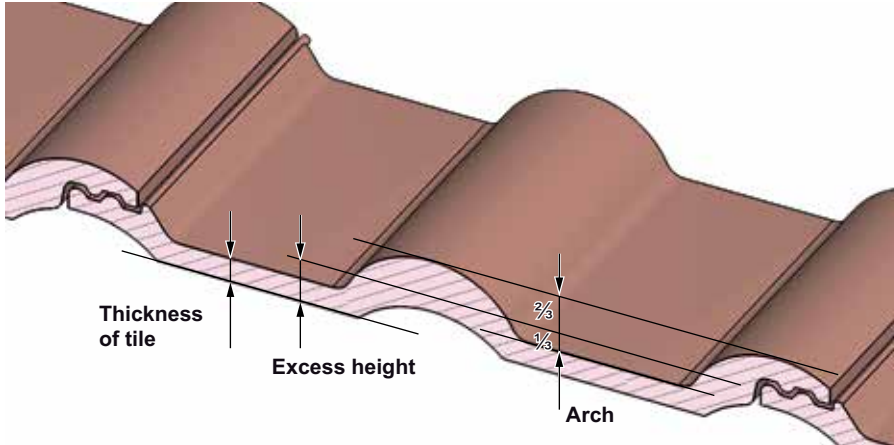


Fig. 14: Excess height

Excess height = approx. $\frac{1}{3}$ arch + thickness of tile

| Roof slope | Excess height ~20 mm | | Excess height ~40 mm | |
|------------|----------------------|----------|----------------------|----------|
| | H_k | D_{Ku} | H_k | D_{Ku} |
| 10° | 145 mm | 50 mm | 300 mm | 70 mm |
| 15° | 75 mm | 45 mm | 170 mm | 65 mm |
| 20° | 45 mm | 45 mm | 110 mm | 65 mm |
| 25° | 30 mm | 40 mm | 80 mm | 60 mm |
| 30° | 20 mm | 40 mm | 60 mm | 60 mm |
| 35° | 10 mm | 40 mm | 45 mm | 60 mm |
| 40° | 10 mm | 35 mm | 30 mm | 55 mm |

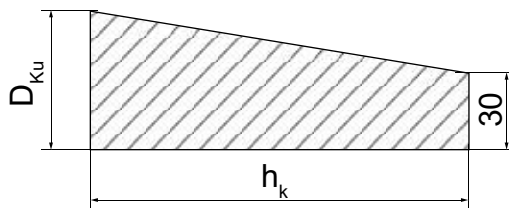


Fig. 15: Measurements of the wedge plank

The length of the wedge plank corresponds to the width of the PV array including the flashing sides (B_{GL}).

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3.2.7.3 Sealing Tape Strip

The sealing tape strip is mounted onto the lead flashing to close the gap underneath the bottom row of clamps against small animals.

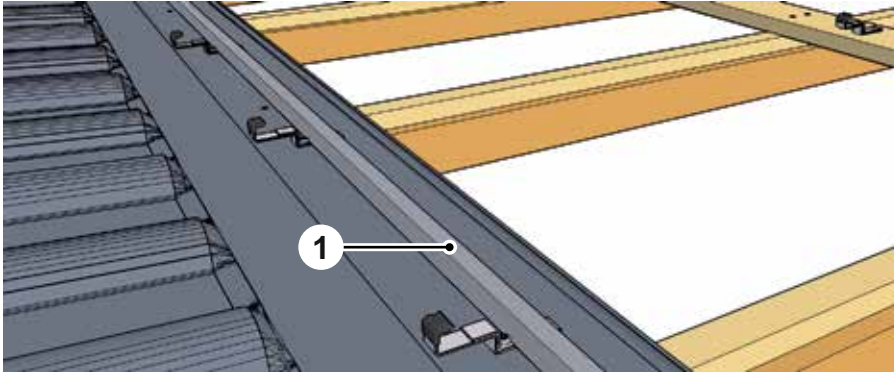


Fig. 16: Sealing tape strip

| | |
|---|--------------------|
| 1 | Sealing tape strip |
|---|--------------------|

3.2.8 Connection Cables, Cable Strings

- Use connection cables and cable strings which fulfil the following requirements:
 - made of flexible copper wire
 - double insulation, suitable for in-roof installation, meets protection class II (SCII) and IEC 61730
 - heat resistant up to at least 90 °C
 - has dimensions in accordance with the regulations at the place of installation
- Follow the directions for the division of the PV array into strings and the resulting position of connection cables and cable strings in the module pitch plan or string plan which was drawn up by the system planner.
- When the modules are arranged in a series connection, ensure that the maximum permissible system voltage is not exceeded.
- When the modules are arranged in a parallel connection, ensure that every row is fused with its own fuse.
- Observe the instructions of the module manufacturer and of the system planner.

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3.2.9 Grounding and Lightning Protection



NOTICE

The national and local requirements regarding grounding and lightning protection must be observed.

In Germany:

- VDE-AR-N 4105:2011-08 Power generation systems on the low-voltage grid, minimum technical requirements for connection and parallel operation of power generation systems on the low-voltage grid
- TAB - Technical connection requirements for connection to the low-voltage grid of the energy supply companies
- VDE-AR-N 4102:2012-04 Outdoor connection cabinets on the low-voltage grid of the general electricity supply grid
- VDE-AR-N 4101:2011-08 Requirements for meter panels in electrical systems on the low-voltage grid
- DIN VDE 0100 (Part 712) - Installing low-voltage systems
- DIN EN 62305 - Lightning protection
- DIN VDE 0184 Part 1-47 - Lightning protection
- DIN VDE 0105 - Operating electrical systems
- DIN VDE 0298 - Electrical cables
- DIN 18015 - Planning and installing electrical installations in residential buildings

Solar Energy Systems by Schweizer:

Installation Manual – Description of the Solrif® System.

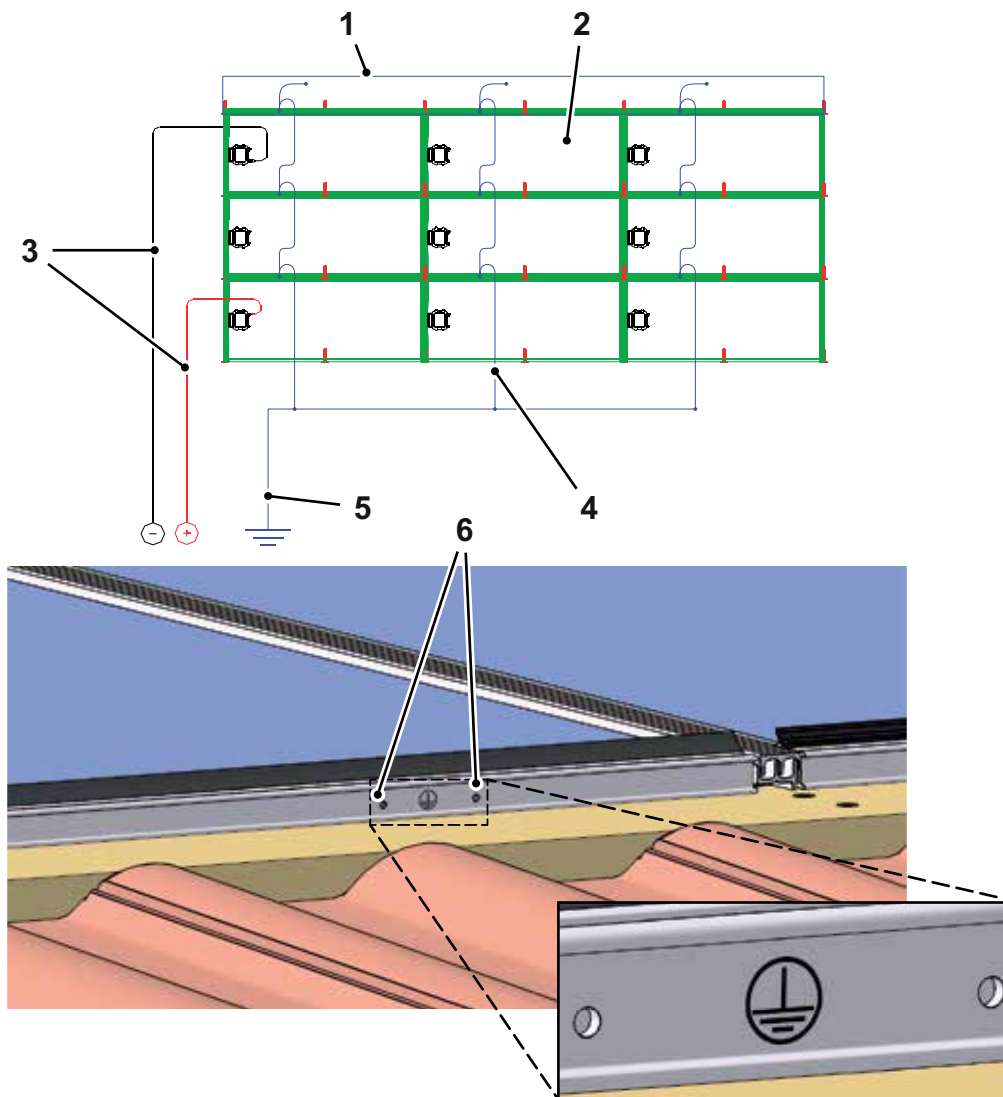


Fig. 17: Drilling work for grounding

| | |
|---|---|
| 1 | Flashing top |
| 2 | Module |
| 3 | Cable strings |
| 4 | Grounding cables within a grounding string |
| 5 | Grounding cables between array and household fuse box |
| 6 | Holes (\varnothing 3.3 mm) for grounding (view onto top module edge) |

WARNING

Electrical voltage from capacitive loading.

Danger of electric shock!

- Observe the tech note regarding grounding and lightning protection under your customer login at www.ernstschweizer.ch.

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Installation Manual – Description of the Solrif® System.

Grounding is recommended as a general rule to prevent electrical voltages from fault current or capacitive loading.

Grounding is generally not required if the entire direct current side is implemented according to protection class II AND the inverter is galvanically isolated.

In the following cases, grounding is absolutely necessary:

- Transformerless inverter
- Existing lightning protection system where the separation distance has not been maintained
- Implementation of the grounding pursuant to DIN VDE 0100 (Part 410) or the equivalent national regulations.

The cable cross-sections required vary from country to country.

In Switzerland, at the juncture when this installation manual was published, the following minimum cable cross-sections apply:

| | |
|---|-----------------------------|
| Grounding cables within a grounding string | Copper 10 mm ² |
| Grounding cables from array to household fuse box 40 A | Copper 10 mm ² * |
| Grounding cables from array to household fuse box 125 ... 160 A | Copper 16 mm ² * |
| Grounding cables from array to household fuse box 200 A | Copper 25 mm ² * |

* alternative: Connection to cable conduit

3.2.9.1 Lightning Protection

A photovoltaic system does not affect whether lightning protection is necessary or not, i.e. a roof without a photovoltaic system which does not have to be fitted with lightning protection does not need lightning protection even with a photovoltaic system.

If lightning protection exists, the photovoltaic system must be integrated into the lightning protection pursuant to the local regulations. You will find further details in the tech note under your customer login at www.ernstschweizer.ch.

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3.2.10 Mounting Screws for Solrif® Battens

To mount the Solrif® battens to the counter battens, 2 wood screws with general building inspectorate approval in accordance with roofing standards are required for each intersection of a Solrif® batten and counter batten:

| | |
|----------------------------|---|
| Diameter | 5 mm |
| Length: | Thickness of the counter batten + 60 mm |
| Permissible shape of head: | Countersunk |

3.2.11 Other Accessories

3.2.11.1 Fixing for Flashing

Fixing for flashing is used to mount the side flashing onto the Solrif® battens or tiling battens.

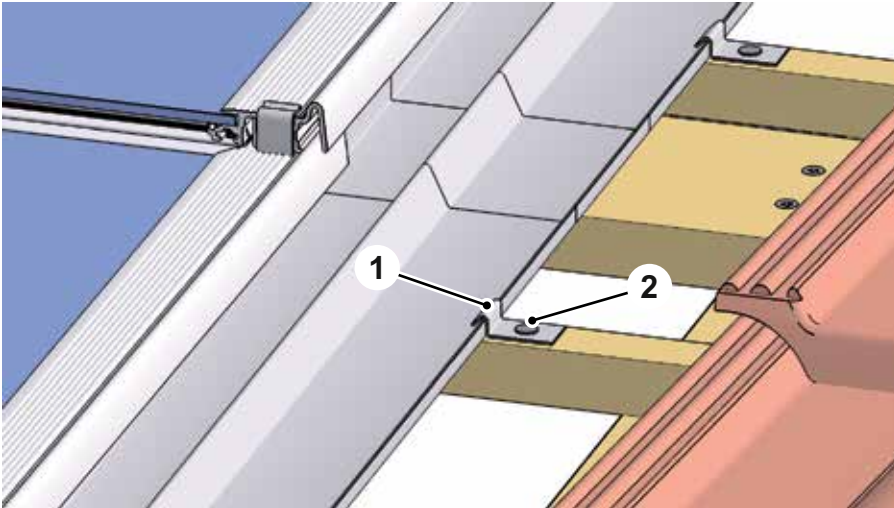


Fig. 18: Fixing for flashing on flashing sides

| | |
|---|------------------------|
| 1 | Fixing for flashing |
| 2 | Clout nail 2.5 × 25 mm |

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Installation Manual – Description of the Solrif® System.

3.2.11.2 Protective Profiles

Protective profiles are used to connect flashing tops, see Chapter „Side Flashings“ on page 22.

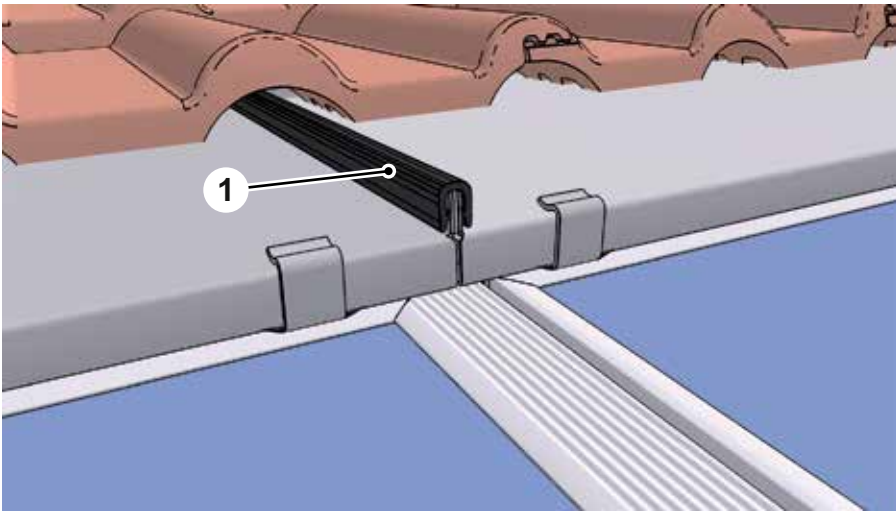


Fig. 19: Protective profile (view onto top edge of array)

| | |
|---|--------------------|
| 1 | Protective profile |
|---|--------------------|

3.2.11.3 L-Section to Support the Bottom Row of Mounting Clamps

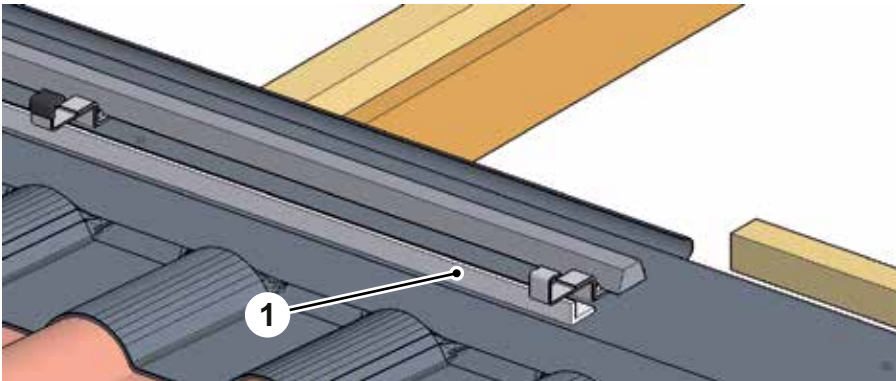


Fig. 20: L-section

| | |
|---|-----------|
| 1 | L-section |
|---|-----------|

In elevated snow load conditions (> 2,400 Pa) the bottom row of mounting clamps must be supported (to be provided by the customer: e. g. using a 16 mm aluminium L-section, a piece of wood or similar).

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Installation Manual – Description of the Solrif® System.

3.3 Technical Data/Limit of Application

| | |
|--|---|
| Measurements/Weight of the Modules | see the module manufacturer's data sheet |
| Max. snow load | 5,400 N/m ² **, structural design must be observed (proSOLRIF design software at www.ernstschweizer.ch for calculating the number of mounting clamps required per module.) |
| Max. wind load (suction) | 2,400 N/m ² **, structural design must be observed (proSOLRIF design software at www.ernstschweizer.ch for calculating the number of mounting clamps required per module.) |
| Substructure | Requirements according to the effects (wind and snow loads) on the supporting structures and taking into account the planned implementation of the PV array (Germany: DIN 1055-4 Wind loads, DIN 1055-5 – Snow and ice loads, EN 1991-1-3 – Snow loads (Eurocode 1), EN 1991-1-4 – Wind loads (Eurocode 1)) |
| Acceptable deviation from the flatness of the substructure | 0.5 % (5 mm per meter) |
| Acceptable roof slope where there is a rainproof roof underlay (see „Glossary“ on page 6) | 22 ... 65° * |
| Acceptable roof slope where there is a watertight roof underlay (see „Glossary“ on page 6) | 10 ... 65° * |
| Min. permissible distance to the coast when using non-salt-water-resistant mounting clamps | 3 km ** |
| Min. permissible distance to the coast when using salt-water-resistant mounting clamps | 50 m ** |
| <p>* With roof slopes below 32°, drainage of the roof underlay into the rain gutter must be ensured.</p> <p>** Please also observe the limit of application stipulated by the module manufacturer or the system planner.</p> <p>In the case of renovation, the characteristics of the roof underlay foil on roof slopes < 32° must be checked for conformity with the above-mentioned requirements and replaced if necessary.</p> | |

Solar Energy Systems by Schweizer: Installation Manual – Transportation.

4. Transportation

4.1 Transportation in Packaging

Depending on the supplier, the modules can be packaged differently.

- Please observe the personnel requirements pursuant to Chapter „Qualifications“ on page 9.
- Please observe the handling instructions on the packaging.

4.2 Transportation of Individual Modules

ATTENTION

Unprotected glass rim on the lower edge of the module.

Risk of damage to module!

- Do not set the module down on its glass rim.
-
- Leave the module in its original packaging until immediately prior to insertion into the PV array.
 - Never hold or carry the module under any circumstances by its connection cables or junction box.

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5. Installation

5.1 Checking the Requirements

5.1.1 Roof Plan and String Plan

Ensure that a roof plan and a string plan are supplied which contain at least the following information:

- Description of the system as well as of the snow and wind load assumed for the system
- Positioning of the PV array within the roof area
- Positioning, number and type of mounting clamps
- Specification of all module mounting pitches measured from a reference point
- Division of the PV array into strings
- Grounding and lightning protection cables

5.1.2 Limit of Application



WARNING

Deviation in the actual conditions from the values used in the planning.

Mortal danger!

- Check that the limit of application is observed and that the parameters stated in the planning documentation (location, roof slope, building height, wind and snow load zone) correspond to the current building, see also Chapter „**Technical Data/Limit of Application**“ on page 31.

- Ensure that the roof underlay is sufficient in relation to the roof slope for the requirements regarding rain-proofing or watertightness.
- Observe the local customary rules of the roofing industry or country-specific regulations regarding rear ventilation.

5.1.3 Work Safety

- Ensure that the roof is secured with collective protection (scaffoldings, roof guard rails) in accordance with the local regulations.
- Ensure that all personnel is equipped with personal protection equipment (PPE) in accordance with the local regulations and uses this correctly.
- Ensure that assistant personnel is instructed sufficiently and is supervised during the entire work process.

5.1.4 Checking the Shipment Contents

ATTENTION

Combining different manufacturers' connectors

Danger of malfunction!

- Ensure that connectors of the same type from the same manufacturer are used on all modules.
- Ensure that connectors of the same type from the same manufacturer are used for connection cables and cable strings, like on the modules.
- Do not establish any connections using components from different manufacturers or of different types, even if these appear to be compatible.

- Check that the material delivered is complete.

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- Ensure that the Solrif® battens have a cross-section of 120 mm × 30 mm and that all types of coniferous wood at least pass the strength category C24.
- Ensure that two wood screws with general building inspectorate approval (ETA) of type 5×120/6 are used for mounting each of the Solrif® battens.
- Ensure that 4.5×35 SST wood screws with pan heads are used for fastening the mounting clamps. The use of countersunk bolts is not permissible.

5.2 Tools

- Cordless screwdriver with T25 bit
- Disk grinder
- Screwdrivers of various sizes
- Carpenter's hammer
- Wood saw
- Twine, e. g. chalk line
- Tape measure
- Folding yardstick
- Aiming stake
- Carpenter's pencil
- Recommended: Solrif® mounting gauge (gauge for easy positioning of the mounting clamps, matching the module used; see also further information under your customer login at www.ernstschweizer.ch)

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5.3 Mounting

5.3.1 Preparing the Roof

In order to have to cut as few tiles as possible, the PV array should be measured such that only the tiles on one side of the transition (in the case described on the right-hand side of the PV array, depending on the shape of the tiles) have to be cut to fit.

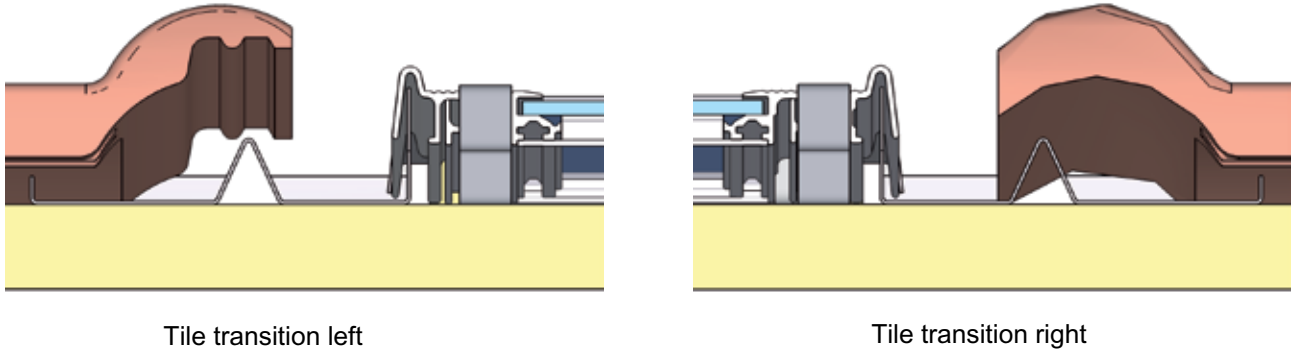


Fig. 21: Tile transition

1. Remove the tiles according to the roof plan and calculated size of the PV array plus one or two rows of tiles at the bottom (depending on the roof slope and the height of the tile) and one tile column on each side, to the left and right of the PV array.

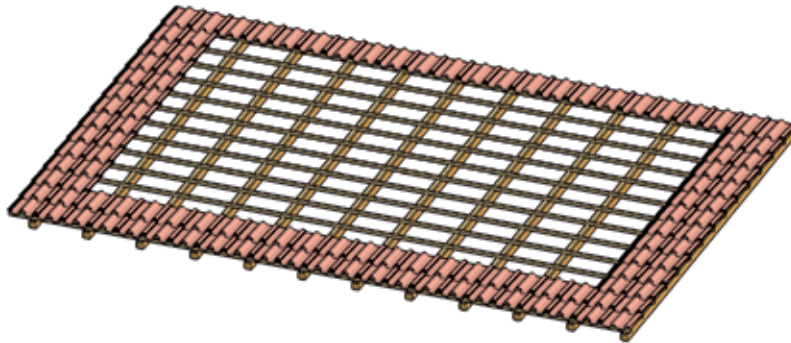


Fig. 22: Removed tiles

To avoid collision with junction boxes:

2. Remove the tiling battens in the area of the PV array, but not from the flashing sides.

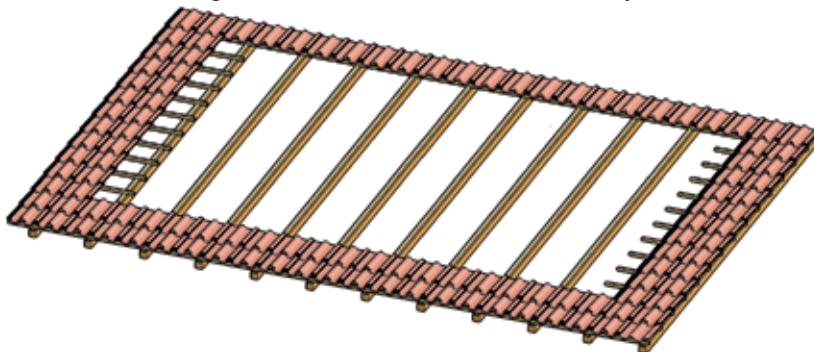


Fig. 23: Removed tiling battens

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5.3.1.1 Checking and Correcting the Evenness of the Roof

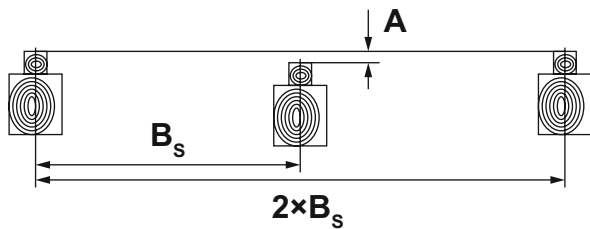


Fig. 24: Cross section of rafters and counter battens

1. Check whether the roof fulfils the following requirements across the entire PV array:

$$A \leq 1 \text{ cm}$$

$$A / (2 \times B_s) \leq 0.5 \%$$

If the requirements are not fulfilled:

2. Even out the troughs by nailing on pieces of wood (shifts).

5.3.2 Calibrating and Placing the Substructure

"Calibrating" is the fitting and alignment of the PV array within the remaining roofing. For definitions of the individual measurements, see Chapter „**Dimension of PV Array and Module Mounting Pitches**“ on page 16, for the placement of the reference points, see also Chapter „**Preparing the Roof**“ on page 35.

NOTICE

In the following diagrams, the lead flashing is blanked out (the lead flashing has to be placed before the mounting clamps are mounted!) for better understanding.

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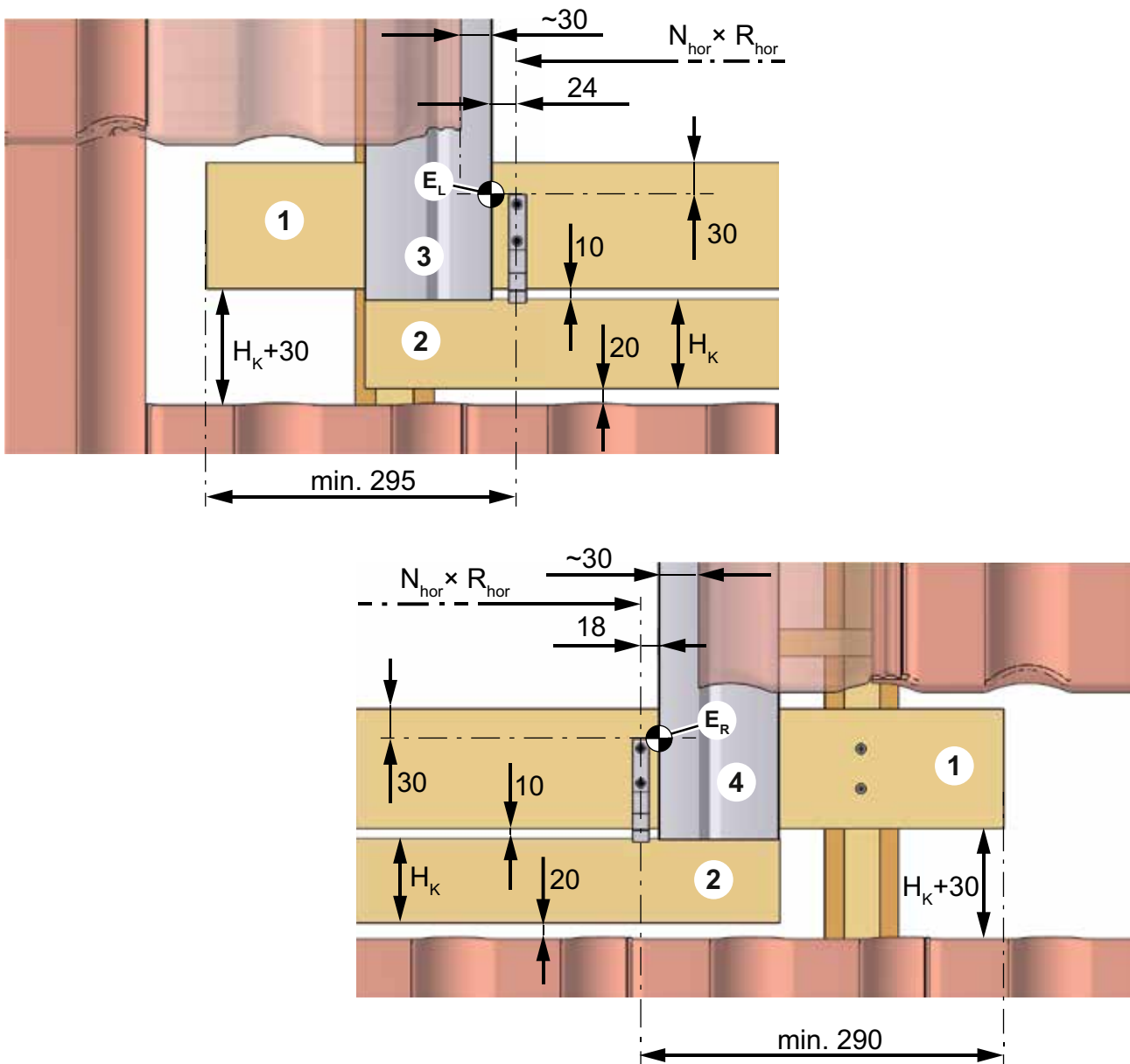


Fig. 25: Calibration

| | |
|--------------------------|--|
| 1 | Bottom Solrif® batten |
| 2 | Wedge plank |
| 3 | Flashing side left |
| 4 | Flashing side right |
| N_{hor} | Number of modules side by side in the PV array |
| R_{hor} | Horizontal module mounting pitch |
| $N_{hor} \times R_{hor}$ | Distance between the centre lines of the outermost mounting clamps |

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| | |
|-------|---|
| H_K | Height of the wedge plank (depends on the roof slope and the shape of the tile, see „ Wedge Plank “ on page 24). |
| E_L | Reference point bottom left |
| E_R | Reference point bottom right |

5.3.2.1 Mounting the Solrif® Battens

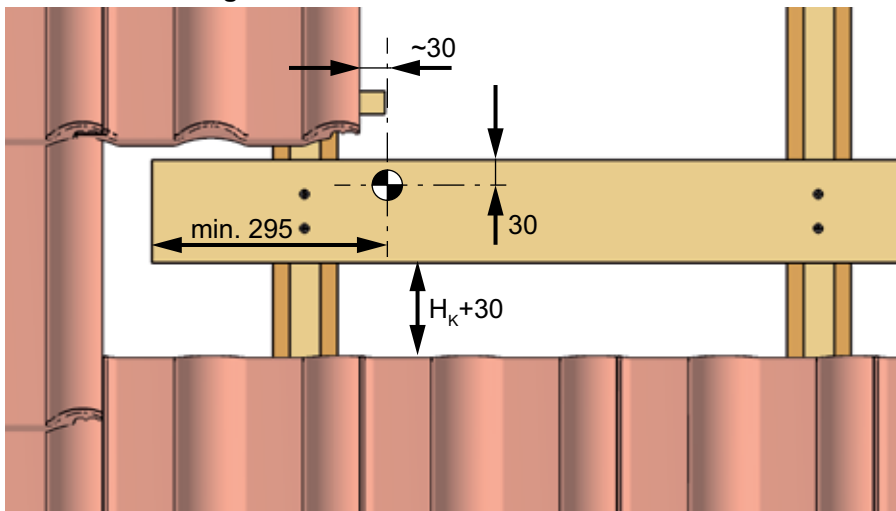


Fig. 26: Mounting the bottom Solrif® batten

1. Mount the bottom Solrif® batten at a distance of the height of the wedge plank plus 30 mm from the upper edge of the bottom row of tiles, observing Chapter „**Rules for Mounting Solrif® Battens**“ on page 62.

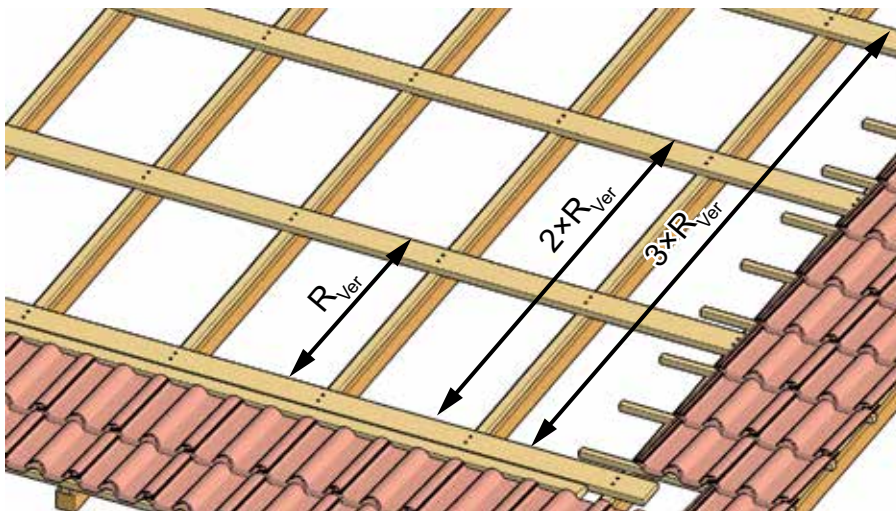


Fig. 27: Mounting further Solrif® battens

2. Mount the other rows of Solrif® battens at intervals of $x \times R_{Ver}$ (measured from the bottom row of Solrif® battens) respectively and mount them with two mounting screws each to each rafter/each counter batten.

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5.3.2.2 Mounting the Wedge Plank

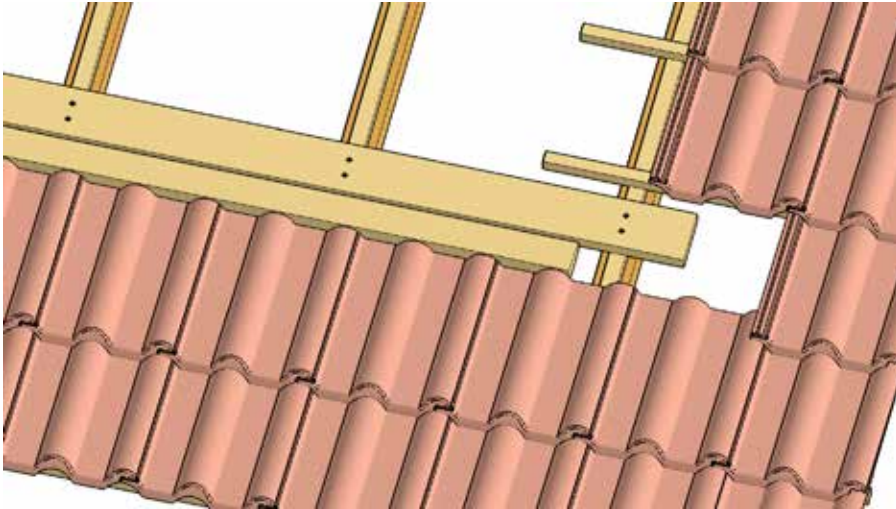


Fig. 28: Mounting the wedge plank

1. Mount the wedge plank at a distance of ca. 10 mm from the bottom edge of the bottom row of Solrif® battens, observing Chapter „Rules for Mounting Solrif® Battens“ on page 62.

5.3.3 Determining the Reference Point and Perpendicularity of the PV Array



NOTICE

The perpendicularity of the PV array is a basic prerequisite for trouble-free and successful installation.

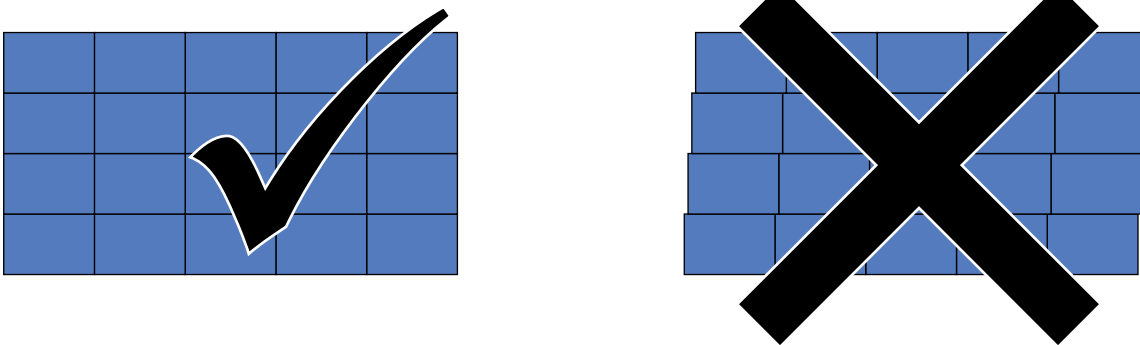


Fig. 29: Rectangular and "warped" PV array

1. In the left-hand bottom corner of the PV array, determine reference point E_L (1), see Chapter „Preparing the Roof“ on page 35.



NOTICE

Do NOT fully screw in the screws that subsequently must be placed: tension lines or tape measures must be tied to them!

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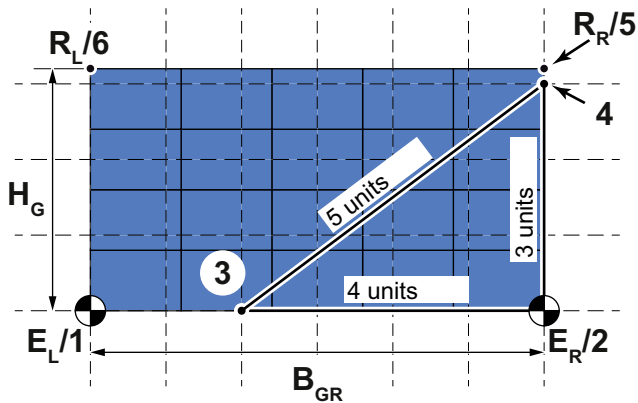


Fig. 30: Calibration

2. Place a screw in the position of the left-hand reference point E_L (1).
3. Place a screw in the position of the right-hand reference point E_R (2) (distance to left-hand reference point = B_{GR}).
4. Stretch a tension line tightly between the two reference points E_L (1) and E_R (2).
5. Measure along the line from E_R (2) to E_L (1) a distance of 4 "units" (e. g. meters) and mark the point (3) with a screwed-in wood screw.
6. Attach the tape measure to right-hand reference point E_R (2) and draw a "compass circle" with the radius of 3 "units" in the right-hand top corner of the PV array.
7. Attach the tape measure to point (3) and draw a "compass circle" with the radius of 5 "units" in the right-hand top corner of the PV array.
 - ⇒ The intersection of the two compass circles is point (4).
8. Extend the line from the right-hand reference point E_R (2) to (4) at the height of H_G on the PV array; this gives you the preliminary right-hand top reference point R_R (5).
9. Mark the right-hand top reference point R_R (5) with a screwed-in wood screw.
10. Attach the tape measure to the wood screw (5) and draw a "compass circle" with the radius of B_{GR} in the left-hand upper corner of the PV array.
11. Attach the tape measure to the left-hand bottom reference point E_L (1) and draw a "compass circle" with the radius of H_G in the left-hand upper corner of the PV array.
 - ⇒ The intersection of the two compass circles is point (6), the preliminary left-hand top reference point R_L .
12. Measure the diagonal of the PV array from point (1) to point (5).
13. Measure the diagonal of the PV array from point (2) to point (6).
 - ⇒ The diagonals must be the same length within the limits of measurement accuracy.
14. Check that the reference point in the left-hand top of the PV array R_L is at a distance of ca. 30 mm from the vertical tile edge.

If this is confirmed:

15. Mark the right-hand PV array edge (2) to (5) across all Solrif® battens, e. g. with a tension line.

5.3.4 Mounting the Lead Flashing

1. Roll the lead flashing out over the bottom row of Solrif® battens and the wedge plank and place it in such a way that the lead flashing extends past the wedge plank on both sides by at least 150 mm respectively.

If the lead flashing comprises several strips:

2. Ensure the strips overlap by at least 100 mm.

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For roof slopes $<22^\circ$:

3. Place the lead flashing in such a way that the top edge of the lead flashing extends past the top edge of the bottom Solrif® batten by 20 mm.

For roof slopes $>22^\circ$:

4. Place the lead flashing in such a way that the top edge of the lead flashing is flush with the top edge of the bottom Solrif® batten.
5. Feel out the positions of the two screws that mark the bottom reference points E_L and E_R , pierce the lead flashing at these points or make 2 short crossed cuts.
6. Press the screw heads through the lead flashing.
7. Remove the two screws, put sealing washers on them and screw them back in so far that the screws are still protruding about 20 mm from the lead flashing.

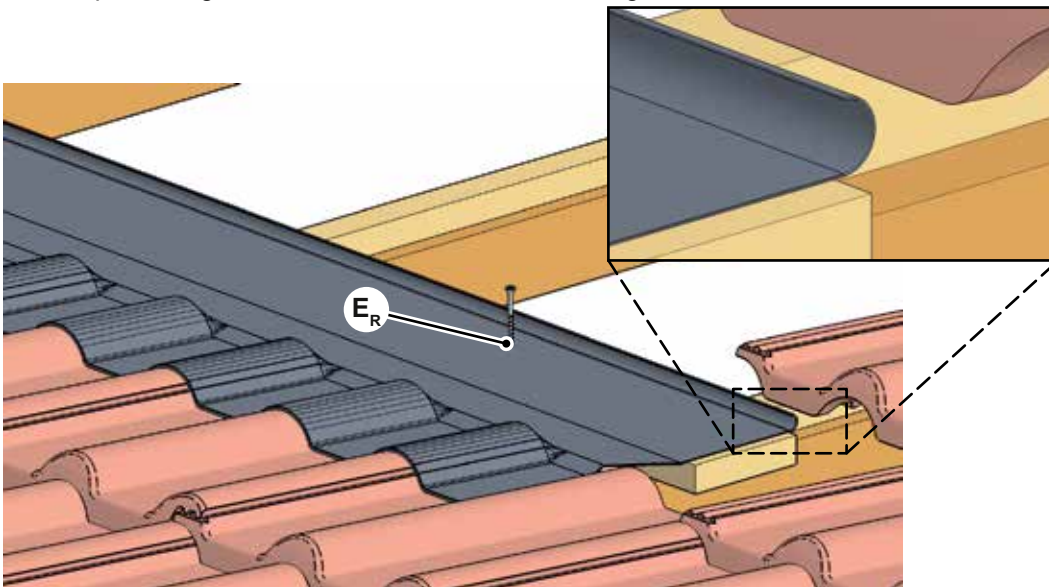


Fig. 31: Lead flashing on roof slopes $<22^\circ$

8. Flange out the top edge of the lead flashing about 20 mm wide.

5.3.5 Laying Cable Conduits, Connection Cables and Cable Strings

1. Lay cable conduits for connection cables and cable strings according to local and national regulations.
2. Lay connection cables and cable strings according to the string plan.

5.3.6 Marking the Horizontal Positions of the Mounting Clamps Profile

1. Stretch a line between the two bottom left reference points E_L and bottom right E_R (see Diag. "Calibration").
2. Stretch a line between the right-hand reference point E_R and the top right reference point R_R (see Diag. "Calibration").



NOTICE

Measuring the clamp positions from one clamp to the next will lead to measurement chain errors. Determine the position of each Mounting Clamp Profile from the right-hand reference line (= tension line on the right-hand edge of the PV array).

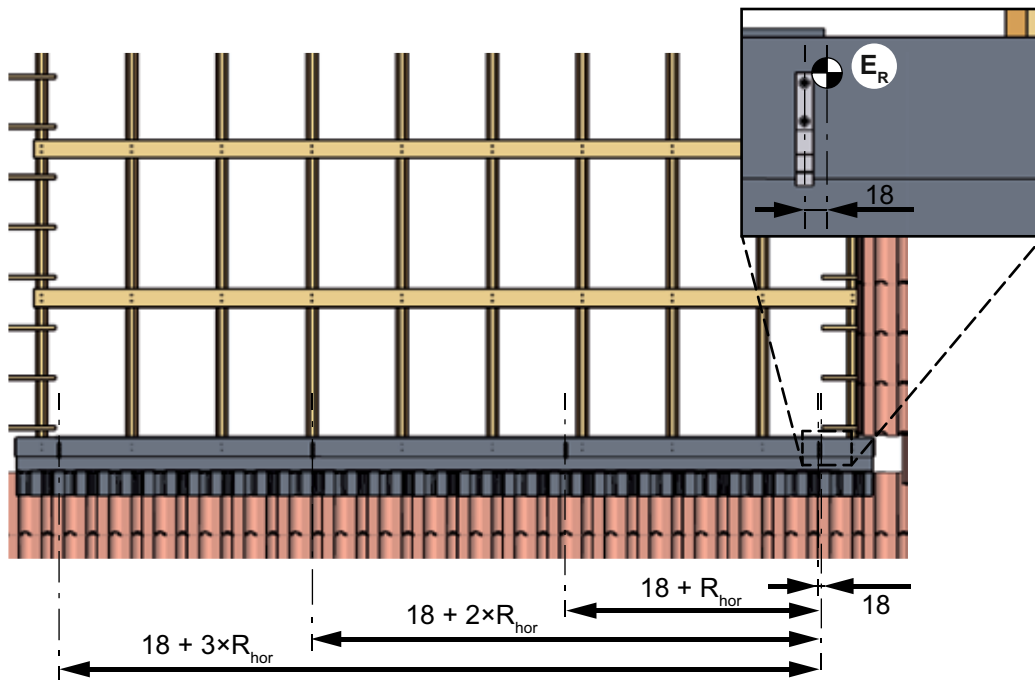


Fig. 32: Mounting clamps horizontal positions

- On each Solrif® batten, mark the horizontal positions of the Mounting Clamps Profile at the following positions starting from the tension line on the right-hand edge of the PV array:

18 mm

$18 \text{ mm} + R_{\text{hor}}$

$18 \text{ mm} + 2 \times R_{\text{hor}}$

...

$18 \text{ mm} + N_{\text{hor}} \times R_{\text{hor}}$

5.3.7 Laying the Bottom Row of Modules

- On the bottom Solrif® batten, mount the Mounting Clamps Profile with 2 screws each, horizontal position at the marked points, vertical position such that the top edge of the mounting clamps is at the same height as the tension line (the mounting clamps should NOT push away the tension line!).

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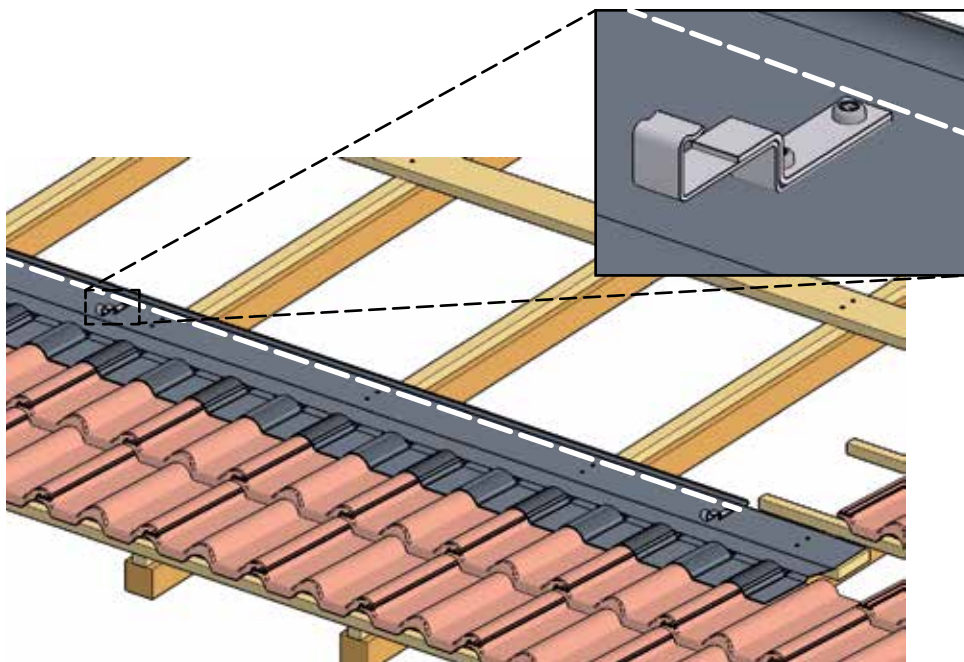


Fig. 33: Mounting clamps bottom row

If you are using a mounting gauge:

2. Remove the tension line at the bottom end of the PV array and screw in the screws at positions E_L and E_R tightly.

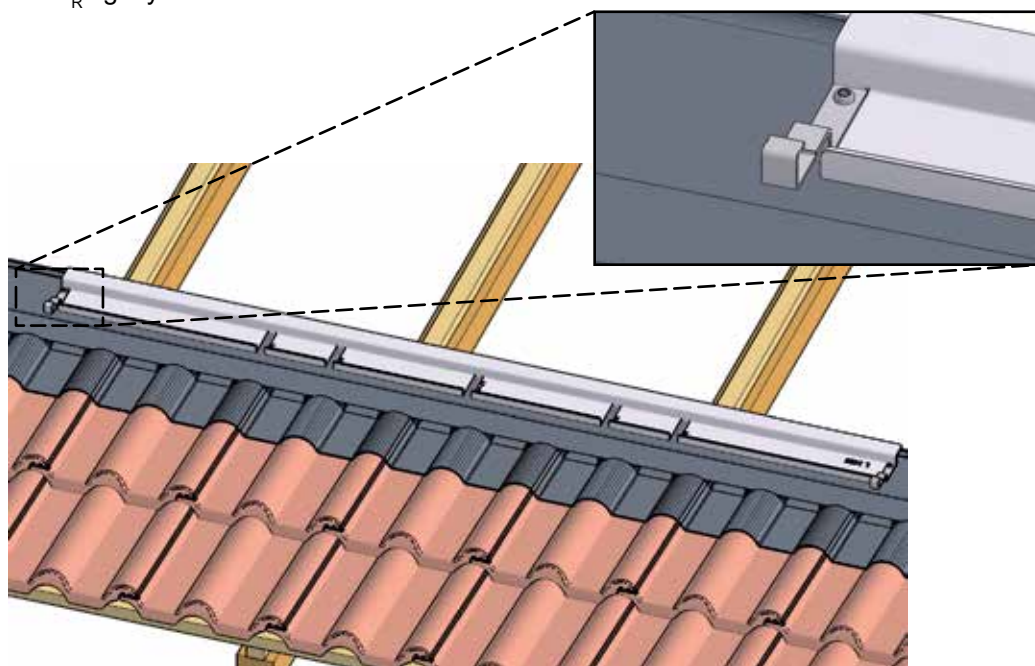


Fig. 34: Fitting the mounting gauge

If Mounting Clamps Glass are to be additionally placed (see roof plan):

3. Fit the mounting gauge into Mounting Clamps Profile.

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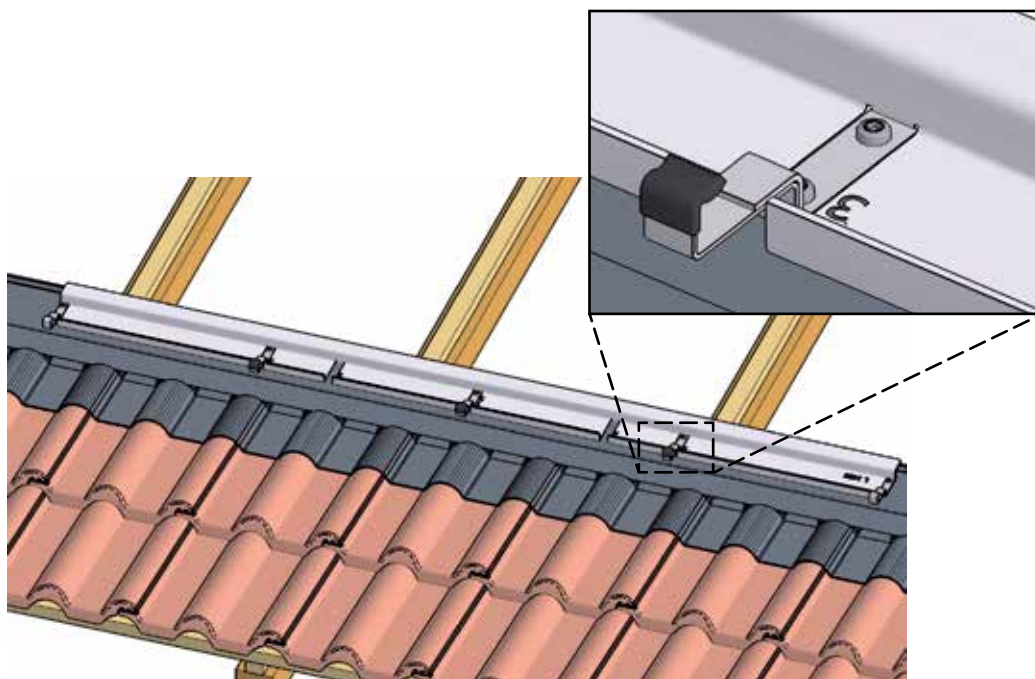


Fig. 35: Place Mounting Clamps Glass

4. Push in the Mounting Clamps Glass until they click into place in the recesses of the mounting gauge and mount them with two screws each onto the bottom Solrif® batten.

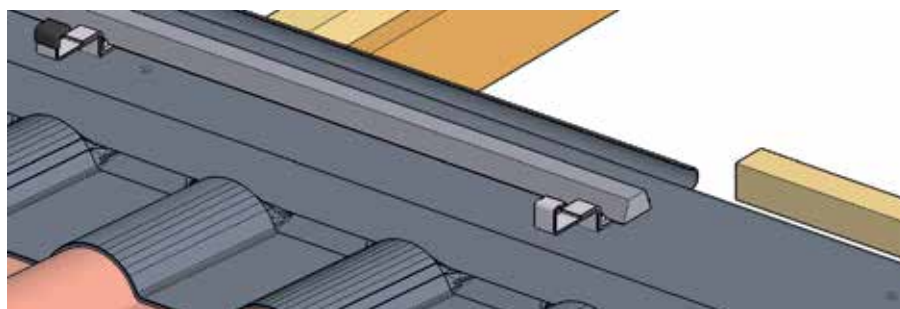


Fig. 36: Laying the sealing tape strip

5. Lay the sealing tape strip over the mounting clamps.

When used in areas with high snow loads:

6. Support the bottom row of clamps, see Chapter „**L-Section to Support the Bottom Row of Mounting Clamps**“ on page 30.

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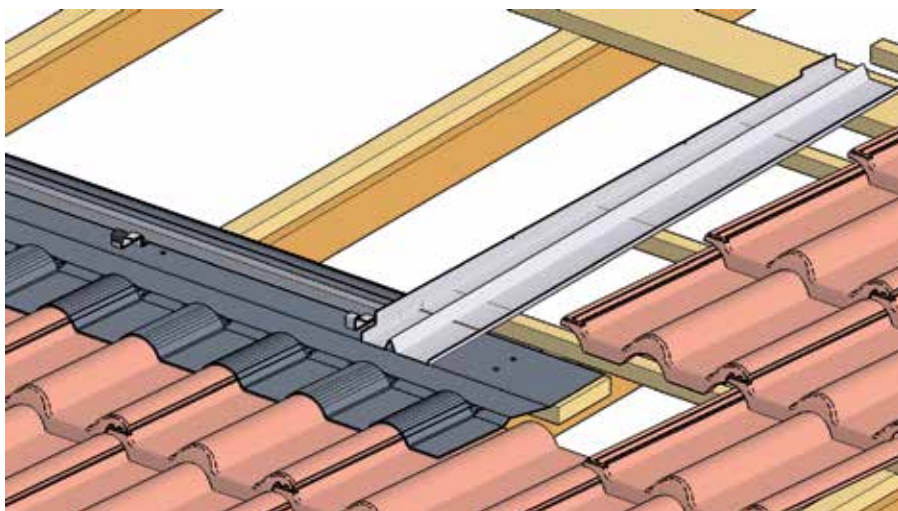


Fig. 37: Flashing side right

7. Place a flashing side in the right-hand bottom corner of the PV array so that its left-hand edge is flush with the vertical reference line on the right-hand edge of the PV array.

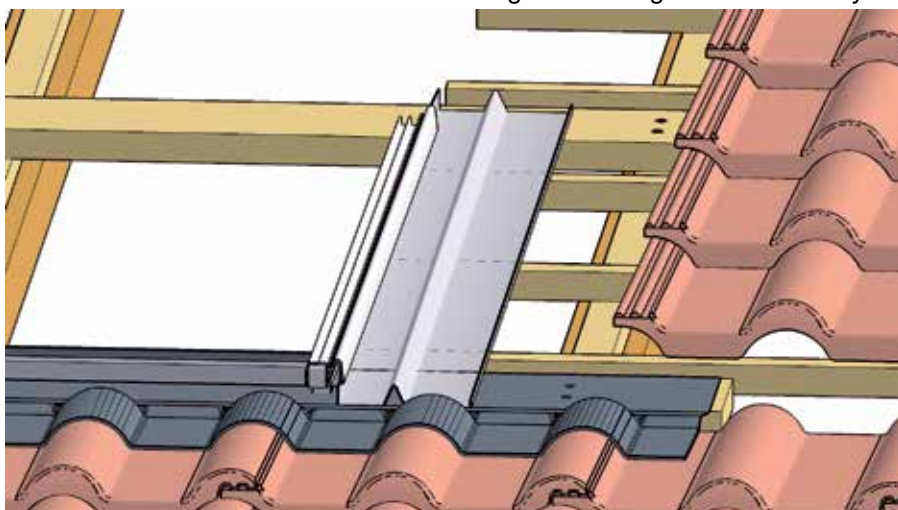


Fig. 38: Flashing profile right

8. Lay the flashing profile right onto the flashing side and push it into the Mounting Clamp Profile.
9. Attach the first module to the associated cable string or connection cable.

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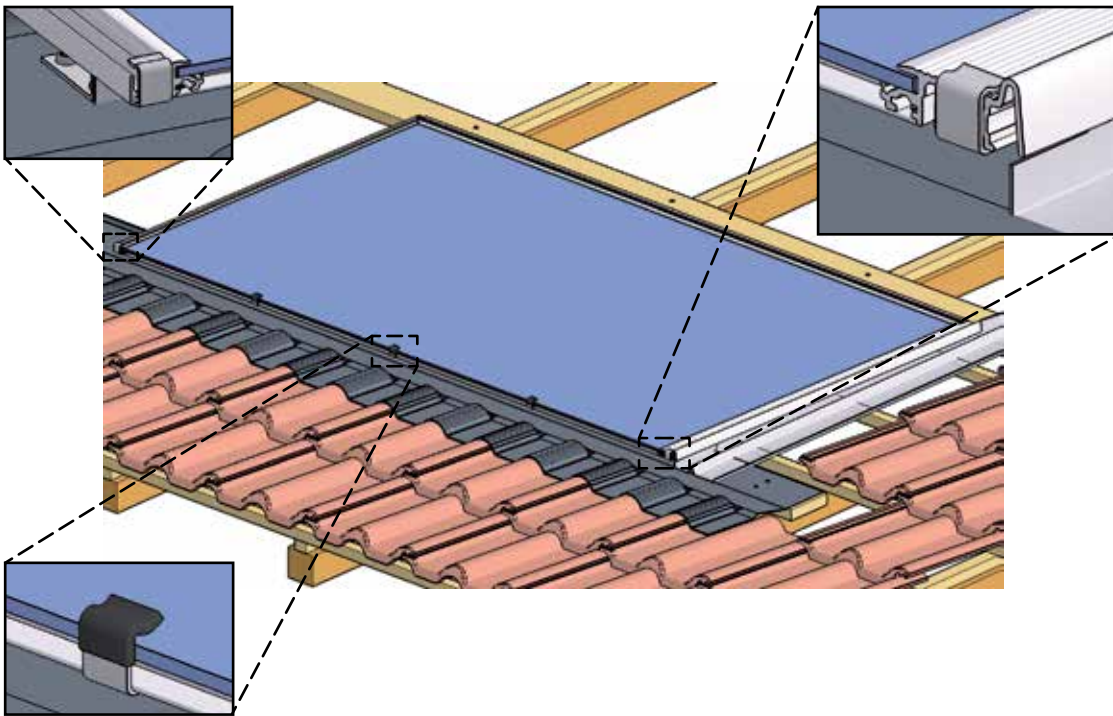


Fig. 39: Lay the first module

10. Lay the first module in the right-hand bottom corner of the PV array (insert bottom edge into the mounting clamps, then lower down).

ATTENTION

Treading on modules that have already been laid

Risk of damage to property! Cell breakage!

If treading on modules that have already been laid is unavoidable, proceed as follows to avoid inadmissible point loading:

- Cover the modules with rigid foam panels or similar.

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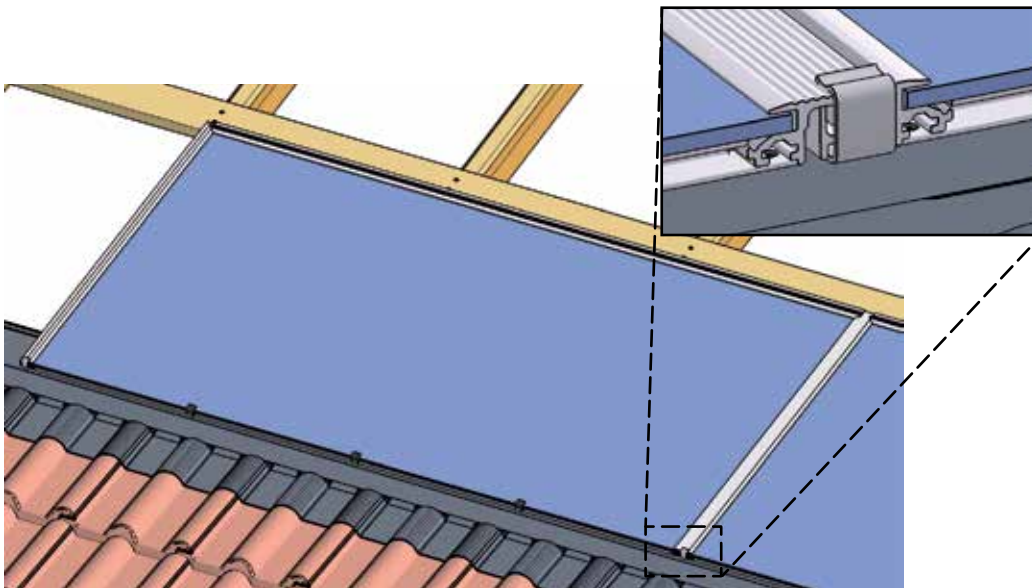


Fig. 40: Lay remaining modules

11. Lay the remaining modules in the bottom row and at the same time connect the connection cables and grounding/lightning protection cables according to the string plan.

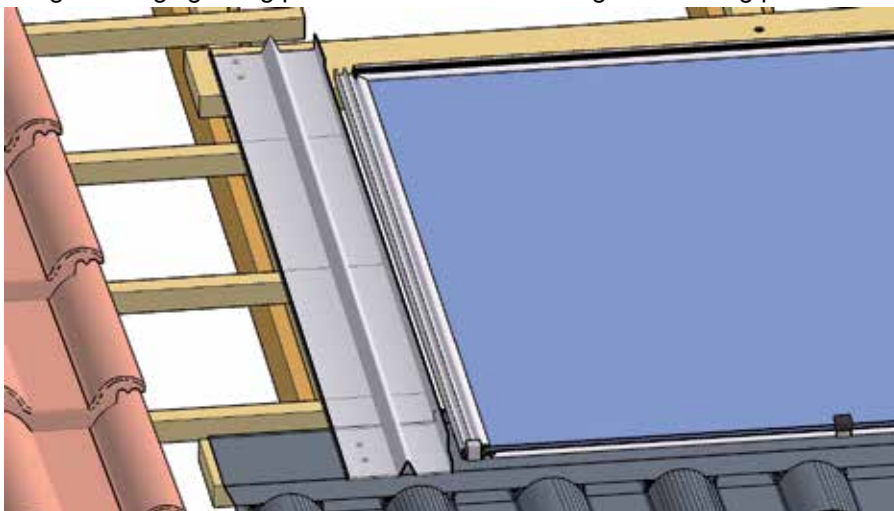


Fig. 41: Laying flashing side left

On the left-hand edge of the PV array:

12. Place the flashing side left with the right-hand edge flush with the last module.

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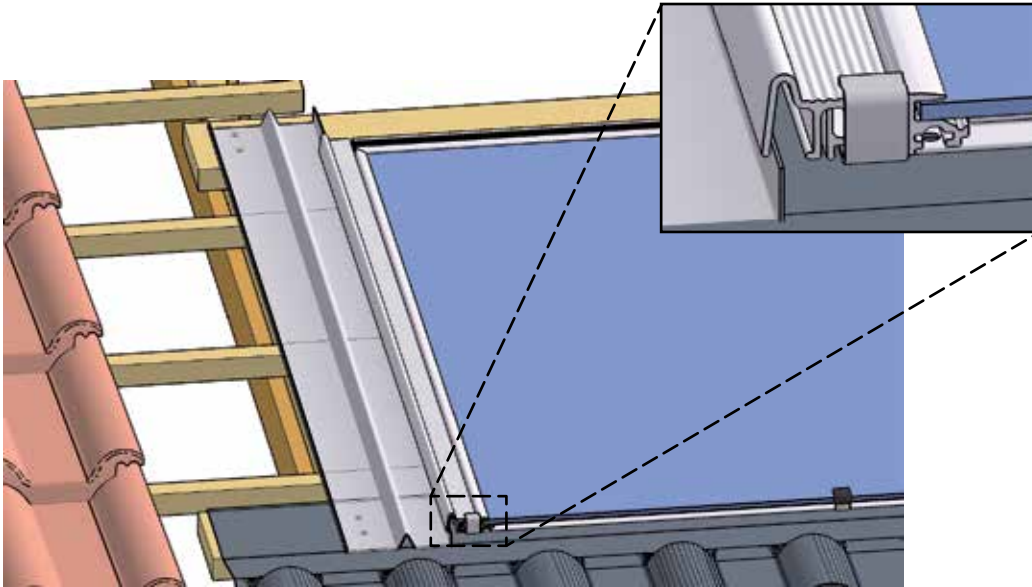


Fig. 42: Inserting flashing profile left

13. Push the flashing profile left into the left-hand bottom Mounting Clamp Profile as a gutter.

5.3.8 Laying the Remaining PV Array



NOTICE

The distance of 15 mm between the upper edges of the modules and the recess of the mounting clamp above must be observed. This distance enables individual modules in the PV array to be replaced at a later stage.

The width of the mounting clamps is 16.5 mm. Thus the mounting clamp is NOT suitable as a spacing template for placing the next row of mounting clamps.

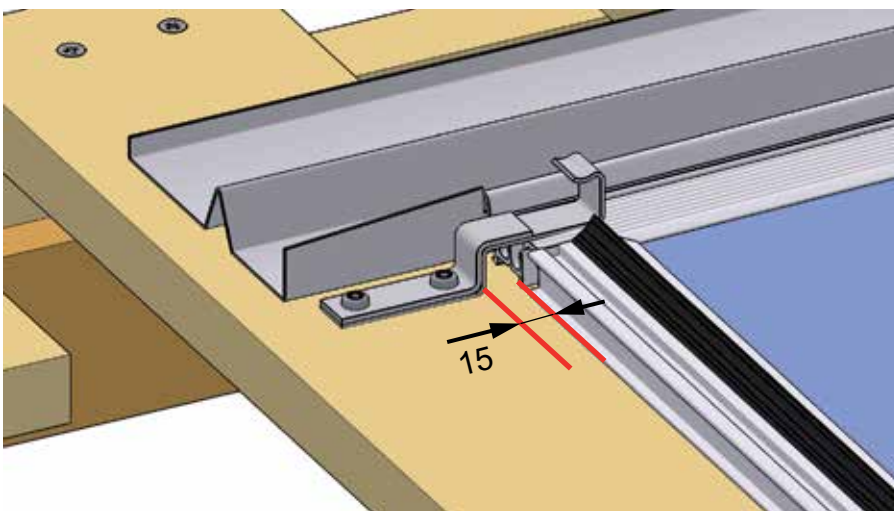


Fig. 43: Mounting clamp distance

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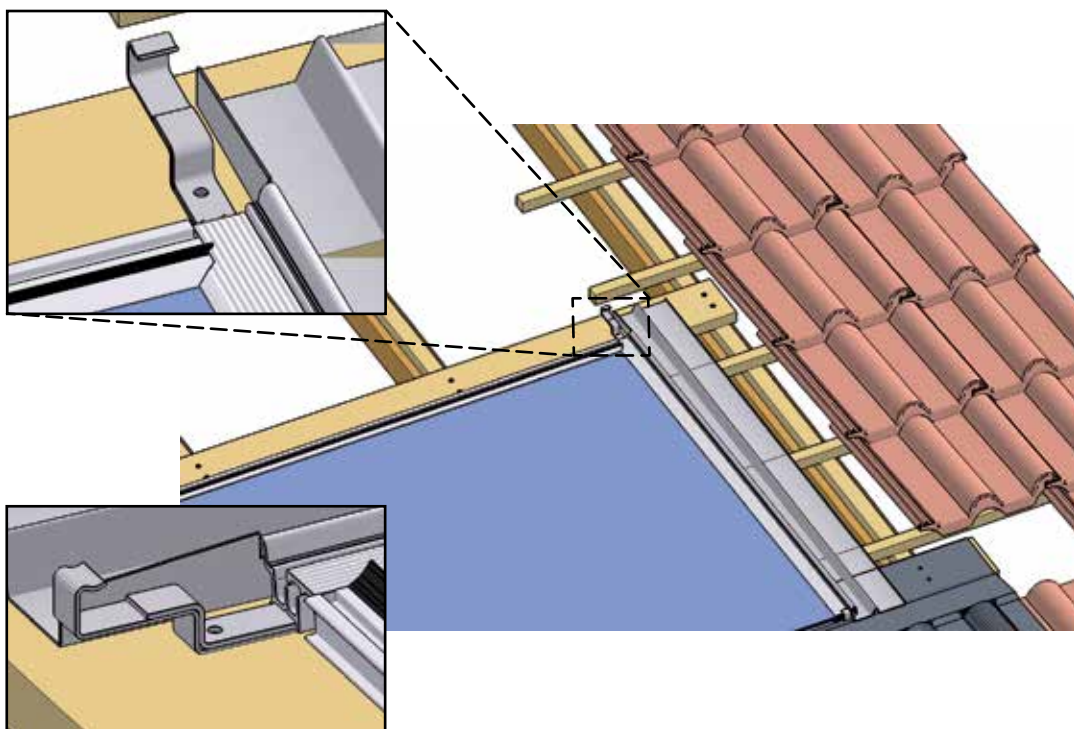


Fig. 44: Push in mounting clamps the wrong way around

1. In order to be able to draw a marking line, push a mounting clamp temporarily the wrong way around into the flashing profile right.

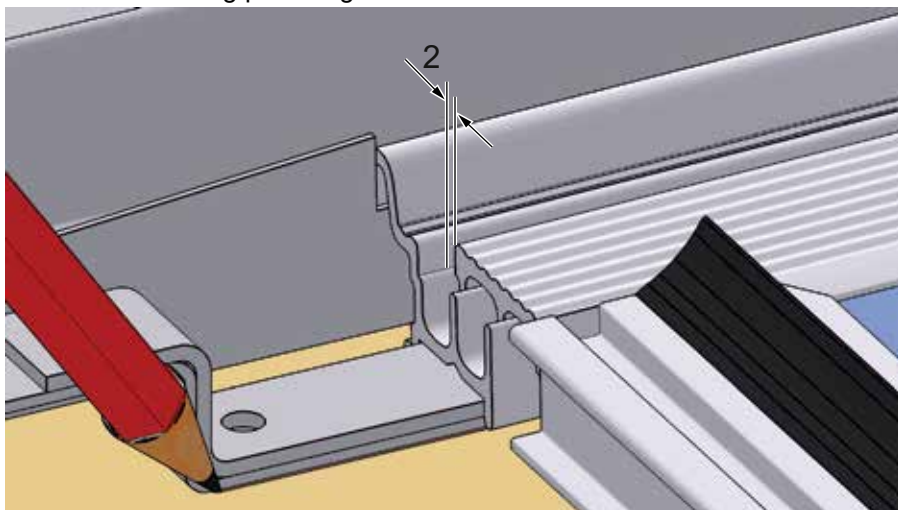


Fig. 45: Marking the position of the left-hand edge of the mounting clamp

2. In doing so, ensure that the flashing profile right maintains a distance of 2 mm to the module frame.
3. Mark left-hand edge of the inserted mounting clamp on the Solrif® batten.

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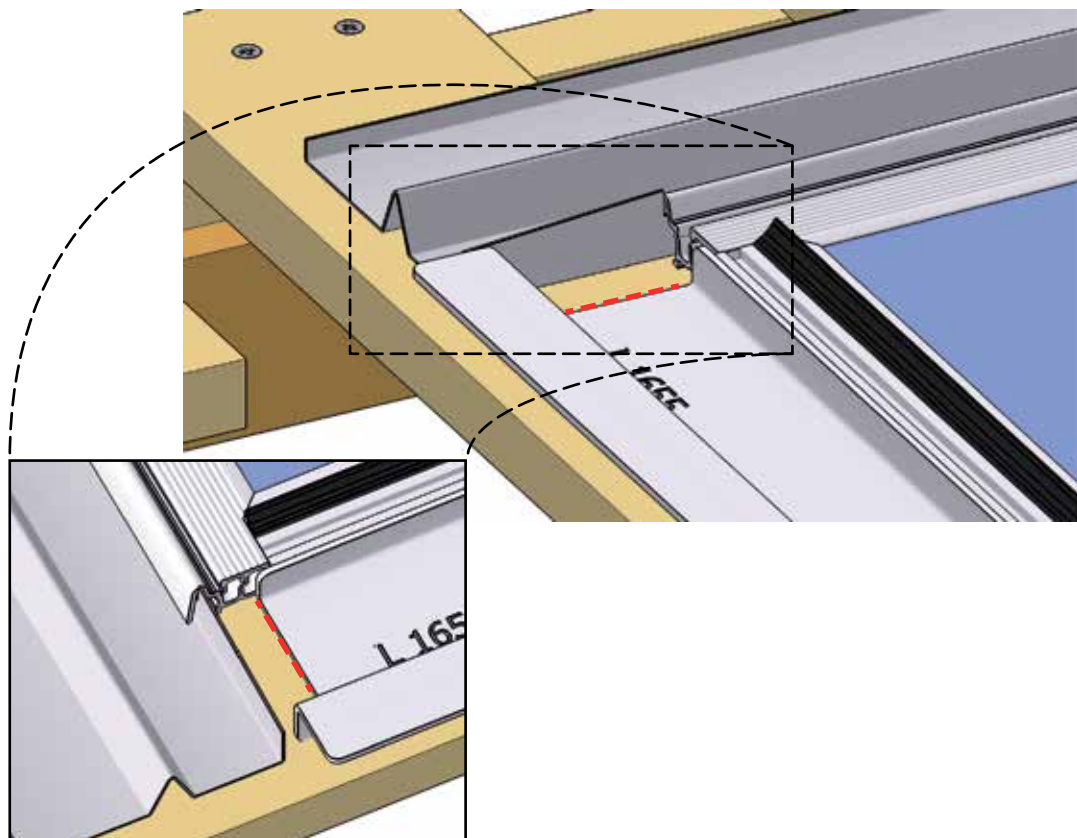


Fig. 46: Aligning the mounting clamp

4. Lay the mounting gauge onto the top edge of the right-hand module and align the mounting gauge to the line you just marked.

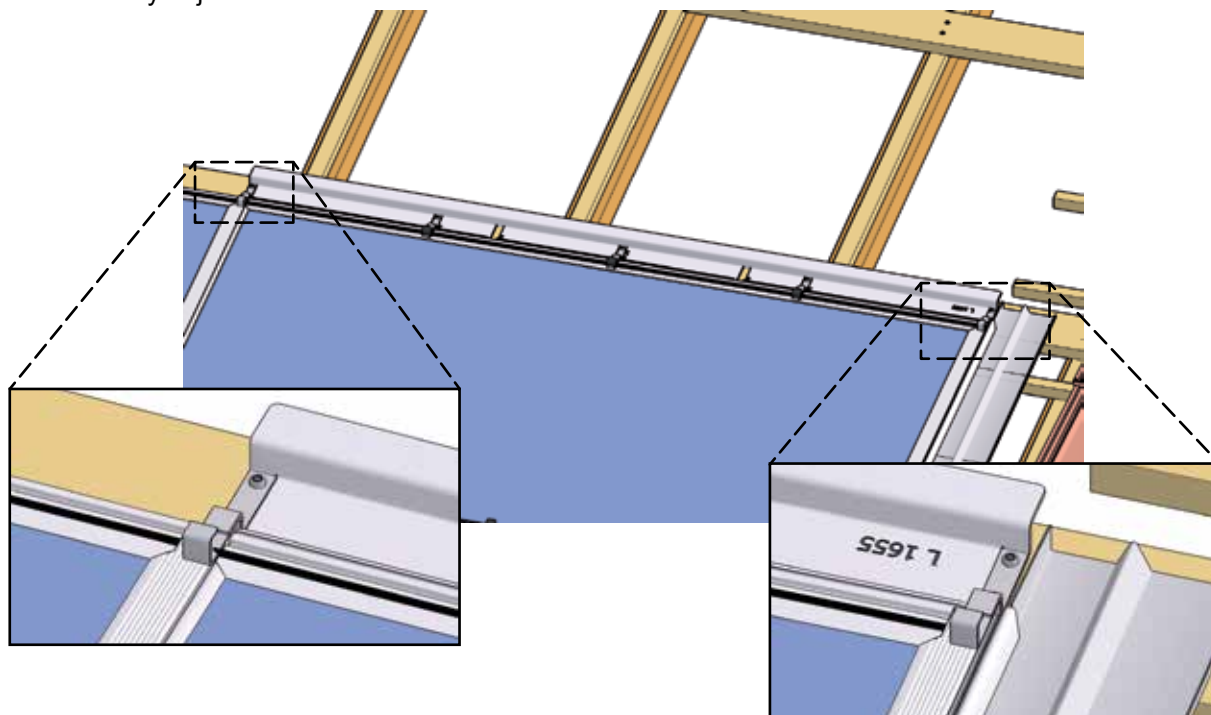


Fig. 47: Mounting the remaining mounting clamps

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5. Mount all the clamps for this module according to the roof plan with the aid of the mounting gauge.
6. Proceed in the same manner for the remaining mounting clamps in this row.

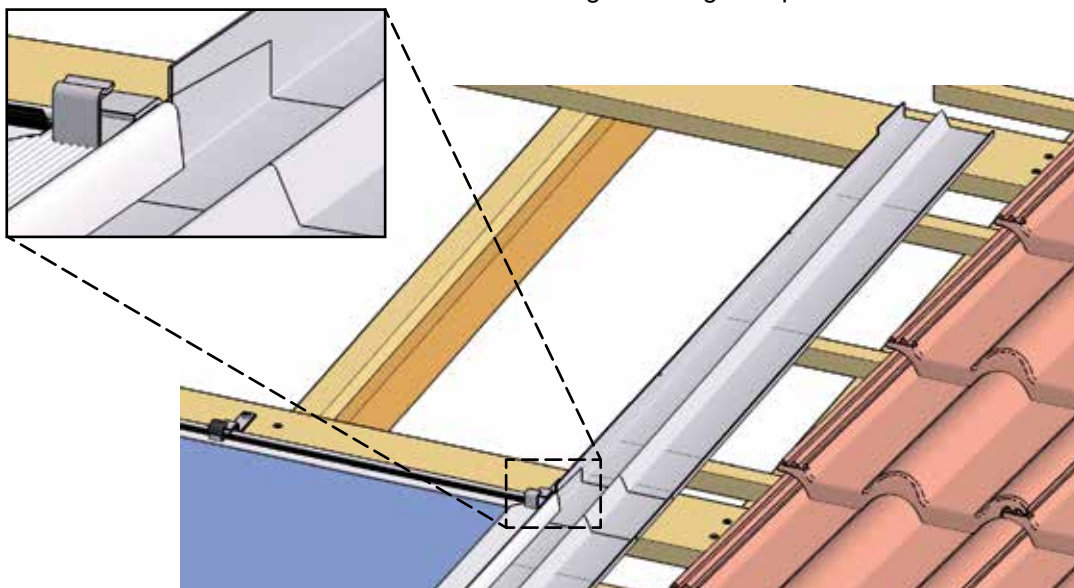


Fig. 48: Push in flashing side right

7. Push the flashing side right into the lower lying right-hand profile until it clicks into place.

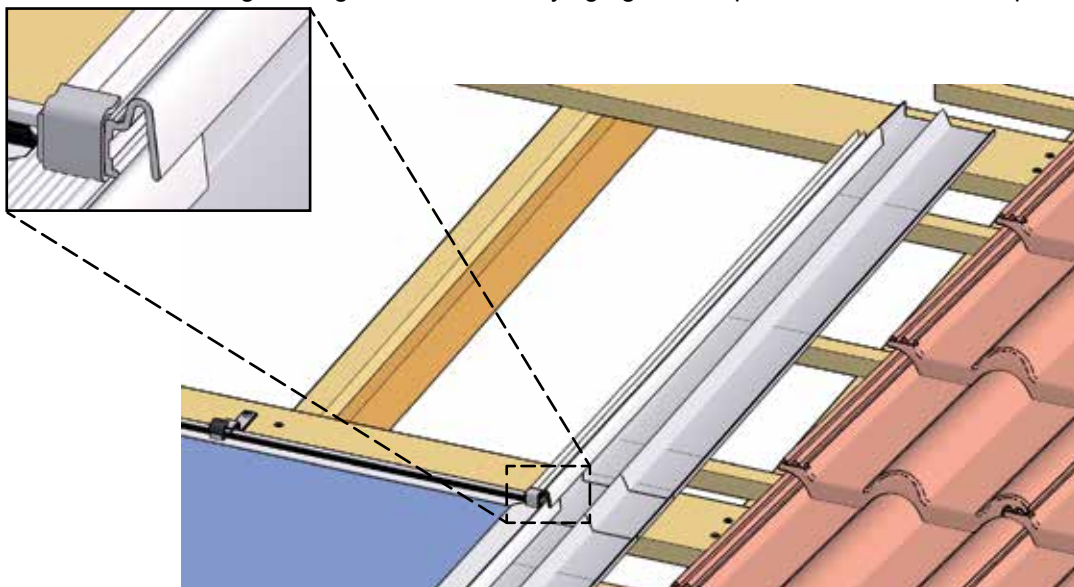


Fig. 49: Push in the flashing profile right

8. Push the flashing profile right into the Mounting Clamp Profile.

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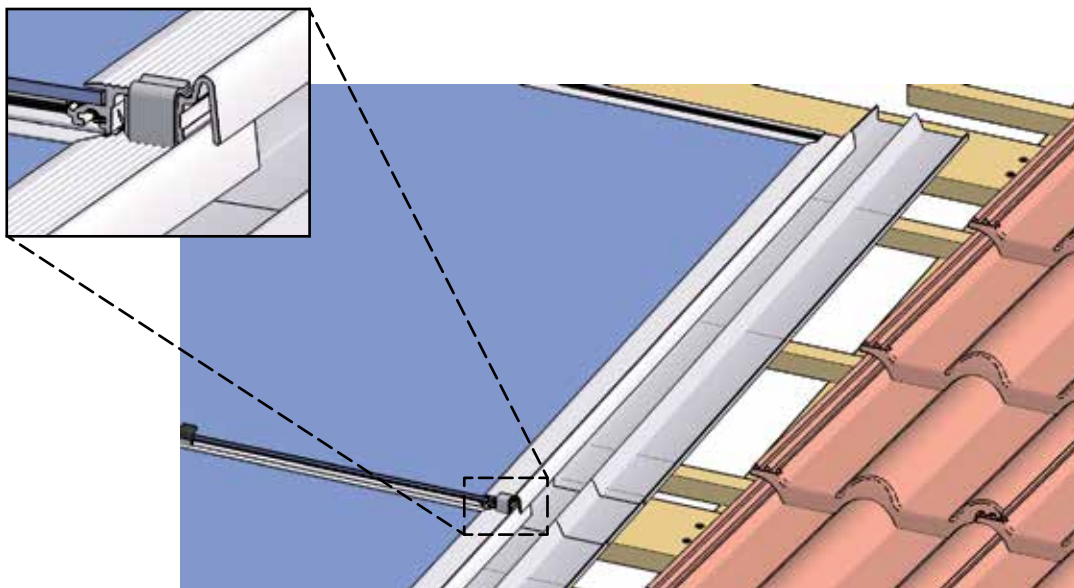


Fig. 50: Lay remaining modules

9. Lay the second row of modules and connect the cables according to the string plan at the same time.
10. Mount the next row of mounting clamps.
11. Complete the PV array including side flashings and flashing profiles like in the bottom row.

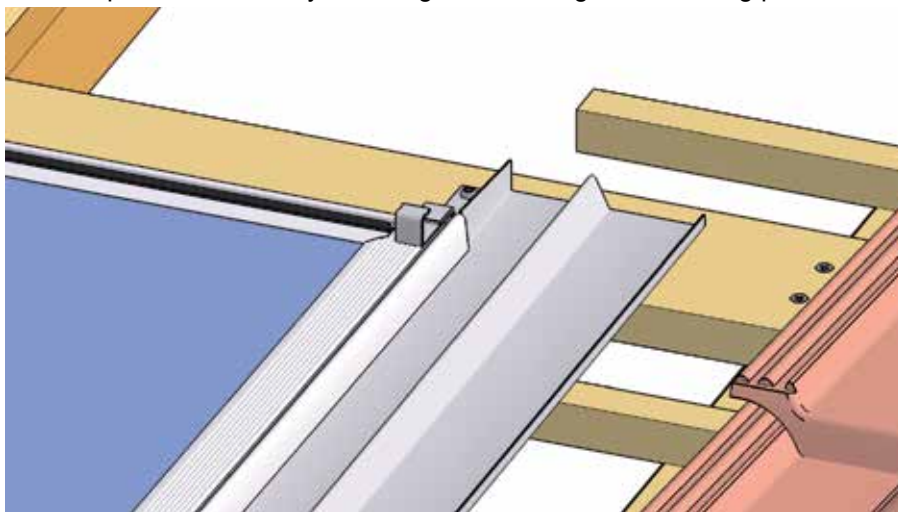


Fig. 51: Mounting clamps top row edge

Placing the top row mounting clamps:

12. Place the outside left-hand and the outside right-hand mounting clamps like in the rows below.

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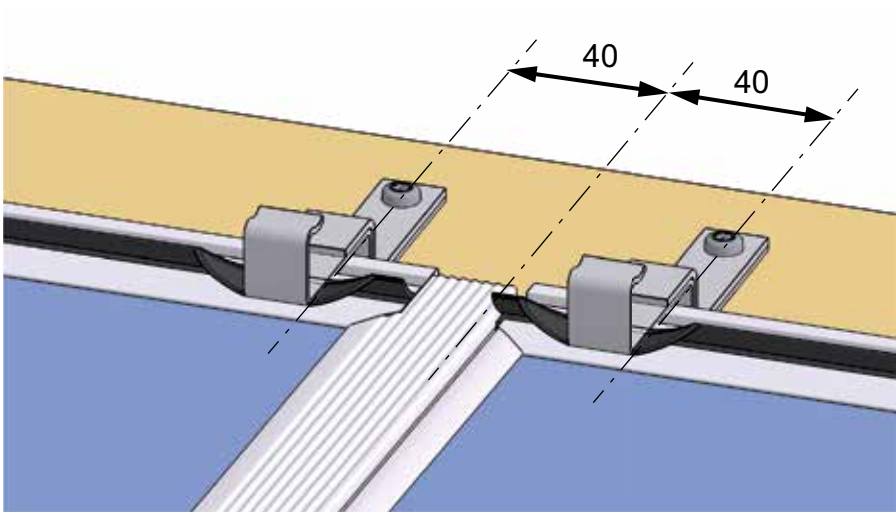


Fig. 52: Mounting clamps top row transitions

13. At the module transitions:

Do NOT place the Mounting Clamps Profile at the marked positions, rather place two Mounting Clamps Profile instead of one, each one offset by 40 mm to the left and to the right respectively of the marking. Like in the rows below, maintain a distance of 15 mm between the top edge of the module and the recess of the mounting clamp.

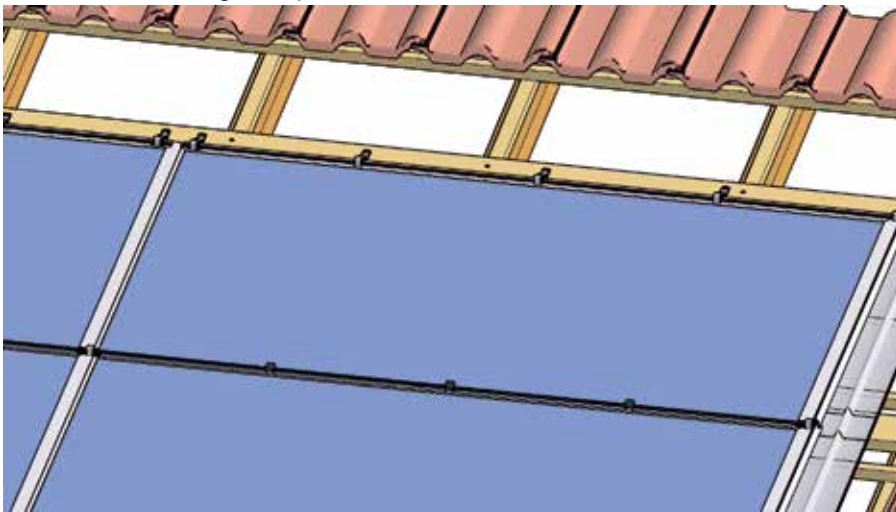


Fig. 53: Top row mounting clamp positions and spacing (maximum number of clamps in this example)

14. Depending on the roof plan: Insert further Mounting Clamps Profile accordingly.

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5.3.9 Top of the Array

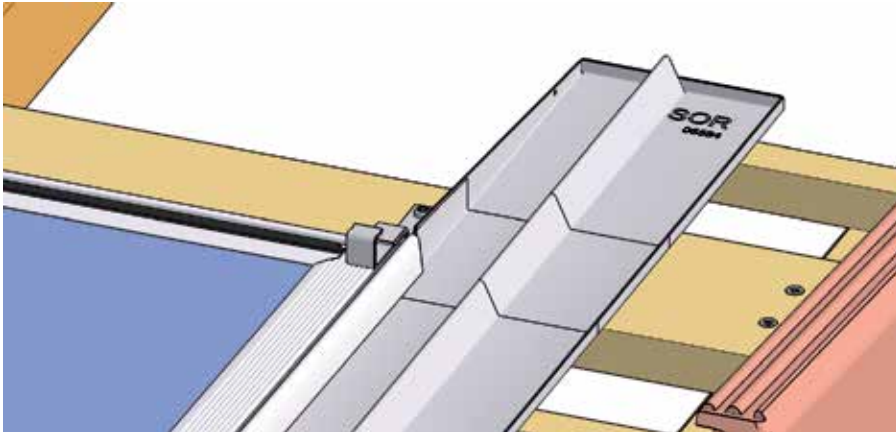


Fig. 54: Array top right

1. Push the flashing side top right into the flashing profile underneath it.

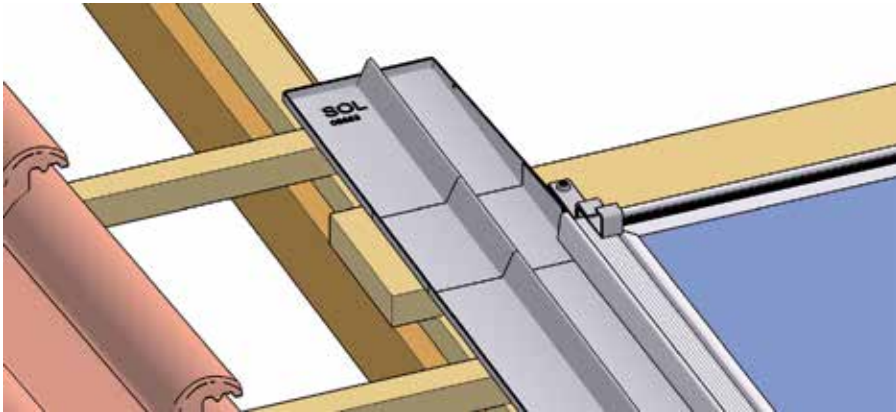


Fig. 55: Array top left

2. Push the flashing side top left into the flashing profile underneath it.
3. Ensure that the side flashings on the top left-hand side and the top right-hand side are sufficiently supported at the top end, e. g. by tiling battens.

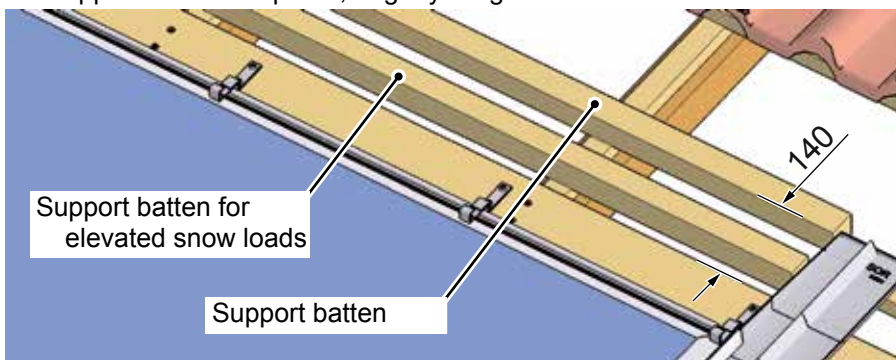


Fig. 56: Support battens

4. Mount a 40 mm thick support batten under the top ends of the flashing tops; distance between the top edge of the top Solrif® batten and the bottom edge of the support batten = 140 mm.

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For elevated snow loads:

5. Mount another support batten that is approx. 45 mm thick in the middle between the top Solrif® batten and the support batten that has just been placed.

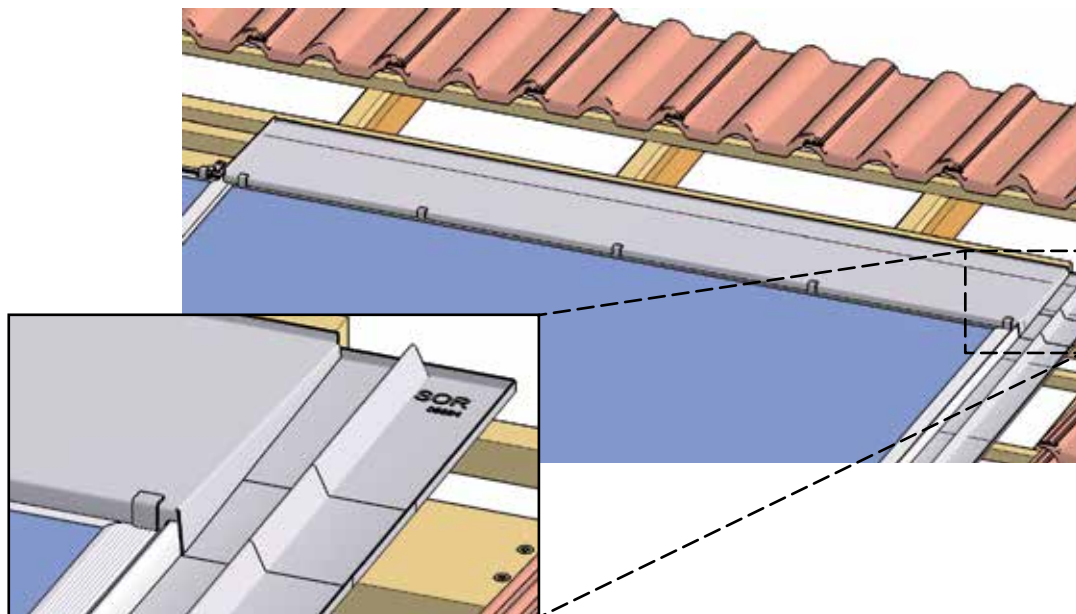


Fig. 57: Insert flashing top right

6. Push the flashing top right into the mounting clamp underneath it and over the vertical side of the flashing side top right.

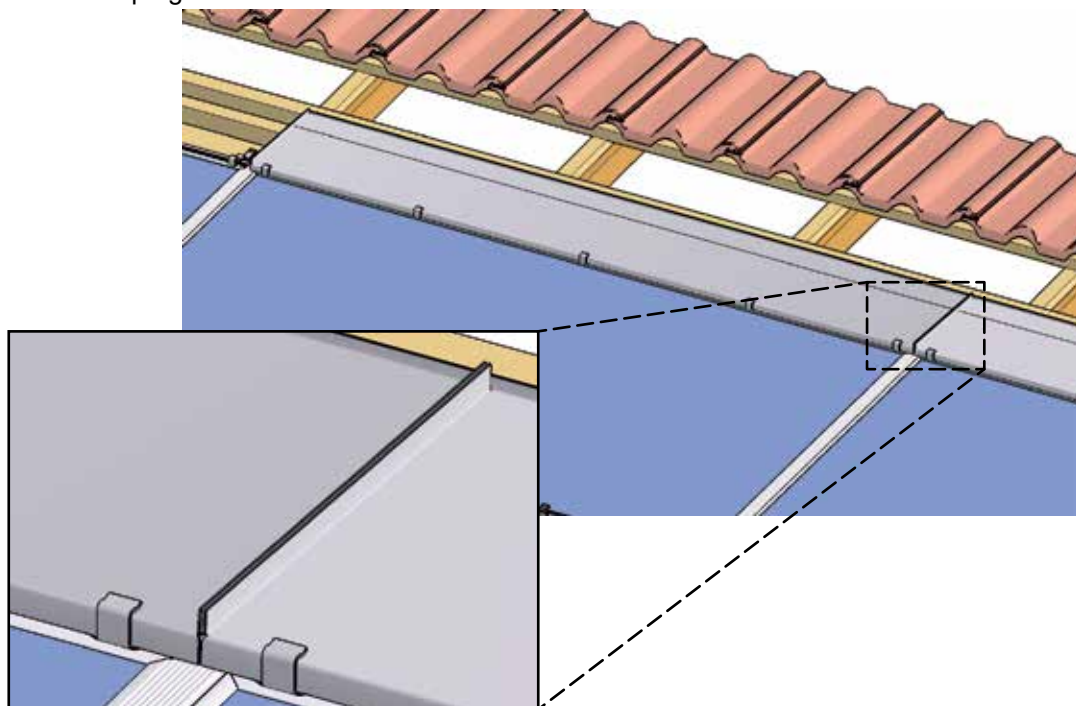


Fig. 58: Flashing top middle

7. Push the flashing top middle(s) into the mounting clamp underneath. The standing seams join up with the neighbouring flashing tops.

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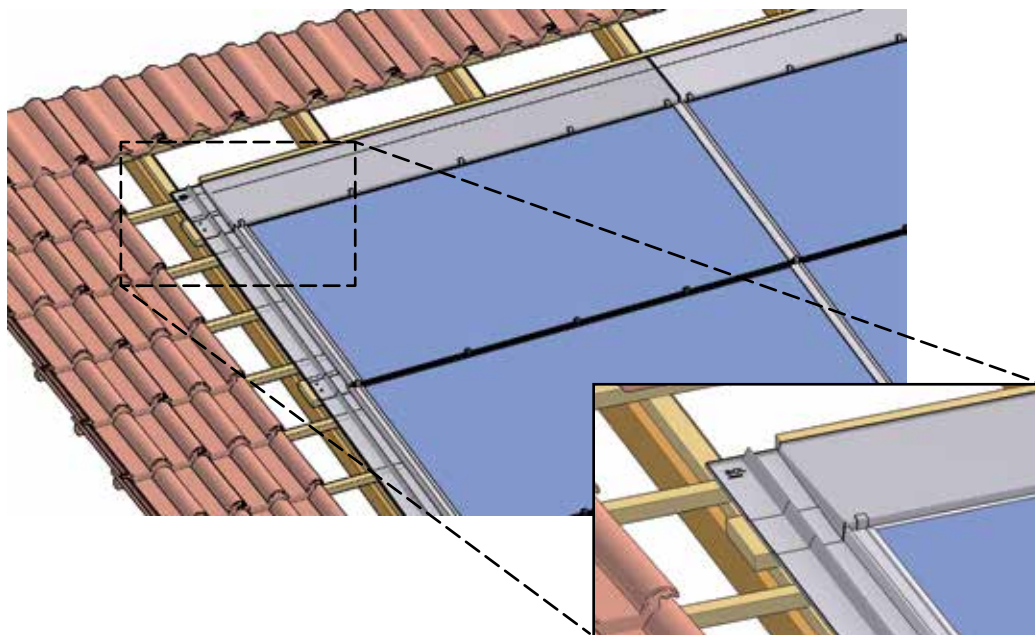


Fig. 59: Flashing top left

8. Finish with the flashing top left. The left-hand seam of the flashing top covers the seam of the flashing side top left.

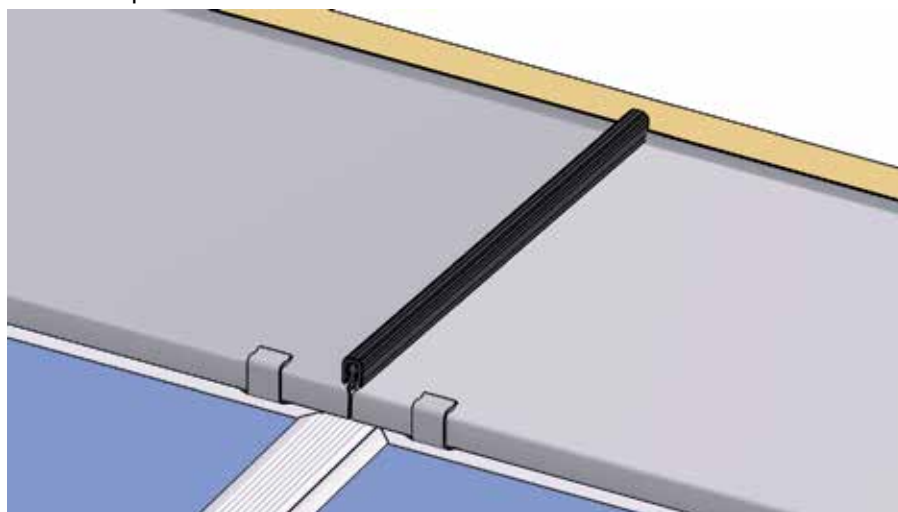


Fig. 60: Mounting protective profile

9. Connect the flashing tops with one another using protective profiles.

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5.3.10 Finishing Process

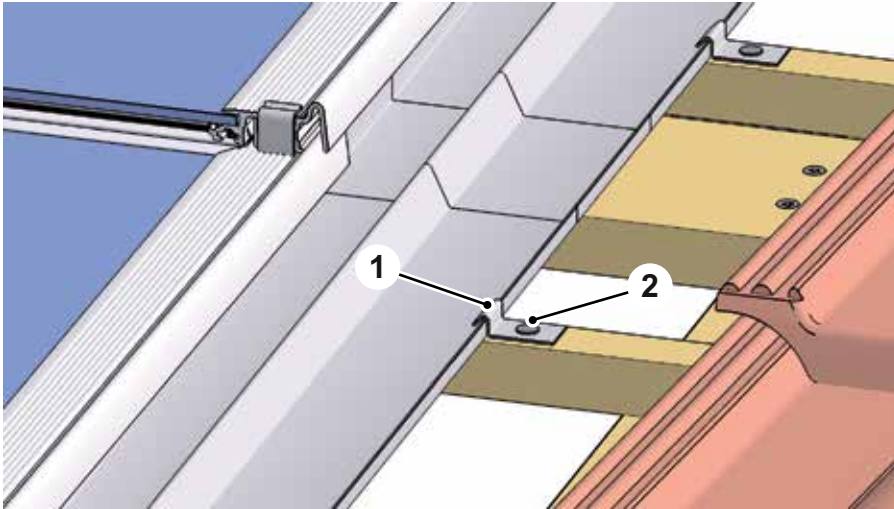


Fig. 61: Fixing for flashing on flashing sides

| | |
|---|------------------------|
| 1 | Fixing for flashing |
| 2 | Clout nail 2.5 × 25 mm |

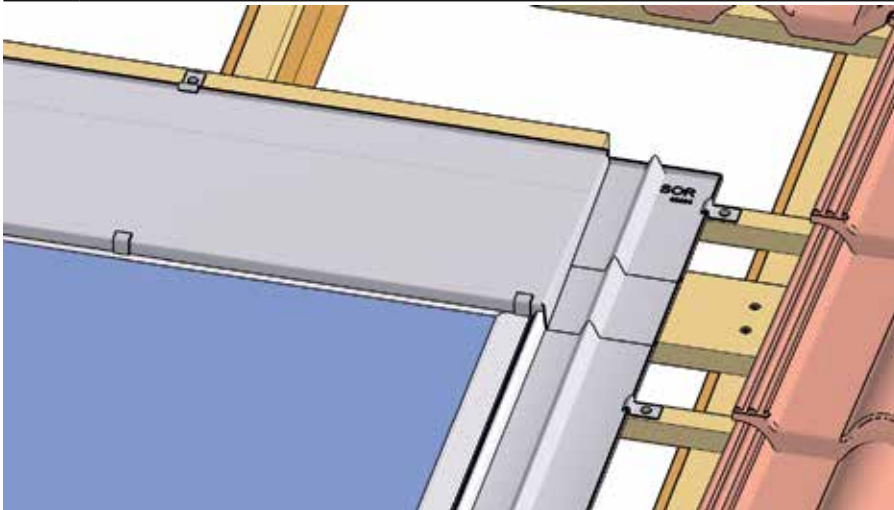


Fig. 62: Fixing for flashing on flashing side top right and flashing top

1. Mount the flashing sides and flashing tops onto the tiling battens, Solrif® battens and/or support battens using fixing for flashing as follows:
 - Flashing sides left and right: 2 fixings per flashing
 - Flashing sides top left and top right: 1 fixing per flashing
 - Flashing tops: at least 3 fixings per flashing

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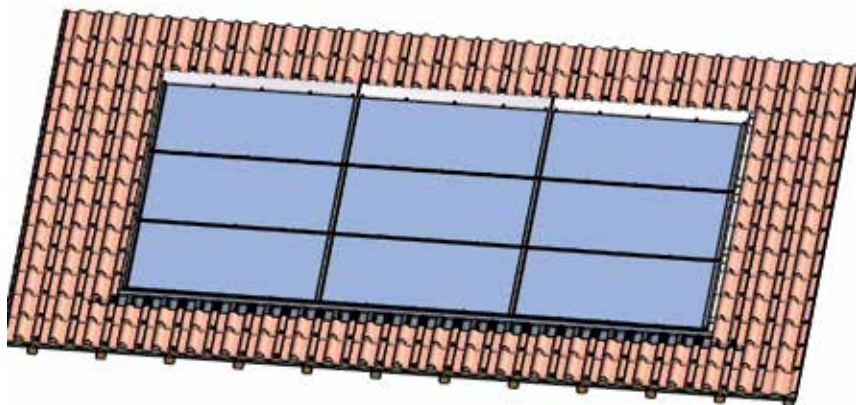


Fig. 63: Tile roofing

2. Complete the tile roofing.

Depending on how tiles and protective profiles meet on the flashing tops:

3. Cut the tiles if necessary using a disk grinder in such a way that the tiles lie smoothly on the flashing tops, including in the area of the protective profiles.

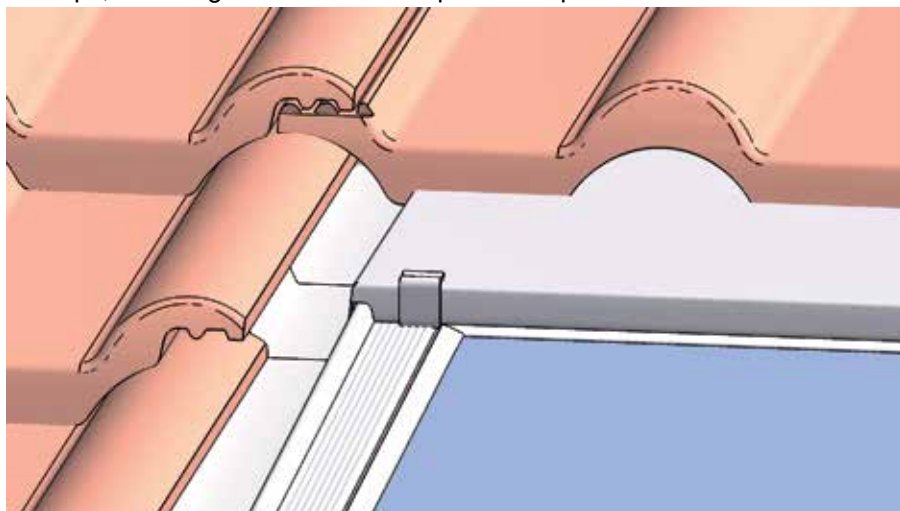


Fig. 64: Left-hand top edge

4. Wherever necessary, remove overhangs and edges on the roof tiles that will overlap with the flashing tops so that the roof tiles will lie as flat as possible.

Depending on the transition on the right-hand edge of the PV array:

5. Cut the tiles in such a way that no water can seep down onto the roof underlay at the sides.
- ⇒ This completes the installation process and the photovoltaic roof is now installed.

Solar Energy Systems by Schweizer: Installation Manual – Maintenance.

6. Maintenance



WARNING

Unqualified personnel treading on the roof

Mortal danger!

- Any work that requires stepping onto the roof may only be carried out by specialist personnel.



WARNING

Falls due to working without personal protective equipment against falls (PPEAF)

Mortal danger!

The installation of the photovoltaic system is only permitted with collective protection. However, certain work may also be carried out before the installation with PPEAF (checking the existing building structure, taking measurements), and likewise maintenance work on the installed photovoltaic system.

When work is carried out using PPEAF:

- Only allow personnel who are trained in its use to carry out work using PPEAF.
- Only use regulation PPEAF including lanyards with energy absorbers.
- Permit no personnel to work alone using PPEAF
- The persons present in the workplace must always be able to rescue persons using PPEAF with their own equipment (even hanging for only a few minutes in the safety harness carries the risk of permanent injury!).
- Installation work is only permissible with collective protection (scaffoldings, roof guard rails) in accordance with the local regulations.



CAUTION

Slipping on damp roofs that are covered in algae, moss or soiled by other means

Danger of injury!

- Before stepping onto roofs that are covered with dew, allow them to dry off
- Descend immediately from roofs that are soiled if it starts to rain

6.1 Maintenance Plan

For personnel requirements, see **Qualifications** [▶ 9]

| When | What | Who |
|---|---|--|
| After exceptional meteorological events, but at least once a year | Visual inspection | No special requirements |
| Quarterly | Yield check | No special requirements |
| If yield declines significantly | Check the PV array with an infrared camera | Specialist personnel, alternatively: Operator with relevant equipment and competence |
| If PV array soiled for instance fallen leaves | Spray off the leaves with a water jet from the ground | No special requirements |

Solar Energy Systems by Schweizer:

Installation Manual – Maintenance.

6.2 Replacing Modules

1. Shift the module to the left of the defective module upwards until it detaches from the mounting clamps on the bottom edge (when replacing modules on the left-hand edge of the PV array, the flashing profile must be pushed upwards).
2. Lift up the right-hand corner of the module to the left of the defective module by about 3 to 5 cm and secure the module in this position using a wooden wedge.
3. Shift the defective module upwards until it detaches from the mounting clamps on the bottom edge.
4. Lift up the defective module by the bottom edge and pull it downward and out.
5. Disconnect the connections to the neighbouring modules in the string and secure the loose cable ends of the neighbouring modules so that these do not "disappear" down between the PV array and the roof underlay.
6. Disconnect the grounding cable and secure the loose cable end so that grounding continues to be provided for all remaining modules.
7. Remove the defective module.
8. Connect the grounding cable to the replacement module.
9. Establish connections to the neighbouring modules in the string.
10. Mount the replacement module under the raised module or the flashing profile left beside it, push it under the module above it (at the top edge of the PV array: under the side flashing) until it clicks into place and lower it.
11. Pull the replacement module downwards until it clicks into place into the bottom mounting clamps.
12. Remove the wooden wedge under the right-hand bottom corner of the module to the left of the replacement module.
13. Pull the module or the flashing profile left beside the replacement module downwards until it clicks into place into the bottom mounting clamps.

Solar Energy Systems by Schweizer: Installation Manual – Deinstallation and Disposal.

7. Deinstallation and Disposal



WARNING

Incorrect handling because of insufficient qualification and expertise

Danger of severe injuries!

- Deinstallation and disposal of PV systems may only be carried out by qualified specialist firms.
-
- Commission only a specialist firm for inroof photovoltaic systems to carry out deinstallation and disposal.

Solar Energy Systems by Schweizer: Installation Manual – Additional Instructions.

8. Additional Instructions

8.1 Rules for Mounting Solrif® Battens

- The open end of a 120 mm × 30 mm Solrif® batten may only overlap the rafter/the counter batten by max. 200 mm.
- If the open end overlaps the rafter/the counter batten by more than 200 mm, the Solrif® batten must be continued as far as the next rafter/next counter batten.

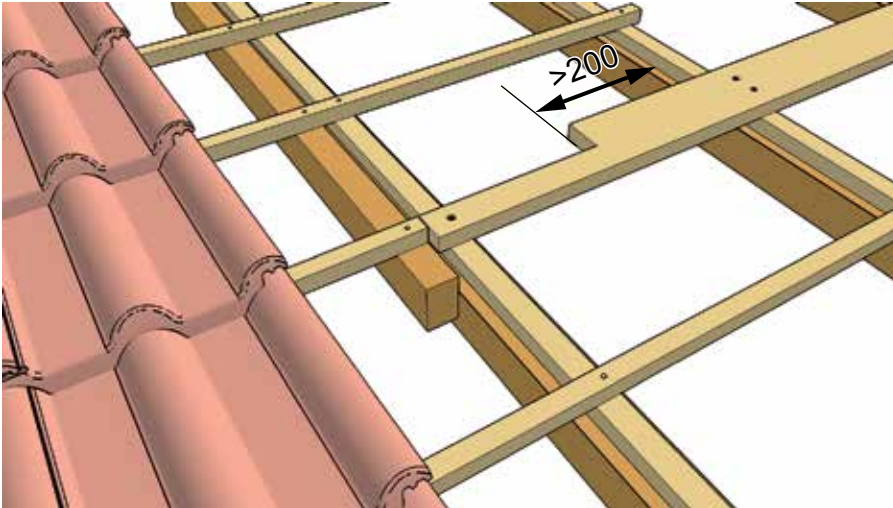


Fig. 65: Cutting a batten to size

- If the Solrif® batten collides with a tiling batten, the Solrif® batten must be continued as far as the next rafter / next counter batten and cut to size in such a way that it replaces the tiling batten in this section (see diagram).

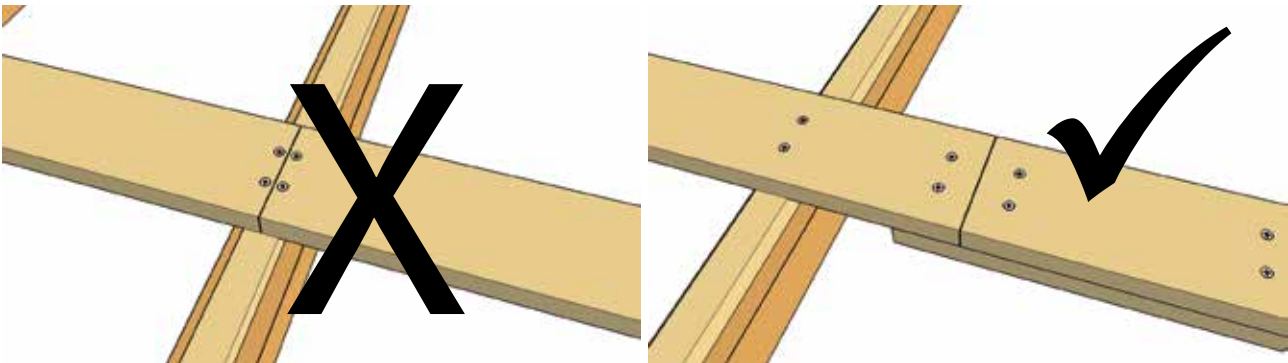


Fig. 66: Incorrect / correct joints

Solar Energy Systems by Schweizer:

Installation Manual – Additional Instructions.

ATTENTION

Solrif® battens must be mounted with screws according to „**Mounting Screws for Solrif® Battens**“ on page 29. The use of nails is not acceptable.

- Mounting screws must observe the following minimum intervals:
 - 31.5 mm distance in the direction of the grain (from the end of the wedge plank / Solrif® batten)
 - 22.5 mm perpendicular to the direction of the grain (from the edge of the wedge plank / Solrif® batten)The mounting of two adjoining battens onto a single counter batten (as in the above diagram) is NOT acceptable if the distance of the end of the batten to fall short of the minimum of 31.5 mm. To ensure that the required minimum distance is observed, the rafter/the counter batten must be "doubled" at the sides and the adjoining batten mounted onto it (as depicted in the drawing „**Rules for Mounting Solrif® Battens**“ on page 62).

Solar Energy Systems by Schweizer: Installation Manual – Further Information.

9. Further Information

You will find further information at www.ernstschweizer.ch in the following documents:

- Application range for Solrif® with regard to rainproofing
- Lightning protection concept
- Tech note for lightning and surge protection with Solrif®
- Fire protection requirements with Solrif® in Switzerland
- Application range for Solrif® with elevated snow loads