



# In-roof Solar Integrated Roof Tile Installation Manual



in-roof **solar** 

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# 1. INTRODUCTION

In-roof solar modules consist of a series of electrically interconnected crystalline silicon solar cells, which are permanently encapsulated between a tempered glass superstrate and substrate. The entire laminate is secured within an anodized aluminium frame for structural strength; ease of installation and to protect the cells from the most severe environmental conditions. In-roof solar modules are a highly reliable, virtually maintenance-free direct current (DC) power source, designed to operate efficiently in sunlight.

**Please read this manual carefully prior to handling and installation.**

Installation and maintenance of in-roof solar modules may only be carried out by trained personnel. If you require further information, contact your supplier or or local Wienerberger representative.

**Please ensure both the installer and owner of the PV system have access to this installation guide for future reference.**

Thank you for choosing in-roof solar modules.

# 2. CLASS APPLICATION

The modules are qualified for application class A: Hazardous voltage (IEC 61730: higher than 50V DC; EN 61730: higher than 120V), hazardous power applications (higher than 240W) where general contact access is anticipated (Modules qualified for safety through EN IEC 61730-1 and -2 within this application class are considered to meet the requirements for Safety Class II).

# 3. APPLICABLE MODULES

This installation manual is applicable to the following modules:

\*\*\* represents module Wp in increments of 5W of figures shown.

|                                       |
|---------------------------------------|
| 24 cells: PLM-***M-24 (** = 110-125)  |
| 24 cells: PLM-***MA-24 (** = 110-125) |
| 24 cells: PLM-***MB-24 (** = 110-125) |

## 4. WARNING AND NOTES



### Warning

In-roof solar modules generate electricity when exposed to light. An array of modules can cause lethal shock and burn hazards. Only authorized and trained personnel should have access to the PV modules. To reduce the risk of electrical shock or burns, modules may be covered with an opaque material during installation. Do not touch live terminals with bare hands. Use insulated tools for electrical connections.

Each in-roof solar module has a pair of male and female waterproof connectors. For a series electrical connection, connect positive (+) connector of first solar module to negative (-) connector of the following module.

Do not short the positive and the negative. Do not disconnect under load. Ensure each connection is sound with no gap between the insulators. Poor connections may cause arcing and pose a fire and/or an electrical shock hazard.

Artificially concentrated sunlight shall not be directed on the in-roof solar module. The electrical characteristics are the indicated value of Pmax under standard test conditions (Irradiance of 1000W/m<sup>2</sup>, AM 1.5 spectrum, and cell temperature of 25°C).

Under normal conditions, a solar PV module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly the value of Isc and Voc marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor current ratings, fuse sizes, and sizes of controls connected to the in-roof solar PV module output. Refer to local and national Electrical Code for any additional multiplying factors, which may also be applicable.

### **Handle with care**

Unpack and handle the PV modules with care. For safety always avoid installing PV modules during wet and windy conditions or during electrical storms.

- Do not place heavy objects on to the PV modules.
- Do not step or walk on the module, although in-roof solar modules are rugged, flexing caused by bodyweight on the module face can create micro-cracks in the solar cells, which may not be visible but will effect cell performance as the module ages. Take care not to impact the module during installation, module glass can be broken (and the module will no longer work properly) if it is dropped or hit by tools or other objects.
- Take care not to allow the front glass or backsheet of the module come into contact with hard or sharp surfaces such as scaffold during the installation process to avoid scratching or damaging the PV module.
- Do not scratch the PV module backsheet.
- Do not drill or cut the PV module frame.
- Do not apply paint or glue to the PV module.

## 5. PERMIT

Before installing your system, contact local authorities to determine the necessary permit, installation and inspection requirements.

## 6. CLIMATE CONDITIONS

Install the In-roof solar PV modules in the following conditions:

- Ambient temperature:  $-20^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ .
- Operating temperature:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .
- Storage temperature:  $-40^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$
- Humidity: below 85RH%
- Wind pressure: below 5400Pa
- Corrosion resistant: Except for corrosive salt areas and sulphurous areas.

## 7. MODULE STRUCTURE

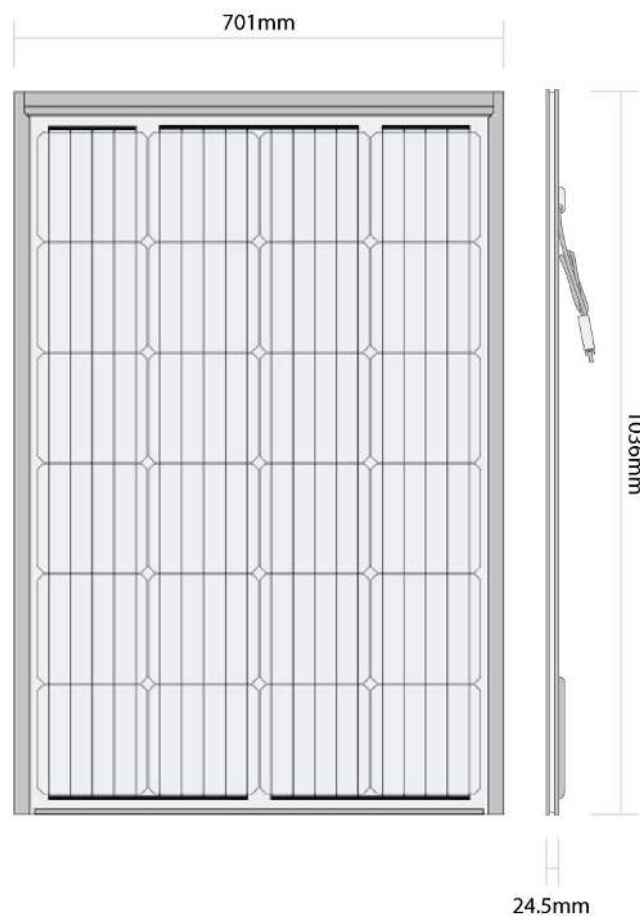
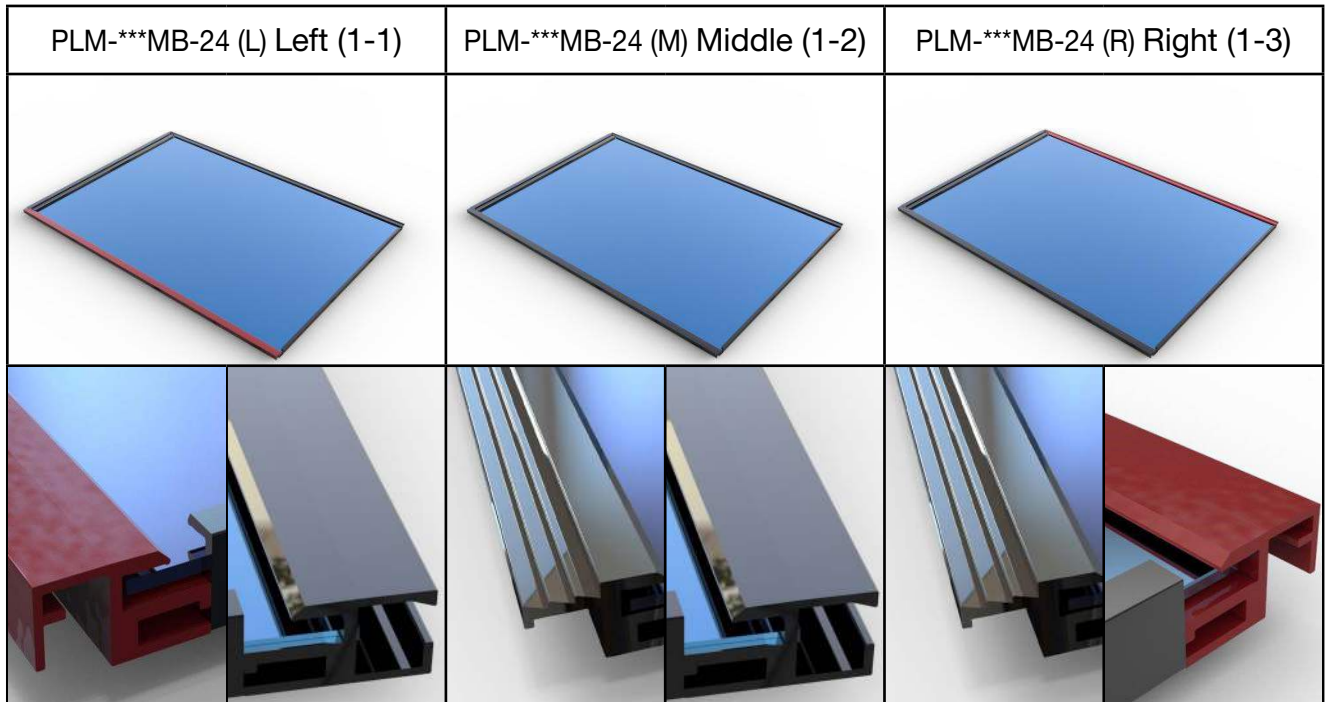


Fig.1: Module Structure

## 8. MOUNTING AND NOTES

### Identification of Left side, Right side and Middle modules.

Take care to identify the modules correctly. Outer module frames are designed to fit with the surrounding flashing and cannot be interchanged.






**The design of the outer left and outer right frames of Left & Right modules is different from that of the Middle modules.**

**Outer left and right frames of Left & Right modules connect to the flashing system.**







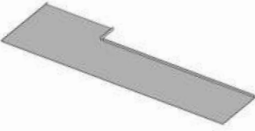
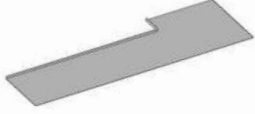

| In-roof Solar Frame details   |   |   |  |   |
|---|---|---|--|---|
|  |  |  |  |  |
| Upper Frame:<br>All modules   | Lower Frame:<br>All modules   | Flashing Edge:<br>Left & Right<br>Modules Only                                      | Female Edge:<br>Left & Middle<br>Modules Only  | Male Edge:<br>Middle & Right<br>Modules Only  |
| Material: 6063-T5   |   |   |  |   |

## Fittings List

|              |   |   |   |
|--------------|---|---|---|
| Illustration |  |  |  |
| Name         | Bottom Edge   | Self-Tapping Fixing<br>5*30mm<br>For In-roof Solar & Mid-clamp                    | BS5534 Graded<br>Wooden Batten**<br>(not included in kit)                           |
| Material     | 6063-T5   | Galvanised Steel  | Timber  |
| Part No.     | 2-1   | 2-2   | 2-3   |

|              |   |   |  |   |   |
|--------------|---|---|--|---|---|
| Illustration |  |  |  |  |  |
| Name         | Seal Strip 02<br>Side and Top Flashing to<br>Tile                                   | Seal Strip 01<br>Affixed to Upper Frame<br>between panel rows                       | Mid-Clamp<br>Left<br>2pcs on every<br>Left module (1-1)                              | Mid-Clamp<br>Right<br>2pcs on every<br>module<br>(1-1, 1-2, 1-3)                      | Bung<br>2pcs per system   |
| Material     | EPDM  | EPDM  | Stainless Steel  | Stainless Steel   | EPDM  |
| Part No.     | 2-4   | 2-5   | 2-6  | 2-7   | 2-8   |

## Flashing Components

| No. | Position  | Shape  | Part No. |
|-----|---|--|----------|
| 1   | Flashing- <b>Top Mid</b>  |    | 3-1      |
| 2   | Flashing- <b>Top Left</b>   |    | 3-2      |
| 3   | Flashing- <b>Top Right</b><br>(Symmetrical to 3-2, and has the same function)                           |    | 3-3      |
| 4   | Flashing - <b>Side Left</b>   |  | 3-4      |
| 5   | Flashing - <b>Side Right</b><br>(Symmetrical to 3-4, and has the same function)                         |  | 3-5      |
| 6   | Flashing - <b>Bottom Mid</b>  |  | 3-6      |
| 7   | Flashing - <b>Bottom Left</b>   |  | 3-7      |
| 8   | Flashing - <b>Bottom Right</b>  |  | 3-8      |
| 9   | Lead replacement flashing - <b>Seal Strip 03</b><br>– Used under Bottom Flashings & Over Top Flashings. |  | 3-9      |



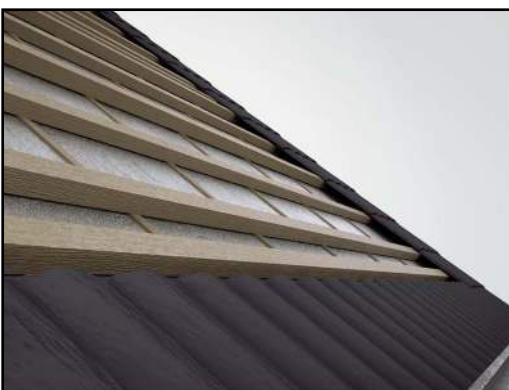
## Preparation



**Unpack and check all components are present, correct and undamaged before beginning the installation.**

## Tools required

|  |  |  |   |  |
|--|--|--|---|--|
|  |  |  |  |  |
| Cordless Drill Driver  | Spirit Level   | Hammer   | Chalk-Line  | Tape Measure   |



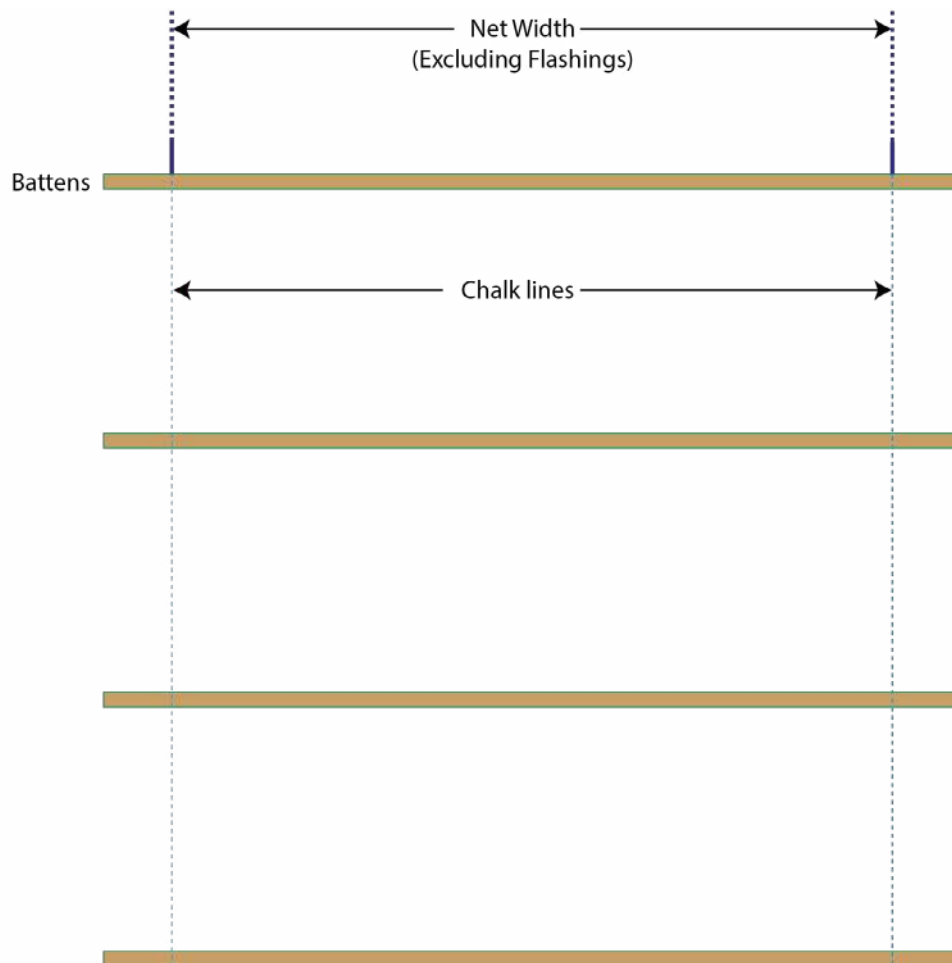
**Advisory:**  
Pre-install the tiles to the underside of the in-roof Solar array.

## Installation Steps

Modules are installed left-to-right, starting with the bottom row.  
Complete the installation of each row before beginning the row above.



Mark the net width of the array. Use Chalk-lines to ensure correct positioning of the system and provide guidance throughout the install.

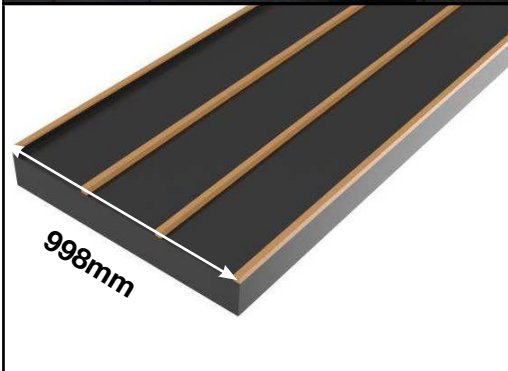


## Installation Steps

### Positioning Wooden Battens (2-4)



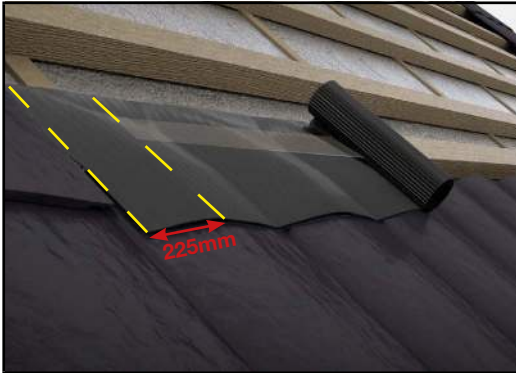
If a tiling batten does not sit <200mm away from the top of the tile below you will need to install an extra batten that supports the array. This should be no more than 200mm above the tile below.



Batten the roof for the tile being used. 998mm between Bottom Edge (2-1) position & the top of the module is the ideal spacing for the solar panels. If possible adjust tile batten gauge to suit this, if not additional battens will be required to fix the panels to.

## Installation Steps

Installing lead replacement flashing - Seal Strip 03 (3-9), Bottom Flashings (3-6, 3-7, 3-8) & Bottom Edge (2-1)



Install lead replacement flashing -Seal Strip 03 (3-9). The top of Seal Strip 03 will cover the bottom batten and provide a waterproof barrier between the array and first row of tiles. The lead replacement flashing - Seal Strip 03 should be formed with care on top of the first row of tiles below. Use the chalk lines and allow 225mm overrun each end of the bottom batten.

### Important:

The ambient temperature should be above 5 degrees Celsius and roof tiles must be dry and free from dirt, dust and loose materials before Seal Strip 03 is fixed.

Do not remove backing if bottom row of tiles is not in place. Fix only when certain of install position.

### Caution:

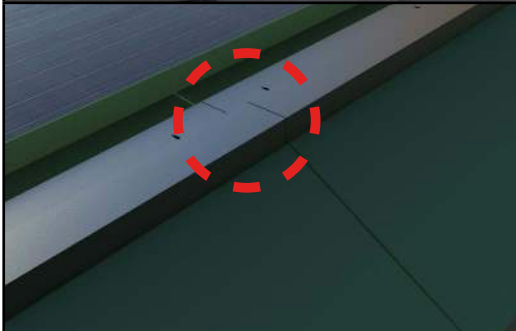
Correct alignment of Flashing-Bottom Left & Bottom Edge is a critical step of installation, take extra care to ensure correct alignment.



Install Flashing-Bottom Left (3-7) & Bottom Edge (2-1) Align both Flashing-Bottom Left & Bottom Edge with the top of the bottom batten.

Use the Self-Tapping Fixings 5\*30mm (2-2) to secure both into position.

Use a spirit level to ensure both are level.



Continue to install Flashing-Bottom Mid (3-6) & Bottom Edges ensuring they are in alignment and level.

Note that all Bottom Edges must be aligned in a uniform line and level so that the subsequent modules can be aligned. It is highly recommend you take your time and use a spirit level to ensure this is achieved.







Upon reaching the final column, butt-up and fix the Flashing-Bottom Right (3-8) & Bottom Edge (2-1) in the same way as the previous Bottom flashings and Bottom Edges.

The right hand side of the final bottom edge bar should align with the right hand chalk line made earlier.

Ensure the entire row is level before proceeding.

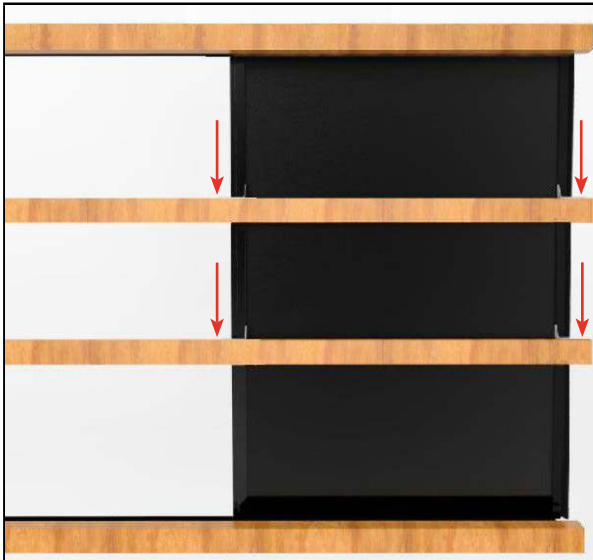
## Installation Steps

### Placement of the First Module

| <b>Always begin in-roof Solar installation from the bottom left.<br/>Complete the row from left to right before beginning installation of the row above.</b> |   |
|--|---|
|   | <p>Prior to install test each panel with a multimeter to check there are no faults.</p>   |
|    | <p>Installing bottom row of modules:<br/>The Lower Frame of the module slots into the Bottom Edge as illustrated.</p> <p>Begin module installation with panel marked with 'L' on label to rear.<br/>Slot the Lower Frame into the Bottom Edge.</p>                                    |
|   | <p>Ensure the Junction box is not in contact with any existing tile battens. If necessary, remove the tile batten.</p> <p>Also take care to ensure cables do not become trapped between battens and module frame.</p>   |
|   | <p>Prior to fixing the first module, temporarily insert the Flashing Side Left (3-4) (see page 19) ensuring it sits within the bottom corner flashing. Adjust the module position if necessary.<br/>Repeat this step on completion of the row with the Flashing Side Right (3-5).</p> |
|   | <p>TIP - remove connector cables from behind the panels prior to fixing the panel for easier access.</p>  |
|   | <p>The Upper Frame of the module needs to be fixed with Self-Tapping Fixings 5*30mm (2-2).</p>  |

## Installation Steps

### Mid-Clamps



Fit module Mid-Clamps(2-7) to first module.  
1. Slide the module Mid-Clamp into the rear of the module frame.  
2. Slide down, locking into position onto the supporting batten and screw to secure using Self-Tapping Fixing 5\*30mm (2-2).

Only the first module of each row requires two of both Left & Right Mid-Clamps.

Every other module requires two Right Mid-Clamp (2-8) only.

#### Left side Mid-Clamps (2-7)

1st Module of each row only



#### Mid-Clamps (2-8)

Install on every module



## Installation Steps

### Placement of additional modules



Connect to the first panel before laying the second In-roof Solar, paying attention to wiring string design.



Panel marked with 'M' on label to rear (1-2) should be used in the middle section only.

Note that when the end of the row is reached, the rightmost module must be panel marked with 'R' on label to rear (1-3).

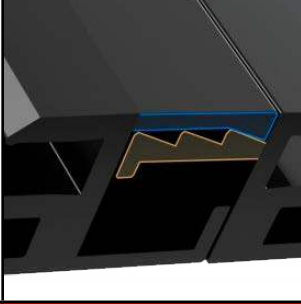
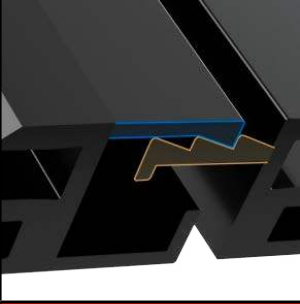
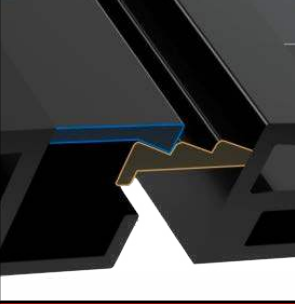
Insert the Male Edge of the second module into the Female Edge of the first module as shown in the image.



Keeping the panel at approximately 30 degrees, lower the panel down past the screws fixing the bottom edge bar, once about a centimetre from the bottom flatten the panel and push it down from the top, engaging the interlock into the bottom edge bar.

## Installation Steps

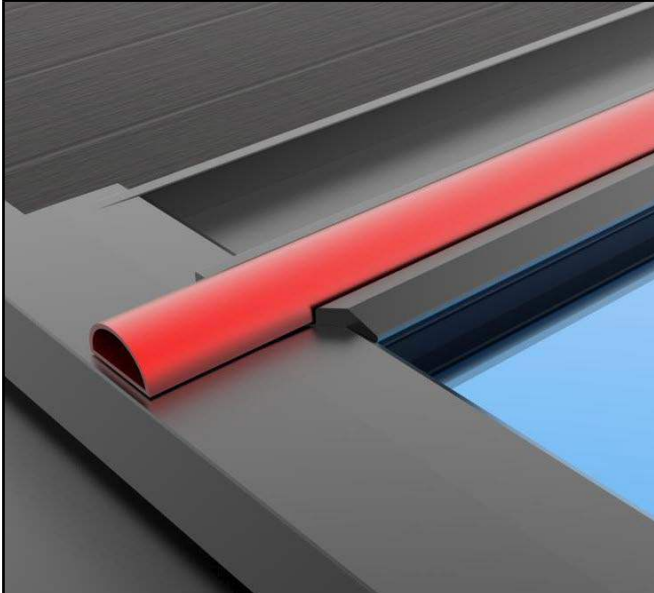
Placement of additional modules

|                |   |  |   |
|----------------|---|--|---|
| Illustration   |  |  |  |
| <b>Warning</b> | Lock in the first slot, for best waterproof and drainage function.                | Lock in the second slot, to meet the requirements.                                 | Avoid locking in the third slot, there will be a risk of leakage.                   |

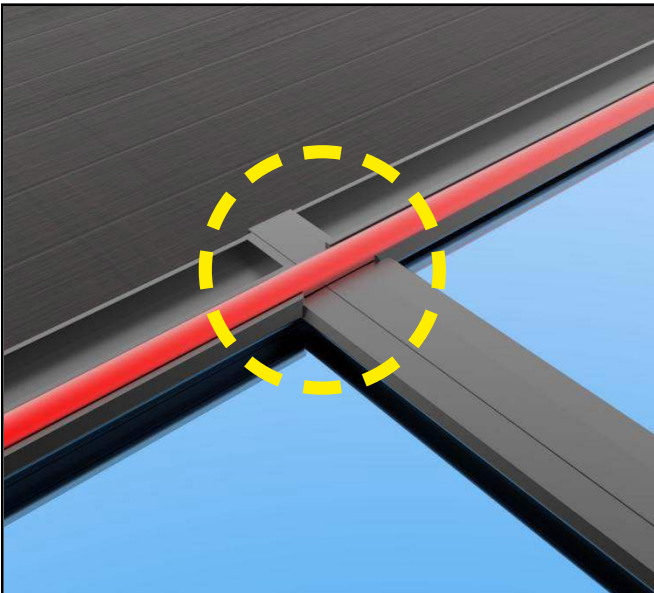


## Installation Steps

### Installing Seal Strip 01



After the installation of the first row of modules is complete, Seal Strip 01 (2-6) is uniformly placed at the slot of the aluminium Upper Frame of the modules that runs below the anchor points.

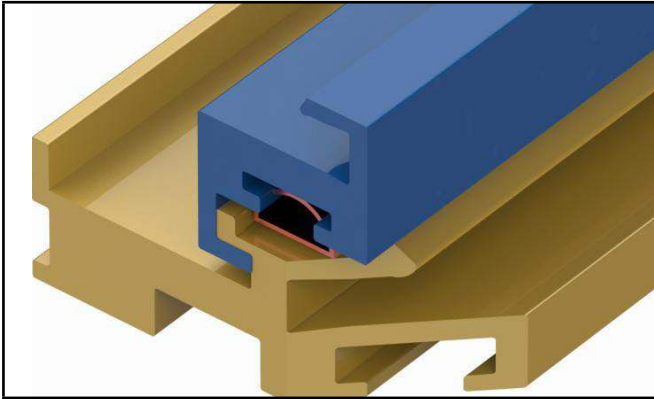


Seal Strip 01 is placed from the first module to the last module, forming a complete waterproof line.

Note: If the strip needs to be extended or joined, do so in the middle of the module, maintaining a continuous piece across the join between two modules.

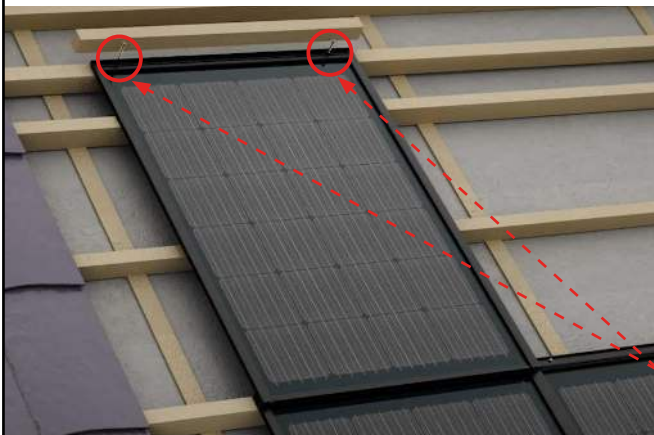
## Installation Steps

### Installing modules above bottom row



Remember when installing the first module in each row, a panel marked with 'L' for left (1-1) must be used.

The figure on the left shows the Lower Frame of the new module (Blue) slotting into the Upper Frame (Yellow) of the already installed module and Seal Strip 01 (2-6)(Red).



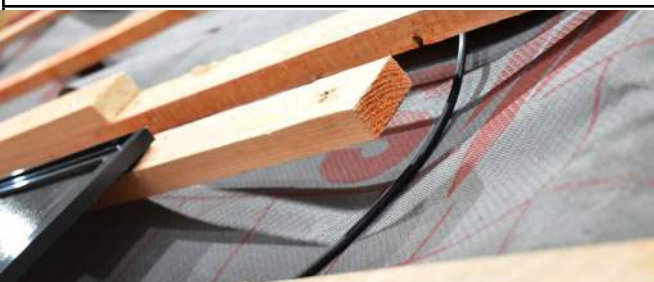
Due to the installation of Seal Strip 01 (2-6), you may feel resistance when trying to pull down the module after placement. To ensure alignment of the upper and lower joining modules, rubber hammer can be used to tap the upper edge of the module. Use a piece of batten with equal length to the module against the Upper Frame and gently tap into final position. Do not strike with excessive force and do not strike the front side of the module. Use Self-Tapping Fixings 5\*30mm (2-2) to lock modules tightly after placement & follow the same steps to add Mid-Clamps as in the first row.



The installation of middle modules in each row is the same.

Also note the final module of the row must be a panel marked with 'R' for right (1-3).

The process is completed the same as the bottom row including installation of Seal Strip 01 (2-6).



Pass the two end connectors up the lap of the underlay into the roofspace, ensuring the connector caps on these two cables are in place and secure.

## Installation Steps

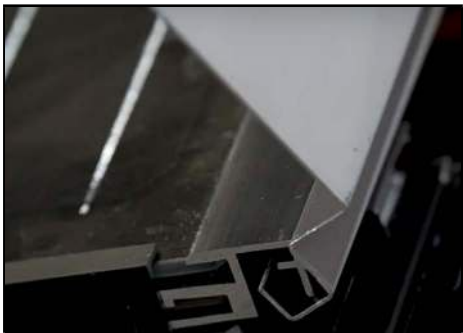
### Side Flashing installation



Each flashing is labelled on the rear side.



Remove white protective backing.



Begin with the bottom row.

Flashing-Side Left (3-4) & Flashing Side Right (3-5) are designed to connect directly with the outer frames of the left and right modules.

Insert the appropriate side flashing into the outer frame at a right angle.



Slowly turn the flashing until it locks into position.



Carefully slide the flashing down and overlapping into the bottom corner flashing.

The end of the side flashing should be flush with the bottom end of the module. Repeat on the other side and work upwards.



The side flashing of each subsequent row slides on top of flashing below, creating an overlap.

Each Side flashing should finish flush with the bottom end of the module, not protruding out of the module frame.

Do not use excessive force as this could deform the flashing and make installation more difficult.

## Installation Steps

### Top Flashing installation

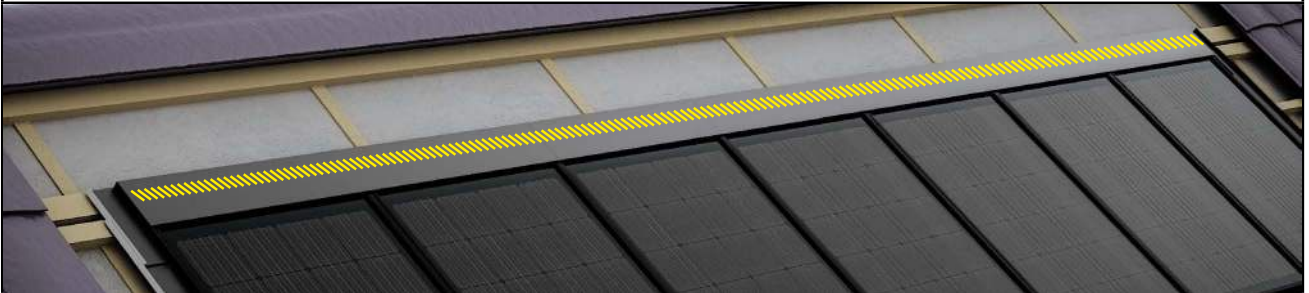
#### Top Flashing Support Batten

Top flashings require an additional support batten at the top to prevent movement when the tiles are laid.

If necessary, fit a double-batten.

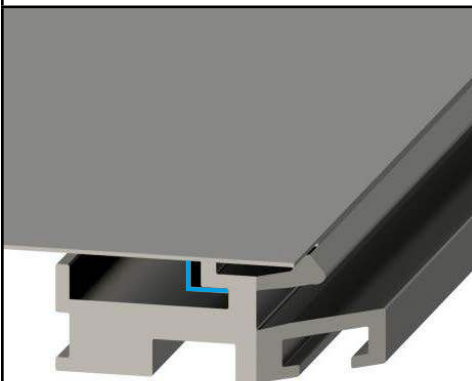
The support batten is only required for the net width of the array. It must not protrude past the end of the modules to allow the top corner flashings to fit correctly into the side flashings.

#### Top Flashing Support Batten Position



Start with one corner, then install the Flashing-Top Mid (3-1) before installing the opposite corner.

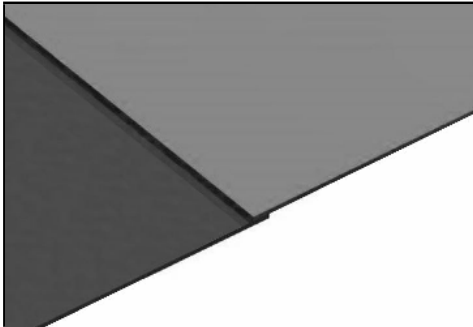
All three types have the same structure as the clamping parts of the module Lower Frames. The Flashing-Top Left (3-2) and Flashing-Top Right (3-3) are symmetrical in shape, and the installation method and function are the same. Compared with the Flashing-Top Mid (3-1), left and right vertical extensions are added, which insert into the side flashings to form an overlapping drainage path.



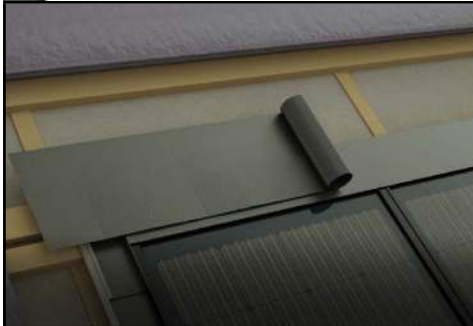
The illustration on the left shows how the Top flashings slot into the module Upper Frame.

## Installation Steps

### Top Flashing installation and Bung



Allow each Top flashing to overlap between 2mm-3mm.



After completing the Top Mid, Top-Left & Top-Right Flashings installation, install Seal Strip 03 (3-7) to ensure water-tightness and leave up to 10mm of Top-Flashing uncovered as shown in the illustration.



At the bottom of the first row only:  
Insert the Bung (2-9) into the outer frames of the Left & Right modules.



## Installation Steps

### Seal Strip 02 installation



Offer up a tile to check the installation position.

Tiles should overlap the side flashing by a minimum of 75mm.



Seal Strip 02 should be installed mid-way between the outside edge of the side flashing and edge of the tile.



Install the strip up the full length of both sides of the array.



Enough will be provided in the kit to allow the strip to be doubled in places where a large profile tile is used.

The strip should be used on all tile types. When a low profile tile or slate is used, the strip can be trimmed.

When pantiles or profiled tiles are used, apply an additional strip of Seal Strip 02 across the top of the array to file any gaps in the tile profile.

## Installation Steps

### Tiling



Take extra care tiling around the edge of the array.

Ensure the tile overlaps the flashing by a minimum of 75mm.

**DO NOT** mechanically fix through the aluminium flashing of the array.



If the tiles will not lay flat due to tile nibs conflicting with the flashing, it is acceptable to remove the nib using a hammer.



If required, it is also permitted to tap flat the raised outer upstand of the aluminium flashing using a hammer to enable the tile lay flat.



If the tile is still not flat, use screw-fixing and additional accessories as needed.



#### Acceptable methods of second fixing

Nail + clip

Nail + adhesive fully adhered to next twice fixed tile

Nail and verge clip

Drill second nail hole.

## Installation Steps

### Tiling



The tile should not overhang the panel and should overlap the aluminium top flashing by the minimum headlap of the tile in use.



Tile the rest of the roof in the usual way.

**Installation Complete**

## Installation Example





## 9. MODULE WIRING

Each solar module is wired with three separate series cell strings.

### **Bypass Diodes**

Bypass diodes are wired in parallel with the series cell strings to prevent hot spot heating caused by individual cell reverse bias that occurs when a module is partially shaded.

### **Output Cables**

Each module has two standard 90°C rated, water-proof, UV resistant output cables each terminated with plug & play connectors. This cable is suitable for applications where wiring is exposed to the direct rays of the Sun.

### **Field connections**

Connecting cables should be a minimum of 12 AWG copper cables, which are UV resistant and insulated for a minimum of 90°C. All wiring and electrical connections must comply with local and national Electrical Code.

### **Blocking Diodes**

In a system utilizing a battery, blocking diodes are typically placed between the battery and the solar module output to prevent battery discharge at night. Diodes that are used as blocking diodes must: Have a Rated Average Forward Current [ $I_{F(AV)}$ ] above maximum system current at highest module operating temperature. Have a Rated Repetitive Peak Reverse Voltage [ $V_{RRM}$ ] above maximum system voltage at lowest module operating temperature.

## 10. MAINTENANCE

### Cleaning

Under most weather conditions, normal rainfall is sufficient to keep the in-roof solar module glass surface clean. If dirt build-up becomes excessive, clean the glass only with a soft cloth using mild detergent and water. **USE CAUTION WHEN CLEANING THE BACK SURFACE OF THE MODULE TO AVOID PENETRATING THE SUBSTRATE MATERIALS.** Wienerberger recommend cleaning the modules during the early morning or evening, when the panels will be operating at a lower temperature and producing little energy.

- Do not lean or stand on the modules during cleaning.
- Do not use high pressure water jets to clean the solar modules.

### Annual Checks

Once a year, check the tightness of terminal screws and the general condition of the wiring. Also, check to ensure the mounting hardware is tight and secure. Loose connections will result in damage to the array.

Changed in-roof solar modules must be of the same kind and type. Do not touch live parts of cables and connectors. Use appropriate safety equipment when working (insulated tools, insulating gloves, etc.).

Ensure a competent and qualified person disconnects the array from the inverter prior to conducting any repairs.



**Warning**

Cover the front surface of the solar module with an opaque or other material when working on the modules. Solar modules generate high voltage when exposed to sunlight.

# 11. RECYCLING

Wienerberger work to avoid unnecessary waste, keeping module packaging to a minimum, while maintaining the protection of the modules during transport.

Please recycle the cardboard and paper packaging in accordance with local guidelines and regulations.

## End of Life Disposal and Recycling

In-roof solar modules are designed to produce electricity for a minimum of 25 years, however the panels may continue to offer useful energy for years to come after this point. Once the panels reach the end of their useful life, they should be recycled in accordance with local guidelines and regulations.

Within the UK and European Union, solar modules are subject to Waste Electrical and Electronic Equipment (WEEE) regulations. The WEEE symbol is displayed on every module nameplate label at the rear of the panel. This means that this product shall not be treated as household waste and must be disposed of at an appropriate collection point.

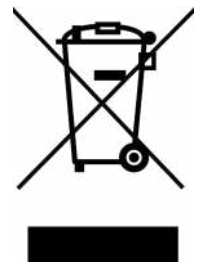


Fig.11: WEEE Symbol



# in-roof solar

## **Wienerberger Ltd**

Wienerberger House  
Brooks Drive  
Cheadle Royal Business Park  
Cheadle, Cheshire  
SK8 3SA

-  T: 01427 871200
-  [wbukmarketing@wienerberger.com](mailto:wbukmarketing@wienerberger.com)
-  [www.wienerberger.co.uk/solar](http://www.wienerberger.co.uk/solar)

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