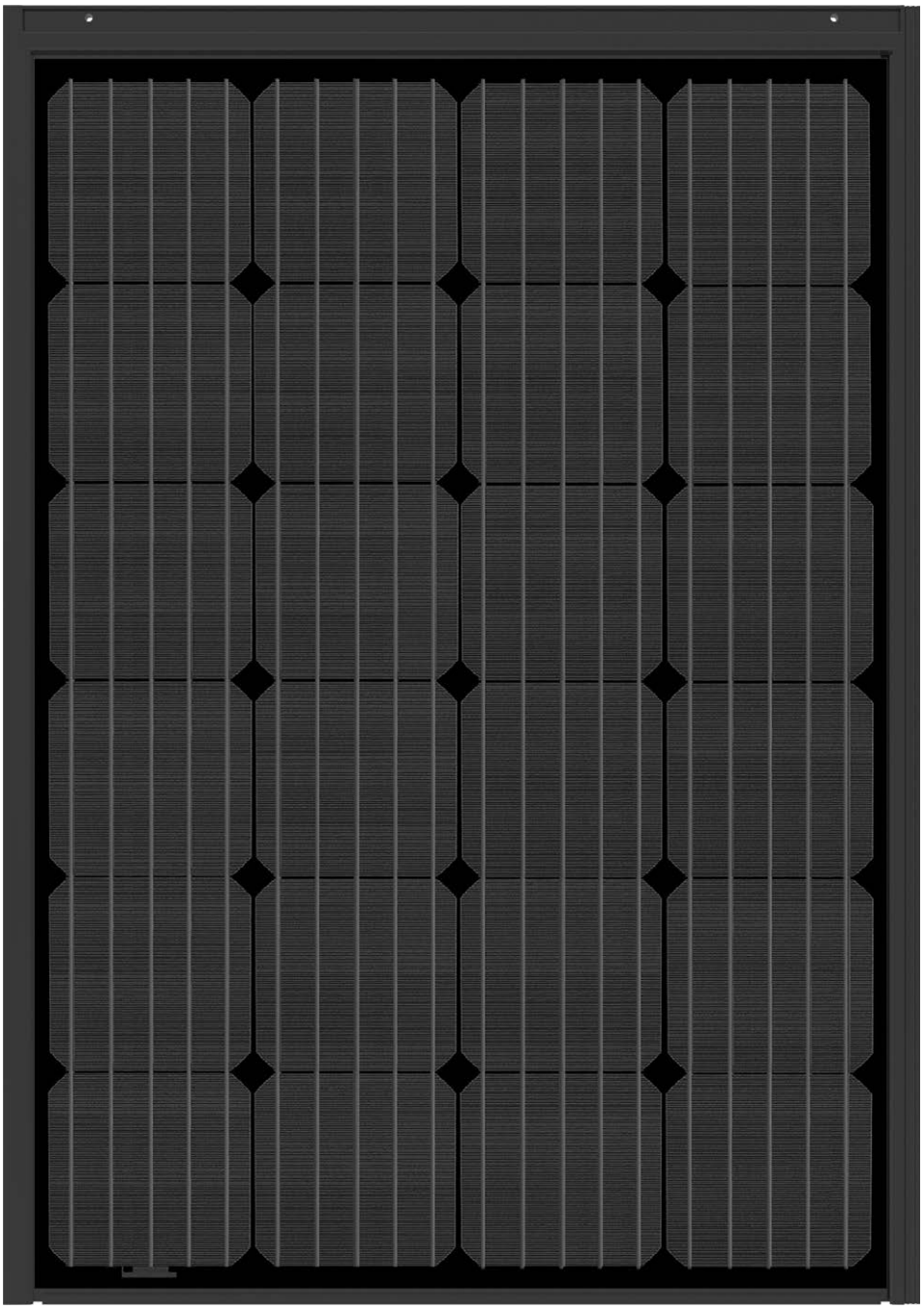
PERLIGHT IRT
INTEGRATED ROOF TILE

Perlight Solar
IRT Integrated Roof Tile
Installation Manual



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1. Introduction

Perlight 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. Perlight Solar modules are a highly reliable, virtually maintenance-free direct current (DC) power source, designed to operate efficiently in sunlight.

The Perlight Integrated Roof Tile (IRT) can be used directly as a roof tile and can cut roofing costs by reducing the number of traditional roof tiles needed. The design of Perlight IRT is different from other BIPV designs in the industry. The module is waterproof due to its physical structure. No other chemical compound such as rubber are used to seal the module to make it waterproof, which reduces the risk of water leakage caused by compound aging. The colour of Perlight IRT is mainly black, to blend in with the roof appearance. Installation of Perlight IRT is very convenient in comparison to other products with the same functionality, the number of fittings installed is reduced by more than 50%.

Please read this manual carefully prior to handling and installation.

Installation and maintenance of Perlight Solar modules may only be carried out by trained and qualified personnel. If you require further information, contact your supplier or local Perlight Service Centre.

Please provide a copy of this manual to the owner and operator of the PV system for reference.

Thank you for choosing Perlight IRT 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

Perlight 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 Perlight 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 Perlight Solar module. The electrical characteristics are the indicated value of Pmax under standard test conditions (Irradiance of 1000W/m^2, 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 Perlight 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 Perlight 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 Perlight Solar PV modules in the following conditions:

- Ambient temperature: -20°C to +40°C.
- Operating temperature: -40°C to +85°C.
- Storage temperature: -40°C to +40°C
- Humidity: below 85RH%
- Max. static load front (Snow): 5400Pa
- Max. static load back (Wind): 3420Pa (Partial safety factor: 1.44)
- Corrosion resistant: Except for corrosive salt areas and sulphurous areas.

7. Module Structure

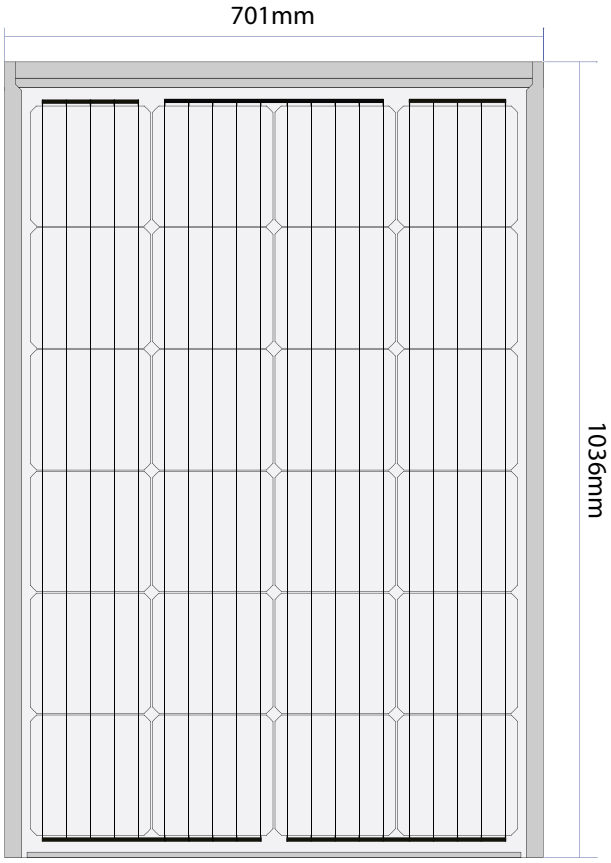
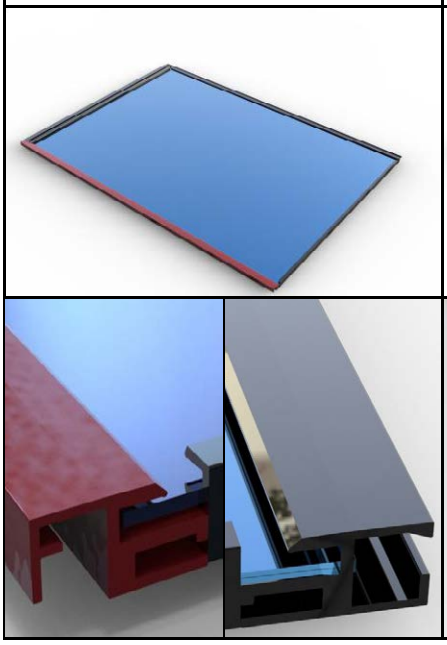
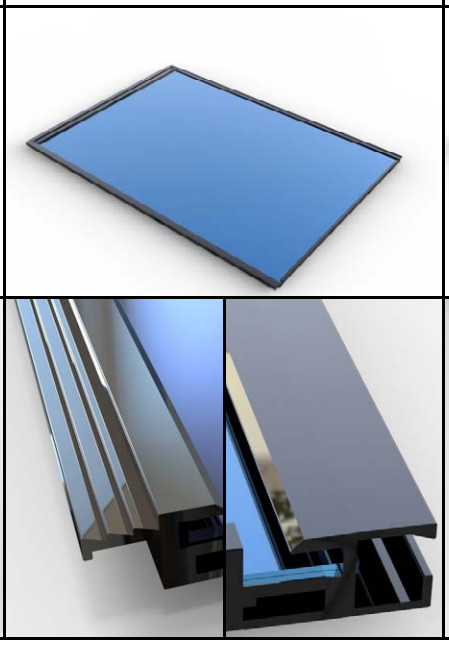
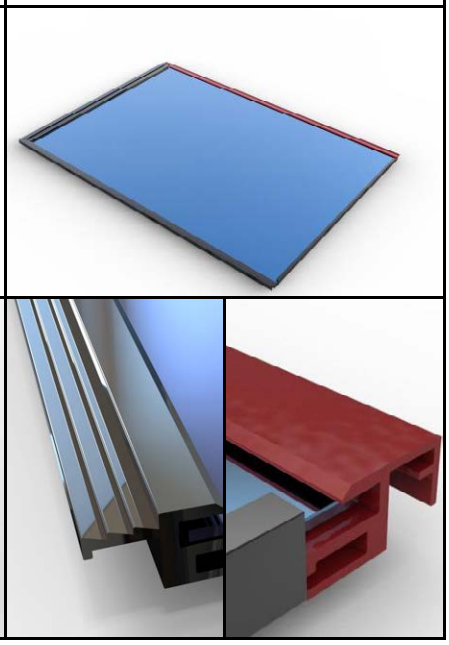


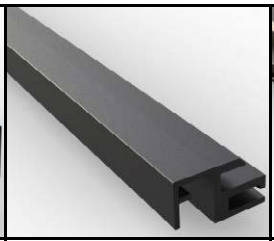
Fig.1: Module Structure

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.

PLM-***MB-24 (L) Left (1-1)	PLM-***MB-24 (M) Middle (1-2)	PLM-***MB-24 (R) Right (1-3)
		

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.

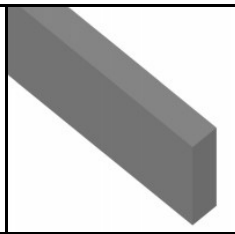
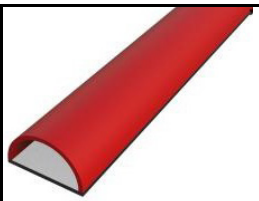
IRT Frame details				
				
Upper Frame: All modules	Lower Frame: All modules	Flashing Edge: Left & Right Modules Only	Female Edge: Left & Middle Modules Only	Male Edge: Middle & Right Modules Only
Material: 6063-T5				

Note: The module Upper Frame is essentially the same as the Bottom Edge (2-1) mounting strip.

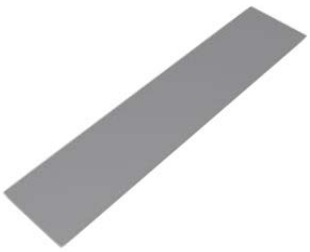
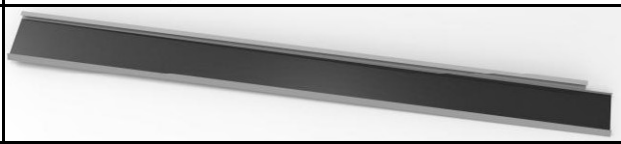
Fittings List

Illustration				
Name	Bottom Edge	Self-Tapping Fixing 5*30mm For IRT & Mid-clamp	Self-Tapping Fixing 5*70mm** For Wooden Batten	BS5534 Graded Wooden Batten** 50*25mm
Material	6063-T5	Galvanised Steel	Galvanised Steel	Timber
Part No.	2-1	2-2	2-3	2-4

**Self-Tapping Fixing 5*70mm (2-3) & Wooden Batten (2-4) not included in kit

Illustration				
Name	Seal Strip 02 Side Flashing to Tile	Seal Strip 01 Affixed to Upper Frame between panel rows	Mid-Clamp Left 2pcs on 1st module of each row	Mid-Clamp Right 2pcs on every module
Material	EPDM	EPDM	Stainless Steel	Stainless Steel
Part No.	2-5	2-6	2-7	2-8

Flashing Components

No.	Position	Shape	Part No.
1	Flashing–**Top Mid**		3-1
2	Flashing-**Top Left**		3-2
3	Flashing-**Top Right** (symmetrical to 3-2, and has the same function)		3-3
4	Flashing - **Side Left**		3-4
5	Flashing - **Side Right** (symmetrical to 3-4, and has the same function)		3-5
6	Flashing - **Bottom**		3-6
7	**Seal Strip 03** – Used under Bottom Flashing & Over Top Flashings.		3-7

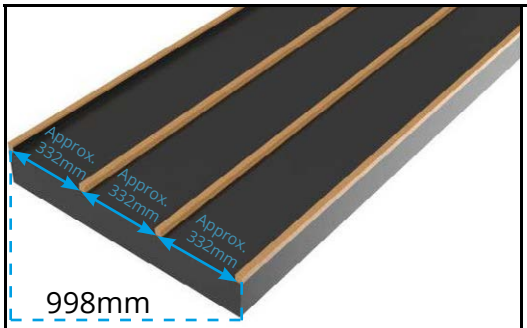
Installation Steps (Example)

Calculate installation position of IRT modules

Four battens required per row.
Supporting Bottom Edge & top anchor positions in Upper Frame and approxamatley 259mm from module ends.

Existing roofs:
Remove Battens/Laths from IRT Junction Box position to avoid contact with Junction box.

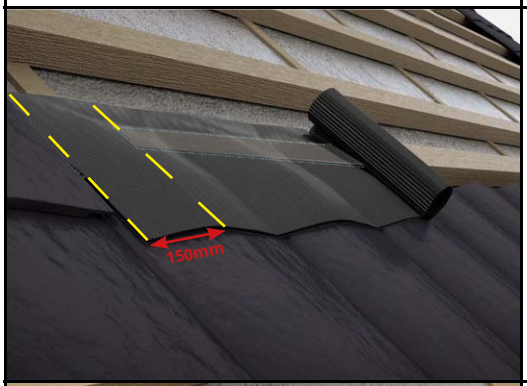
IMPORTANT:
For wind-loading safety all 50*25mm wooden battens **must** be fixed using 5*70mm wood screws.



50*25mm Wooden Batten (2-4) spacing required is 998mm between Bottom Edge (2-1) position & top of module anchor position of the Upper Frame.
Two supporting 50*25mm Wooden Battens are placed between these battens, leaving approxamatley 332mm space between each batten.

Spacing is repeated on every subsequent row using the lower row anchor position in place of Bottom Edge position.

Install the modules left-to-right, starting with the bottom row. Complete the installation of each row before beginning the row above.



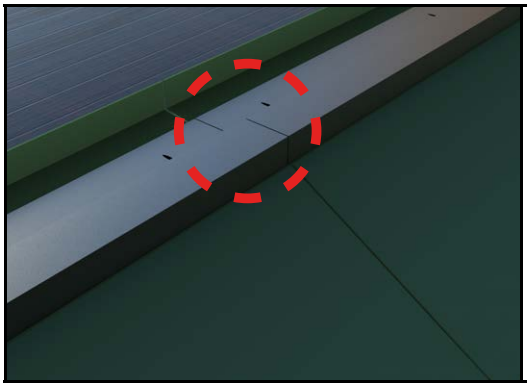
Note: The first row of tiles beneath the array must be in place before beginning installation.

Install **Seal Strip 03 (3-7).** The top of the Seal Strip 03 will cover the bottom batten and provide a waterproof barrier between the array and first row of tiles. The Seal Strip 03 should be formed with care **on top of the first row of tiles below**. Allow 150mm - 200mm overrun after each end of the bottom batten. This will be covered later by the side flashings.

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

Install **Flashing-Bottom (3-6)** & **Bottom Edge (2-1)**
Align both Flashing-Bottom & Bottom Edge with the top of the bottom batten.
Use the **Self-Tapping Fixings 5*30mm (2-2)** to secure both into position.

Installation Steps (Example)

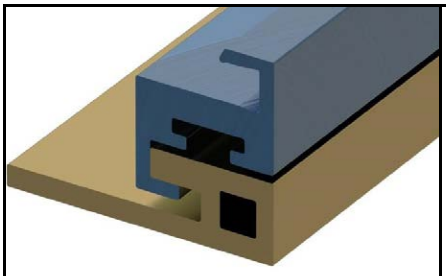


Continue to install the remaining Flashing-Bottom & Bottom Edges ensuring they are level and aligned with the previous ones.

Note that all Bottom Edges must be aligned with each other in a uniform line so that the subsequent modules can be aligned.

Placement of the First Module

Once the Bottom Edge and Flashing-Bottom is installed, installation of the modules can begin.



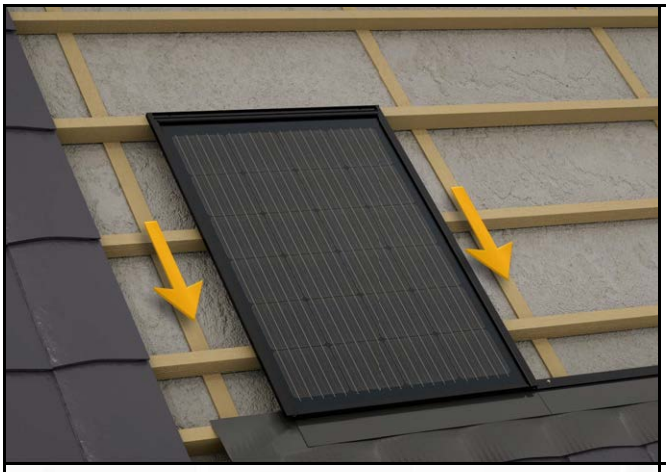
Installing bottom row of modules:
The Lower Frame of the module (Grey) slots into the Bottom Edge (Yellow) as illustrated.

Always begin IRT installation from the bottom left.
Complete the row from **left to right** before beginning installation of the row above.

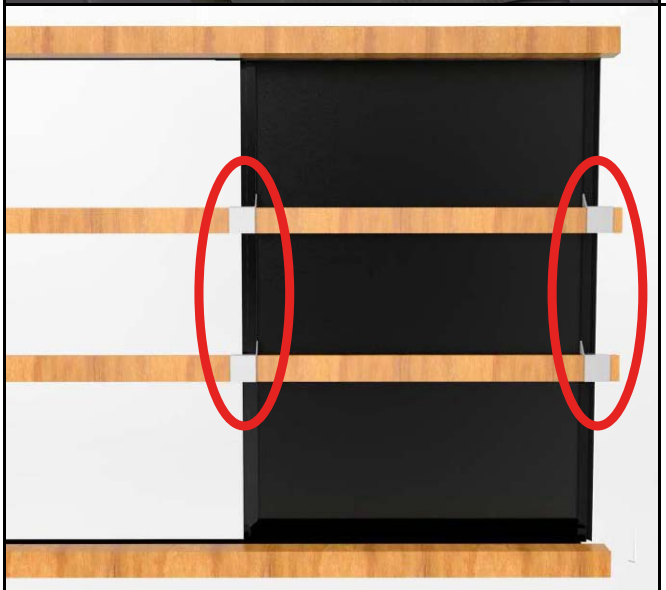
Remember to only use:
PLM-MB-24 (L) for the leftmost module of each row.**
PLM-MB-24 (R) for the rightmost module of each row.**
PLM-MB-24 (M) for every module between Left & Right end modules.**

Installation Steps (Example)

Placement of the First Module



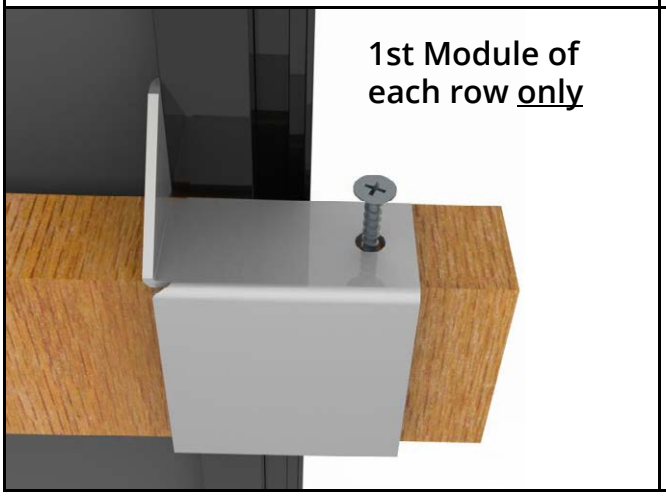
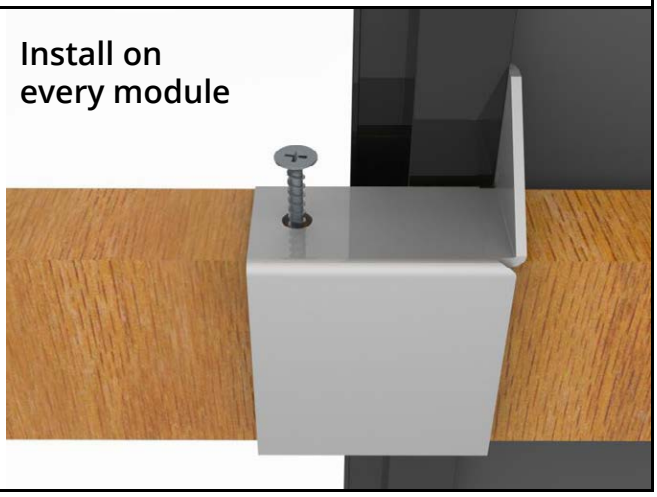
Begin module installation with PLM-MB-24 (L) (1-1).**
Slot the Lower Frame into the Bottom Edge. Fine tune the position of module to keep the centre of the module and the centre of Bottom Edge consistent. The Upper Frame of the module needs to be fixed with Self-Tapping Fixings 5*30mm (2-2) after it is put in place.



Fit module Mid-Clamps: Left (2-7) & Right (2-8) to first module.
1. Slide the module Mid-Clamp into the rear of the module frame.
2. Slide down, locking into postion onto the supporting and screw to secure using Self-Tapping Fixing 5*30mm (2-2).

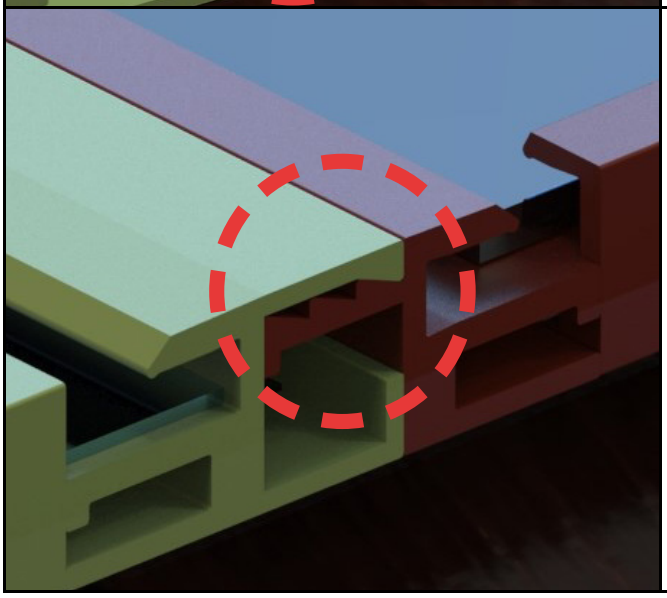
Only the <u>first module of each row</u> requires two of both Left & Right Mid-Clamps.

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

Left side Mid-Clamps (2-7)	Right side Mid-Clamps (2-8)
	

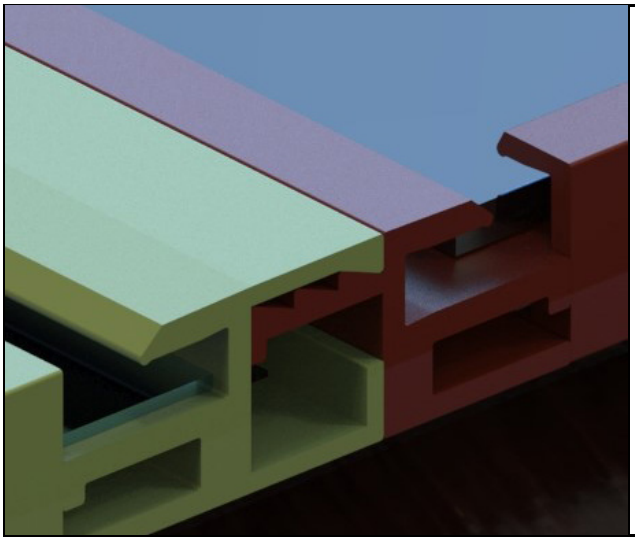
Installation Steps (Example)

Placement of additional modules

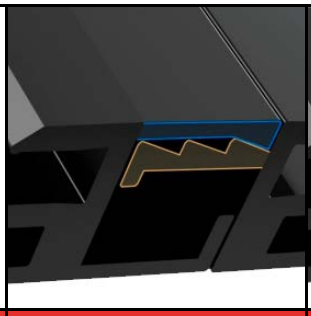
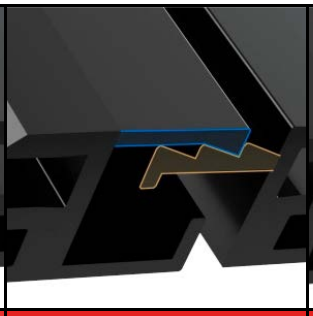
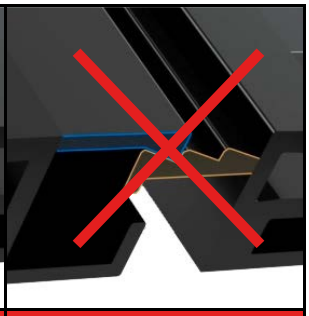
	After the first module (1-1) is fixed, you can continue to install the next module of the same row. PLM-**MB-24 (M) (1-2) should be used in the middle section only. Note that when the end of the row is reached, the rightmost module must be PLM-**MB-24 (R) (1-3). We suggest that two installers carry the module by holding two sides. **Insert the Male Edge of the second module into the Female Edge of the first module as shown in the picture.**
	**At the same time, lock the Lower Frame of this module with the clamp slot of the Bottom Edge.** Lay the module down and slide down into position. Check the placement to make sure the whole frame is in place and the module is placed flat. Because the frame will slide down naturally, there may still be room between Lower Frame and Bottom Edge slot, and slight mismatches between the second module and the first module as shown in the picture. Pull down the second module to make the Lower Frame insert into the Bottom Edge slot.
	To ensure alignment of the upper and lower parts of joining modules, a rubber hammer can be used to tap the Upper Frame of the module. Use a wooded strip with equal length to the module against the module edge and **gently tap** into final position. **Do not strike with excessive force and do not strike the front side of the module.**

Installation Steps (Example)

Waterproofing and Drainage



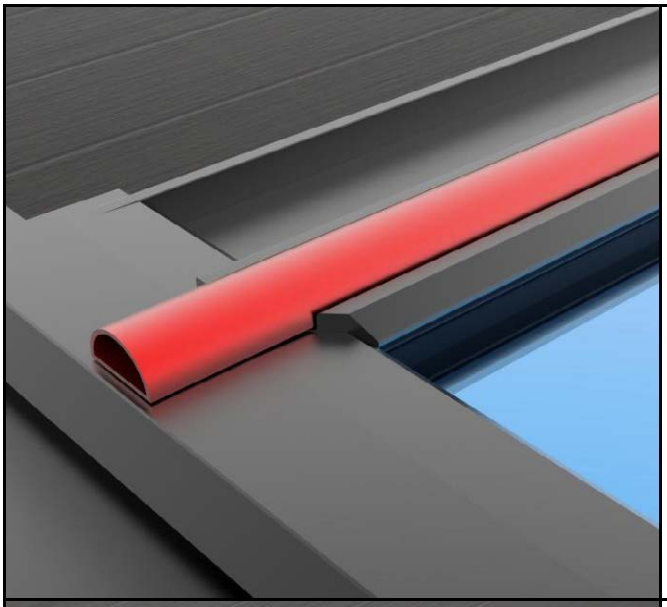
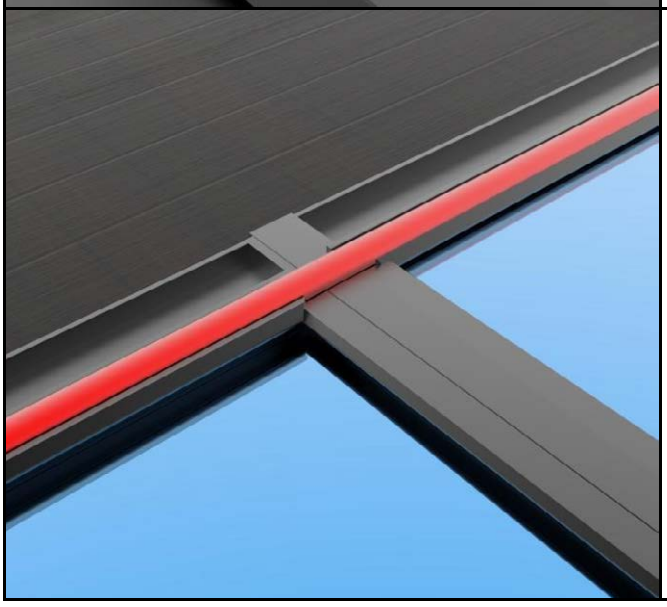
The waterproof and drainage function of the modules can be achieved only when the Male & Female Edges are tightly connected.
There can be no dislocation in order to protect the waterproof and drainage function.
There are three slots to lock the modules. Please lock the module in the first slot. The module can be locked in the second slot and maintain waterproof and drainage function but if the module is locked in the third slot, there will be a risk of leakage. See below.

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

After the module is in the place, fix it with 5*30mm Self-Tapping Fixings (2-2) the same as the first module.
When installing the rightmost side, pay attention to using the PLM-**MB-24 (R) (1-3), so that the rightmost modules can be connected to the Flashing-Side Right (3-4).

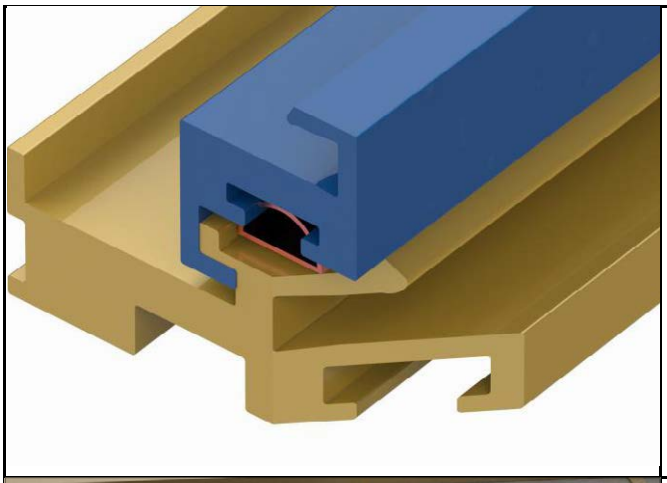
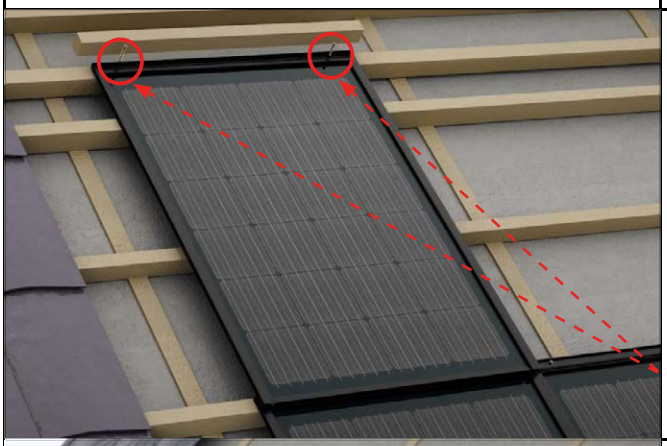
Installation Steps (Example)

Installing Seal Strip 01 after completion of first row

	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. **Seal Strip 01 must run continuously without any brakes.**

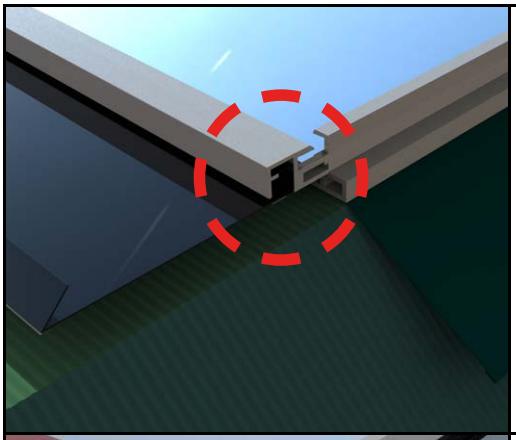
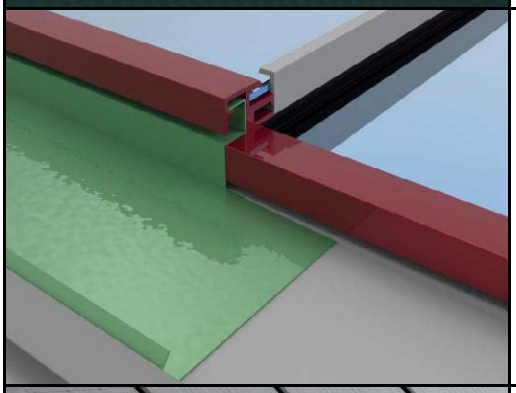
Installation Steps (Example)

Installing modules above bottom row

	The module Lower Frame slots directly into the Upper Frame of the module in below row. **Remember when installing the first module in each row, PLM-**MB-24 (L) (1-1) must be used.** The figure on the left shows the Lower Frame of the 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), it may be difficult 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 wooded strip 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 PLM-**MB-24 (R) (1-3). The process is completed the same as the bottom row including installation of Seal Strip 01 (2-6).

Installation Steps (Example)

Side Flashing installation

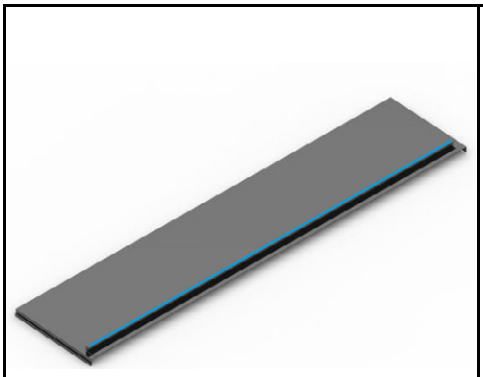
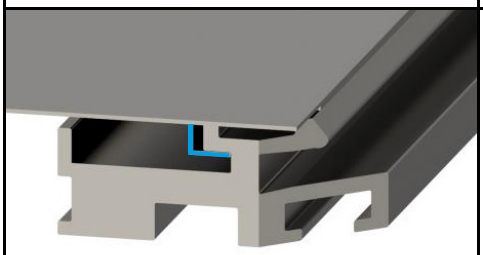
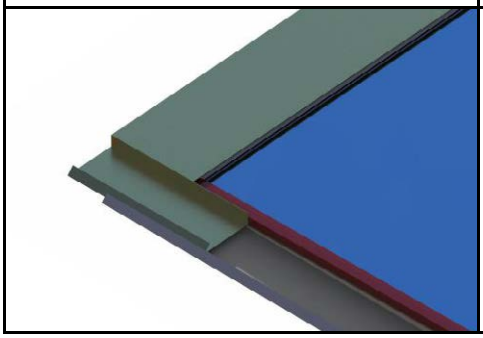
	**Flashing-Left (3-4) & Flashing Right (3-5)** are symmetrically designed and are matched with **PLM-**MB-24 (L) (1-1) & PLM-**MB-24 (R) (1-3)** Flashing Edges. **Flashing-Left & Flashing Right** slide into the outer Flashing Edges of **PLM-**MB-24 (L) & PLM-**MB-24 (R)** Flashing Edges from the bottom. **Begin with the bottom row and work upwards.**
	**Installation of the second row flashing:** The installation of second row flashing is the same as the first, both slide into the module outer Flashing Edges. A partial lower area of the second flashing covers the first to form an overlapping area. **Side Flashings are designed for the upper flashing to overlap the lower Flashing.**
	After Flashing-Left and Flashing-Right are all installed, attach **Seal Strip 02 (2-5)** to the flashing.
	**Seal Strip 02** can be cut later, when laying roof tiles to fill any gap between the roof tiles & flashing as shown.

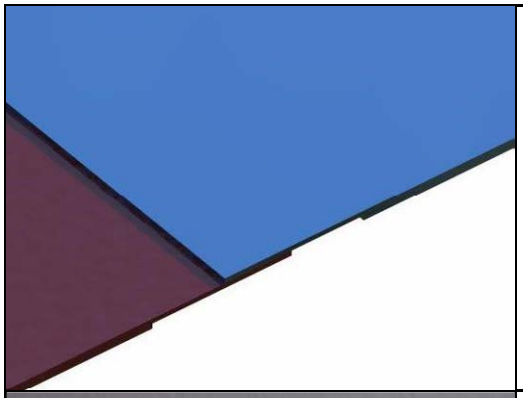
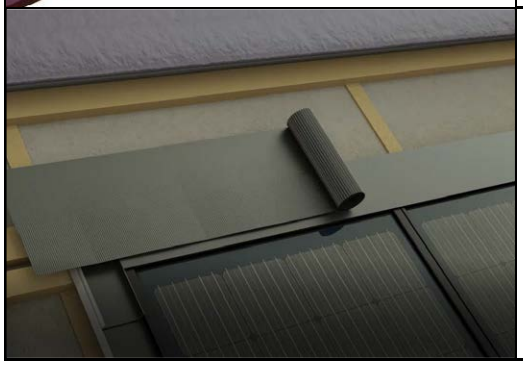
Installation Steps (Example)

Installation of Top flashings

Installation of the top flashings uses three types of flashing: **Flashing-Top Mid (3-1)**, **Flashing-Top Left (3-2)**, and **Flashing-Top Right (3-3)**, which can be installed **from Left to Right or Right to Left.**
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 (3-1), the left and right virticle extension parts are added, which are inserted into the Flashing-Side Left (3-4) and the Flashing-Side Right (3-5) of the system to form an overlapping water drainage path.

	Each Top flashing has a profile, which is similar in shape and size to the profile of the module Lower Frame and connects in the same way to the Upper Frame of the modules in the top row of the array.
	The illustration on the left shows how the Top flashings clamp to the module Upper Frame.
	The virticle extension of the Flashing Top-Left & Top-Right, slide into the side flashings as shown in the figure on the left. Top-Left & Top-Right flashings overlap the side flashings to create a drainage channel.

	**Allow each Top flashing to overlap between 20mm-30mm.**
	After completing the Top Mid, Top-Left & Top-Right Flashings installation, install **Seal Strip 03 (3-7)** to ensure watertightness and leave up to 10mm of Top-Flashing uncovered as shown in the illustration.

Laying Tiles

Perlight IRT can be connected with different types of tiles, including flat tiles and corrugated tiles.

Ensure the Seal Strip 02 is fully filling any gaps in the tiles at the side of the array. Seal Strip 02 may be cut to fit the profile of the tile depending on tile type.

Finally, lay the first row of tiles above the array ensuring the tiles do not protrude over the modules.

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 [IF(AV)] above maximum system current at highest module operating temperature. Have a Rated Repetitive Peak Reverse Voltage [VRRM] above maximum system voltage at lowest module operating temperature.

10. Maintenance

Cleaning
Under most weather conditions, normal rainfall is sufficient to keep the Perlight 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. Solar Modules that are mounted flat (0° tilt angle) should be cleaned more often, as they will not "self clean" as effectively as modules mounted at a 15° tilt or greater. Perlight 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 Perlight 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.).

Warning

Only trained personnel may carry-out repair work to the PV modules and system components.

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

Perlight 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

Perlight 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.

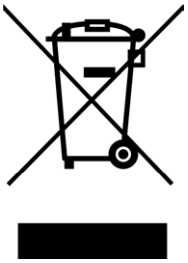


Fig.11: WEEE Symbol

Within the 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.

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