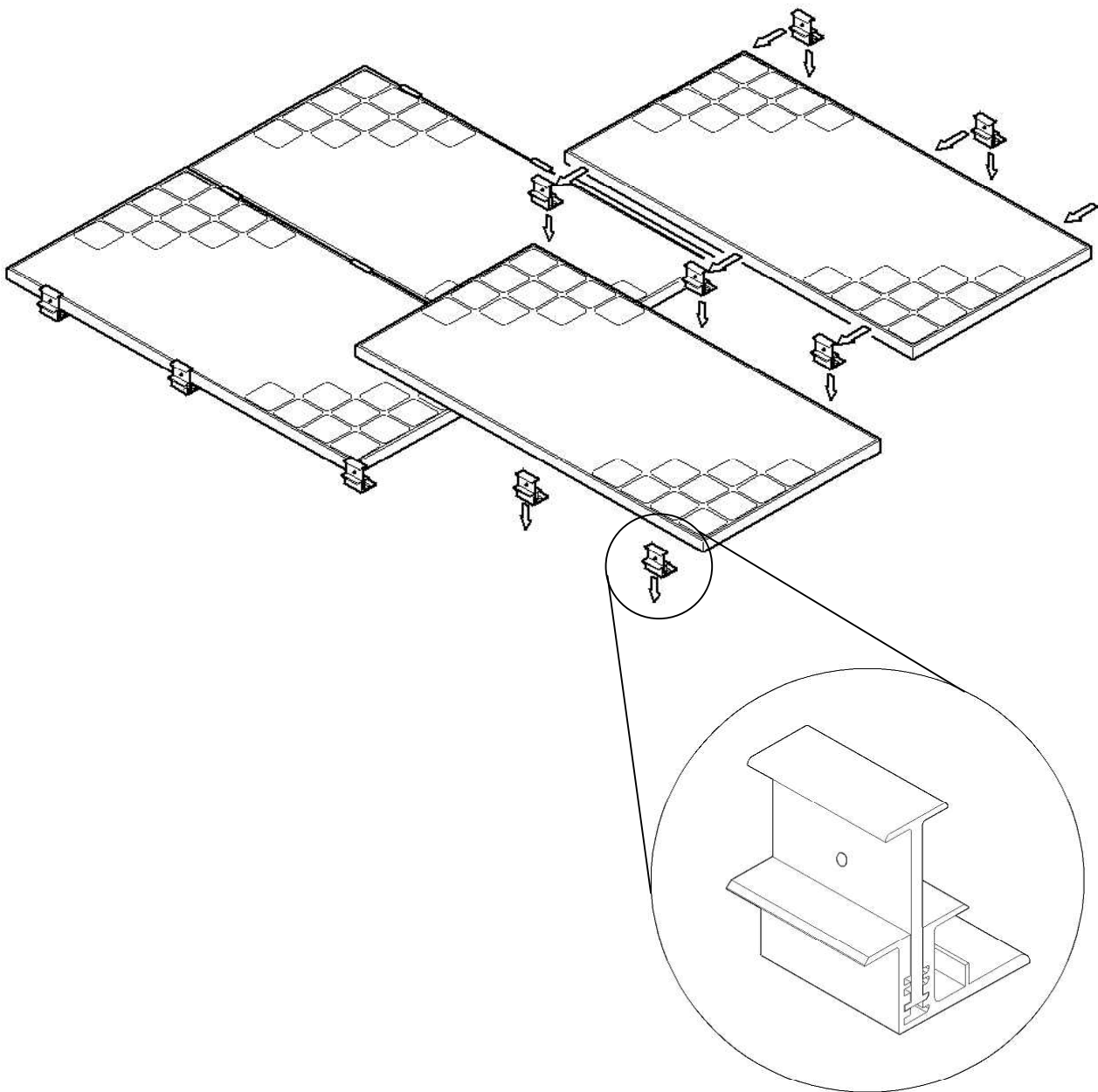


SMART RACK®

スマートラック

General Installation Manual



For Installation Personnel

Please review this manual carefully before installing your SmartRack® mounting system and carry out the installation procedures correctly.

This manual does not list all precautions needed for safe work. The installation of solar modules involves work in high places; take extreme precautions to avoid falling from the roof. To prevent accidents, safety regulations must be observed. When in doubt, follow OSHA guidelines.

This manual provides guidelines for installation, but it does not guarantee the quality of the installation work. Always refer to the PV module maker's installation manual with regards to live and dead loads, wind loads and installation location and conditions.

SmartRack®, when installed in accordance with this manual, will be structurally adequate and will meet the structural requirements of the IBC 2006, ASCE 7-05 and California Building Code 2007 (collectively referred to as "the Code"). Takashima & Co., Ltd. (hereby known as "TAK") also provide a limited warranty on SmartRack® products (page 16).

Please note that the installer is solely responsible for:

- Complying with all applicable local or national building codes, including any that may supersede this manual
- Ensuring that SmartRack® is appropriate for the particular installation and the installation environment
- Ensuring that the roof, its rafters, connections, and other structural support members can support the array under all code level loading conditions (this total building assembly is referred to as the building structure)
- Using only SmartRack® parts and installer-supplied parts as specified by Takashima & Co., Ltd. (substitution of parts may void the warranty and invalidate the letters of certification in all SmartRack® publications)
- Ensuring that lag screws have adequate pullout strength and shear capacities as installed
- Verifying the strength of any alternate mounting used in lieu of the lag screws
- Maintaining the waterproof integrity of the roof, including selection of appropriate flashing
- Ensuring safe installation of all electrical aspects of the PV array
- Ensuring correct and appropriate design parameters are used in determining the design loading used for design of the specific installation. Parameters, such as snow loading, wind speed, exposure and topographic factor should be confirmed with the local building official or a licensed professional engineer

Inspection of Roof Structure

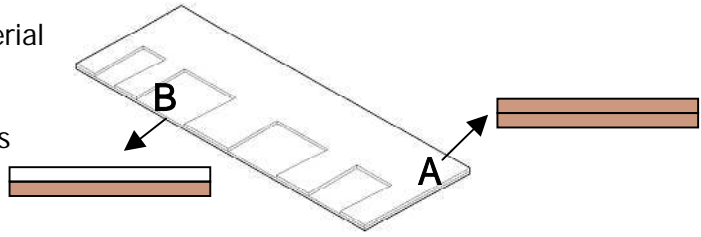
- Before starting installation work, check the condition of the house where the solar power system is to be installed
- It is important to inspect the structural integrity of the roof and the durability of the roof materials
- The SmartRack® mounting system and solar modules require a strong base for durable and reliable operation in local environments
- Inspect the roof surface in the area of the installation for cracks, water leakage, and roofing material quality and uniformity. This is especially important if the roof is more than 10 years old
- Inspect the roof for sags and other abnormalities. A sag or deep depression in the roof may indicate structural weakness in the support system that may require correction.

Inspection of the Roof Support System

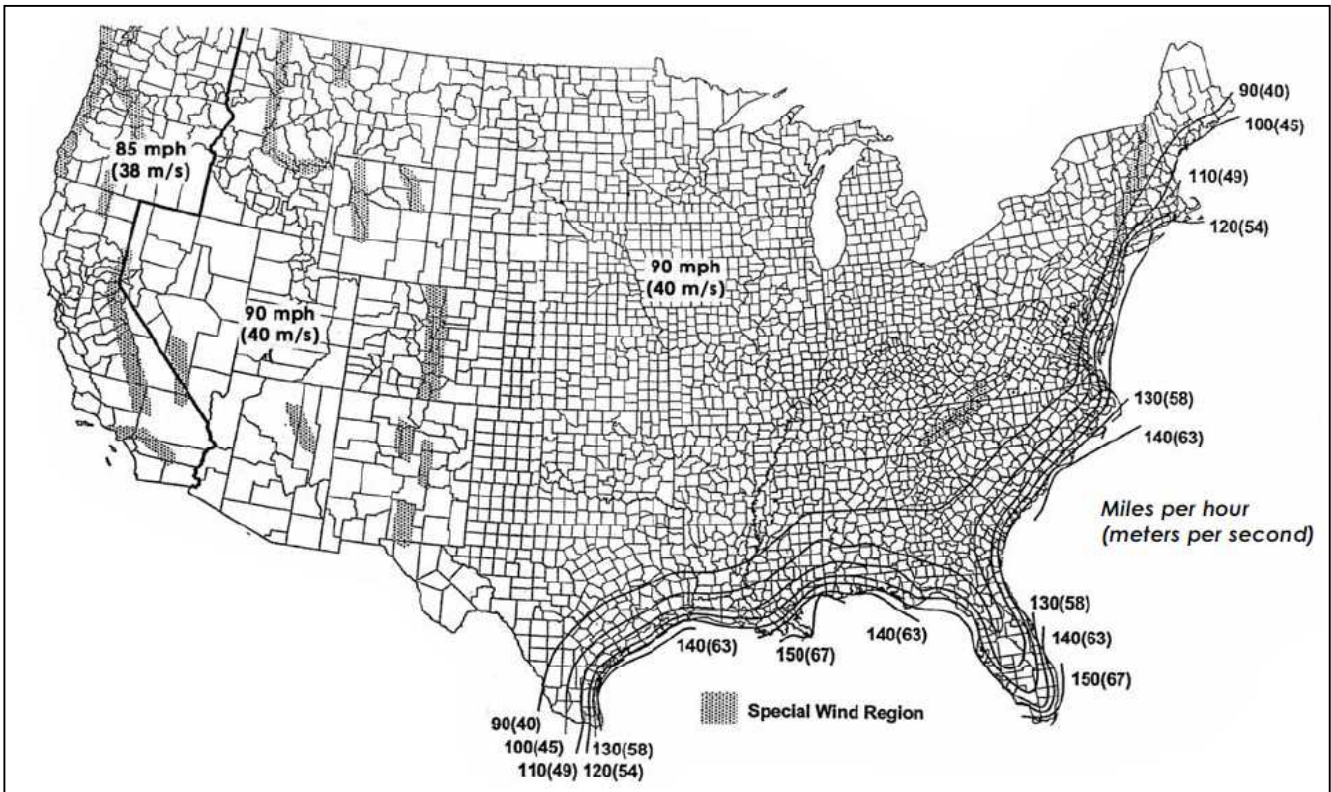
- This may require access to the attic
- Check that all rafters, trusses and other materials are in good condition
- Check for indication of previous water leaks
- Measure the spacing of the rafters or trusses to confirm the dimensions and prepare for the system layout

The following are conditions for for the use of SmartRack® Mounting System

- (1) Use on asphalt shingle roofing material
 - Planar Section (A): 6mm or less
 - Recessed Portion (B): 3mm or less



- (2) Determine the wind loads for the installation site. Check with your local building and safety department for the specific requirements
- (3) Determine the Basic Wind Speed by consulting your local building department or locating your installation on the map below
 - Installation is not advisable in areas where the Basic Wind Speed is >105 mph (>47 m/s)

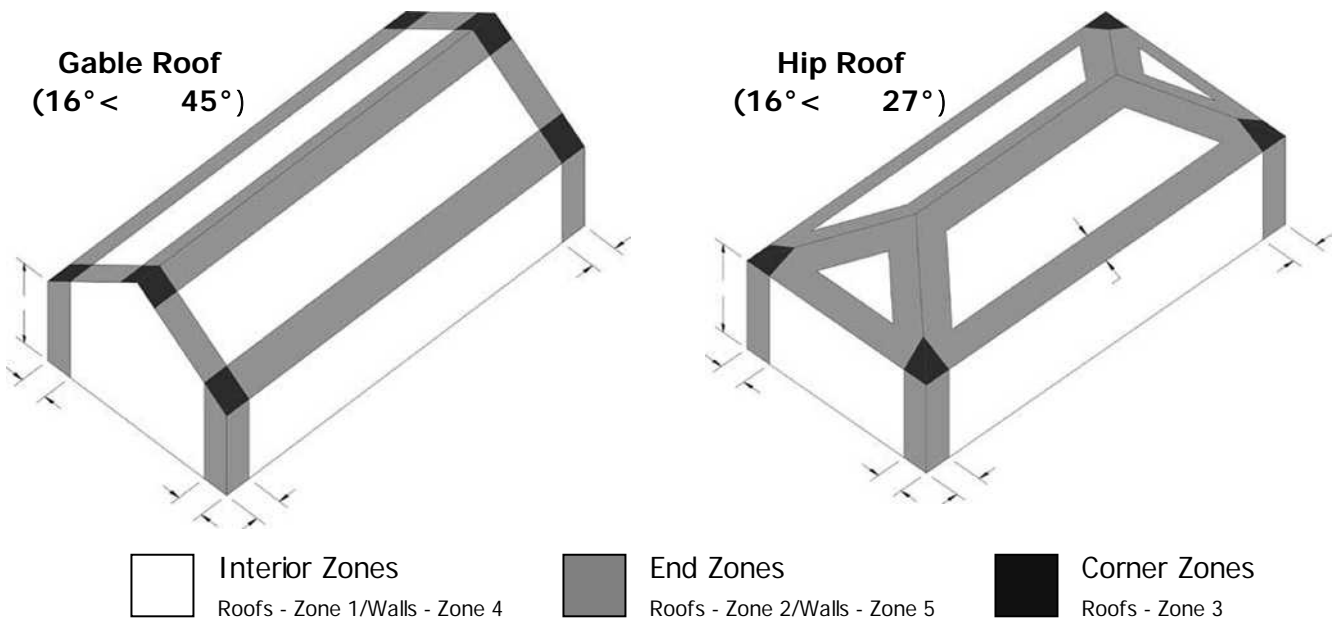


- (4) Determine the Exposure Category (obtain latest definitions from IBC or local building code)
 - We recommend using in exposure category B only
 - For reference, the ASCE/SEI 7-05 defines wind exposure categories as follows:
 - Exposure B is urban and suburban areas, wooded areas, or other terrain with numerous closely spaced obstructions having the size of single family dwellings
 - Exposure C has open terrain with scattered obstructions having heights generally less than 30 feet. This category includes flat open country, grasslands, and all water surfaces in hurricane prone regions
 - Exposure D has flat, unobstructed areas and water surfaces outside hurricane prone regions. This category includes smooth mud flats, salt flats, and unbroken ice

- (5) Determine the Roof Zone Setback Length, a (ft), according to the width and height of the building which you are installing the PV system
- We recommend installing in roofs with a maximum height (h) of 45 feet
 - We do NOT recommend installing on flat roofs

Roof Height (ft)	Least Horizontal Dimension (ft)																			
	10	15	20	25	30	40	50	60	70	80	90	100	125	150	175	200	300	400	500	
10	3	3	3	3	3	4	4	4	4	4	4	4	5	6	7	8	12	16	20	
15	3	3	3	3	3	4	5	6	6	6	6	6	6	6	7	8	12	16	20	
20	3	3	3	3	3	4	5	6	7	8	8	8	8	8	8	8	12	16	20	
25	3	3	3	3	3	4	5	6	7	8	9	10	10	10	10	10	12	16	20	
30	3	3	3	3	3	4	5	6	7	8	9	10	12	12	12	12	12	16	20	
35	3	3	3	3	3	4	5	6	7	8	9	10	12.5	14	14	14	14	16	20	
40	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	16	16	16	16	20	
45	3	3	3	3	3	4	5	6	7	8	9	10	12.5	15	17.5	18	18	18	20	

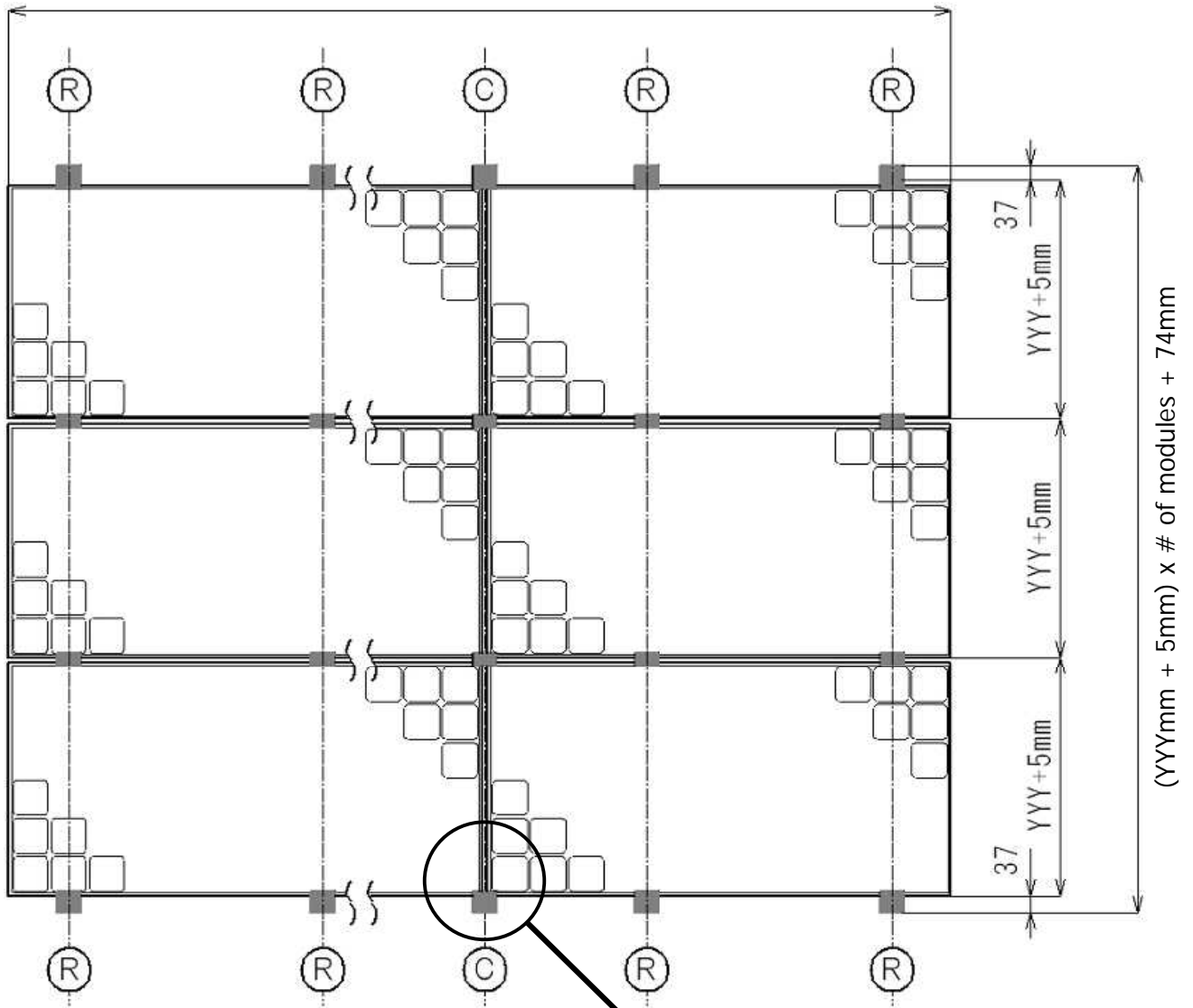
Source: ASCE/SEI 7-05, Minimum Design Loads for Buildings and Other Structures, Chapter 6, Figure 6-3, p. 41.



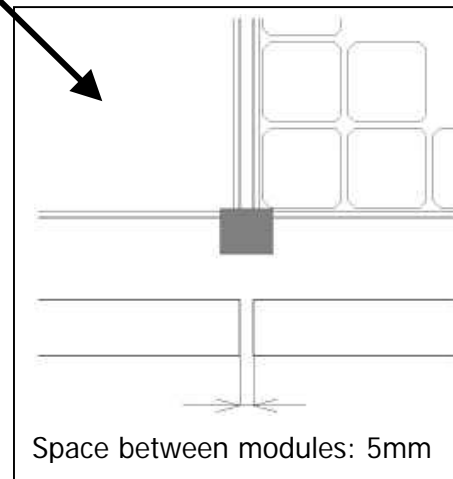
- (6) Determine the Net Design Wind Pressure by compiling Basic Wind Speed, Exposure Category and Roof Zone. Make sure to refer to the module maker's manual for the maximum net pressure allowable
- (7) Make certain that the roof structure can support the live and dead loads resulting from the installation of the PV array
- Consult with a professional engineer if additional assistance is required

Module Array Layout Dimensions

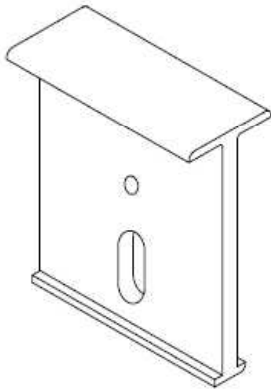
$(XXXXmm \times \# \text{ of modules}) + 5mm \times (\# \text{ of modules} - 1)$



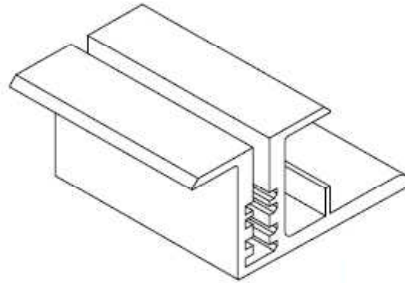
- Ⓜ rafter position
- ⓐ space between two horizontal modules
- XXXX length of 1 module (mm)
- YYYY width of 1 module (mm)



Parts List



T-clamp
x
10 pcs



Flanged
L-clamp
x
10 pcs



M6 x 25
Hex Flange Bolt
x
10 pcs



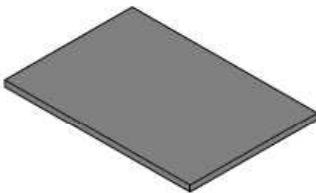
M4 x 16 Tapping
Screw
x
10 pcs



M6 x 25
Hex Flange Nut
x
10 pcs

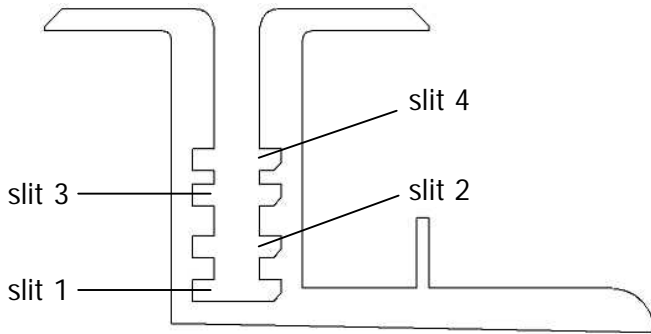


$\frac{5}{16}$ " x 3"
Lag Screw
x
10 pcs



Levelling Sheet
x
30 pcs

SmartRack® Assembly



Before assembling the SmartRack® mounting clamp, confirm the module height and slide the T-clamp to the appropriate slit in the flanged L-clamp

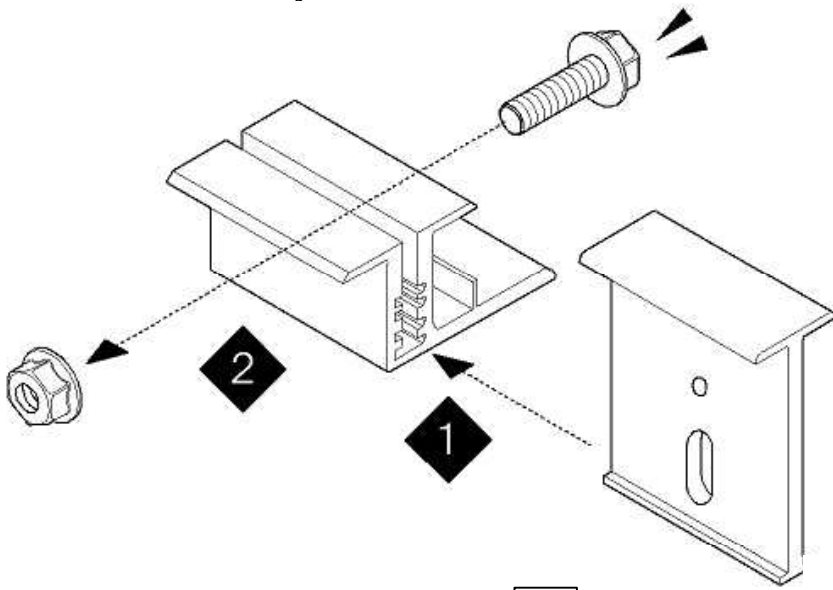
Note: There are 3 "sizes" for slit 1. Make sure that you have the appropriate clamp for your installation needs.

Style No	34mm	40mm	46mm	50mm
SR 034-S SR 034-B				

Style No	35mm	40mm	46mm	50mm
SR 035-S SR 035-B				

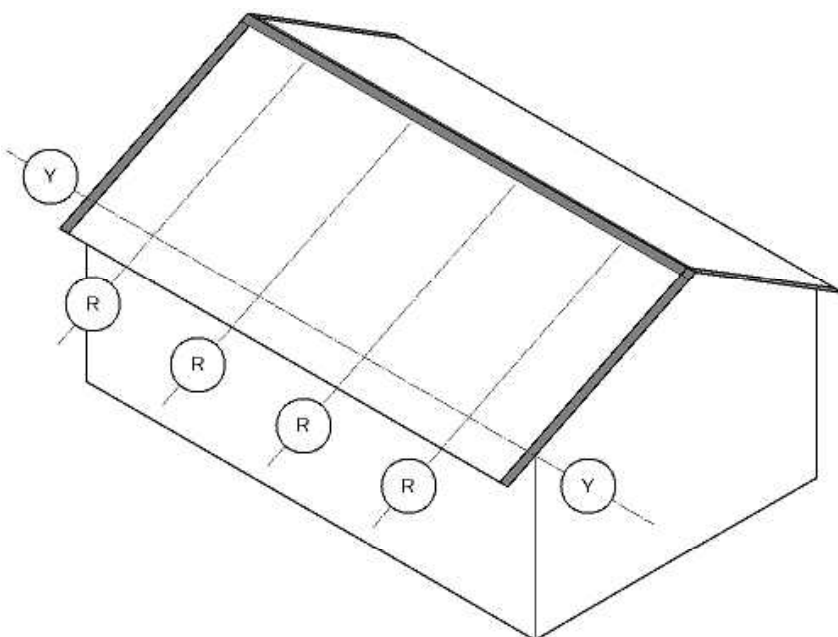
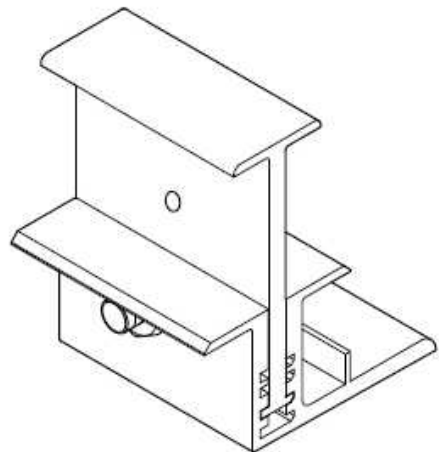
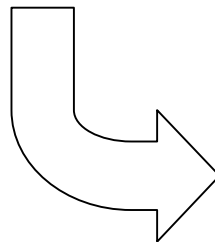
Style No	36mm	40mm	46mm	50mm
SR 036-S SR 036-B				

SmartRack® Assembly



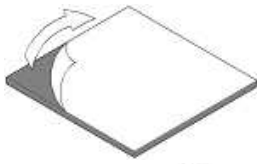
To assemble the SmartRack® clamp together, take the T-clamp and slide it into the appropriate "slit" of the flanged L-clamp depending on the height of the module you are installing.

Use the provided hex nut and bolt to lock the T-clamp

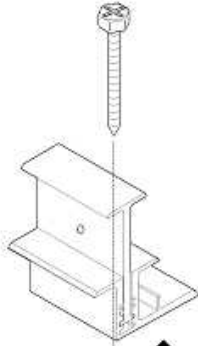


Prior to installation, it is recommended to use marking chalk to mark the location of the rafters (R) and where the first row of modules (Y) starting from the eaves side of the roof

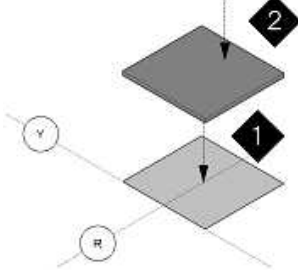
SmartRack® Installation



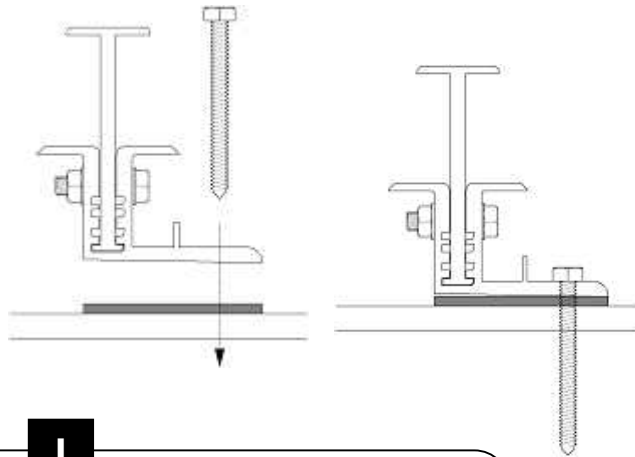
(1) Peel off the paper liner from the levelling sheet
*Rain leakage may occur if the paper liner is not peeled off prior to installation



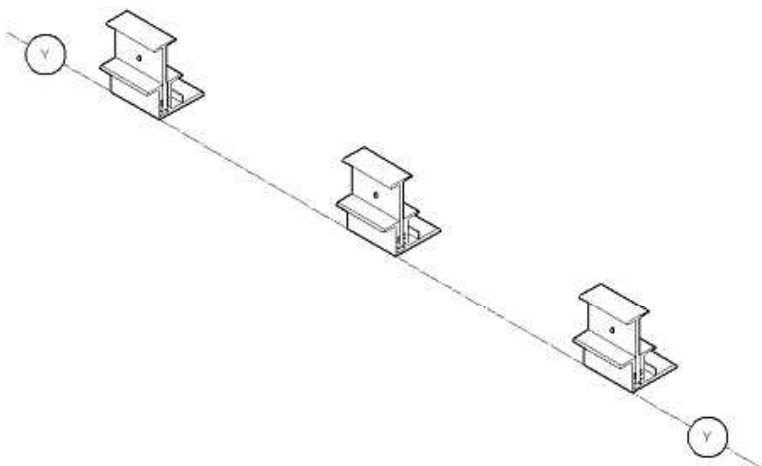
(2) Place the levelling sheet where the (R) line and (Y) lines intersect
*Make sure that the area where you place the levelling sheet is free from any dirt or dust



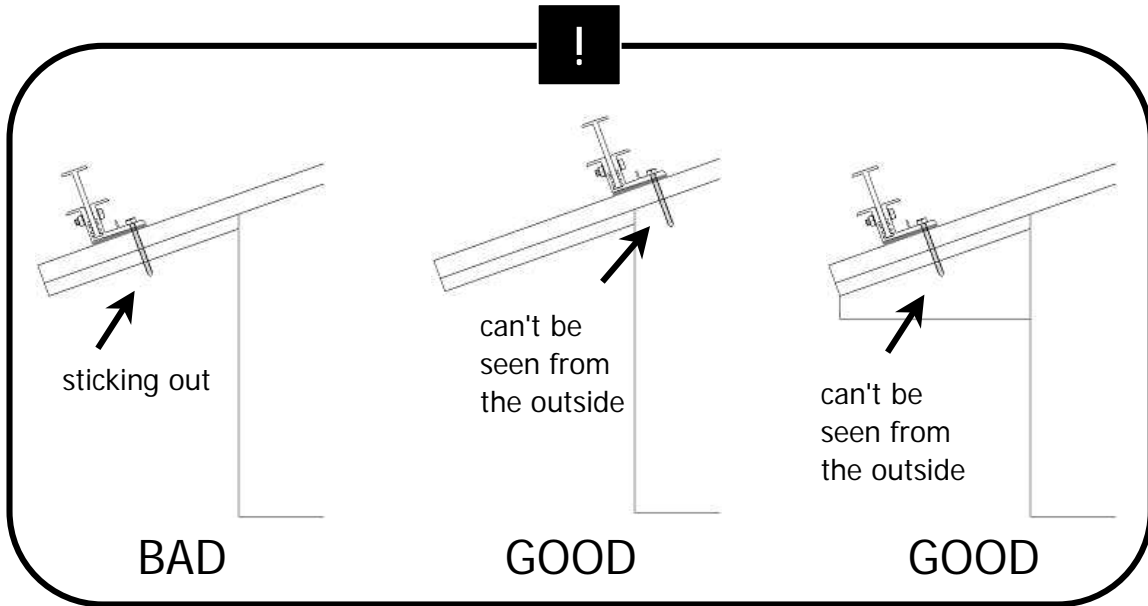
(3) Place the SmartRack® clamp on top of the levelling sheet from (2) above. Fix the SmartRack® clamp in place using the lag screw provided with your kit



BAD	GOOD	! Be careful to make sure that the lag screw is screwed on straight into the rafter, otherwise the clamp will not be properly installed



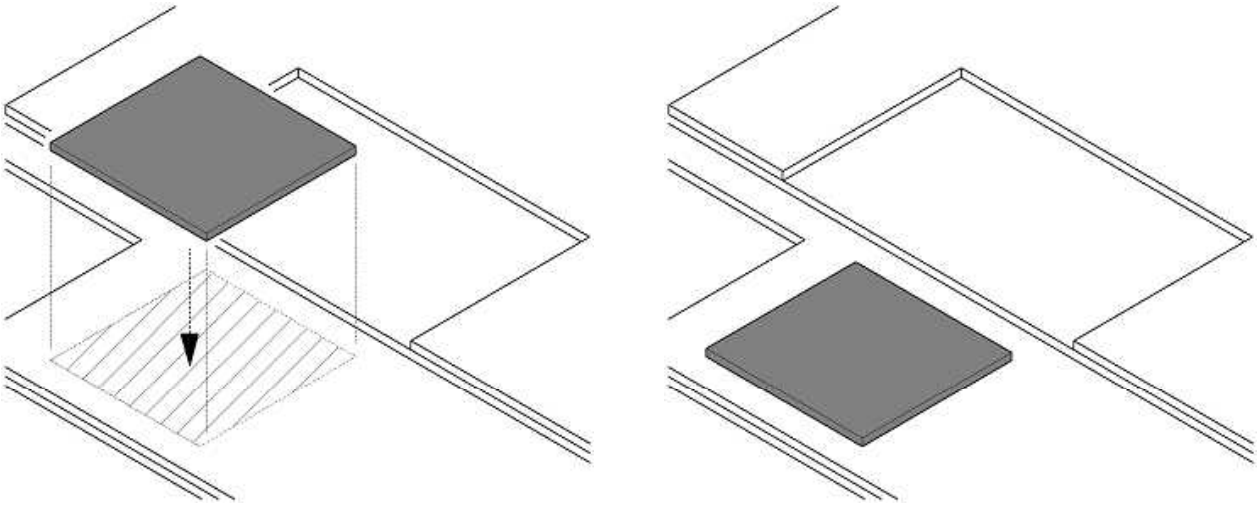
(4) Repeat (1), (2) and (3) for all the necessary clamps you need to install on the (Y) line to complete the first row



Make sure that the bottom of the lag screw is not sticking out and should not be seen from the outside

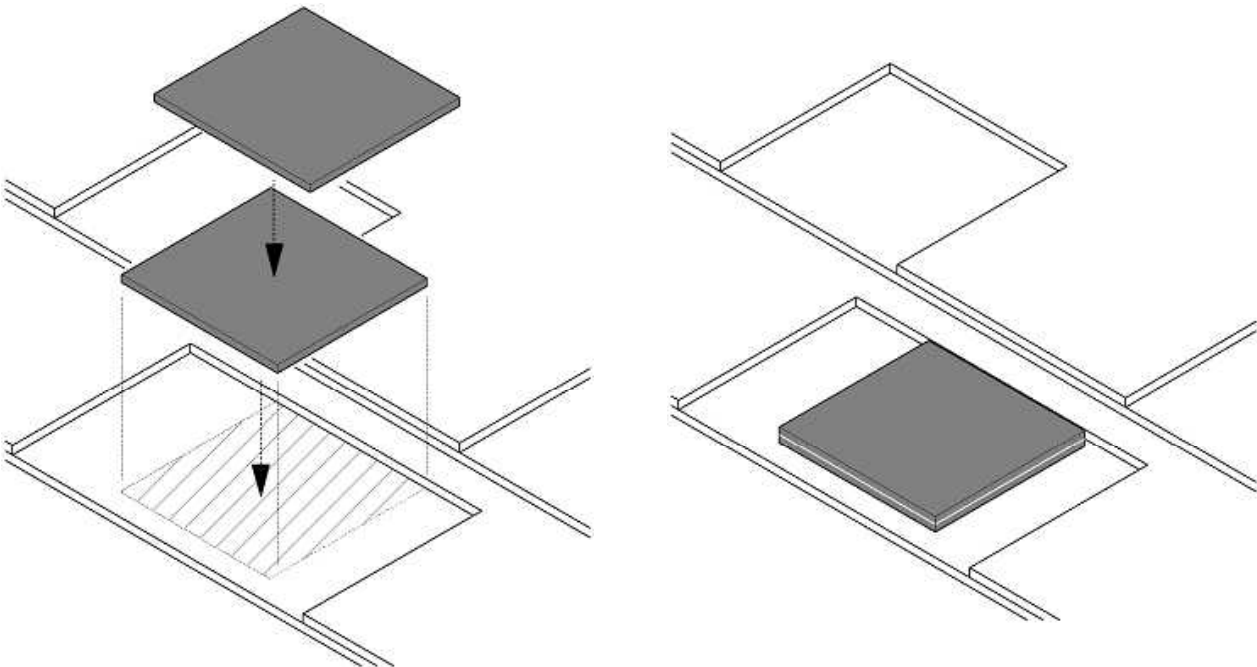
Different ways to affix the levelling sheet

I. Even Surfaces

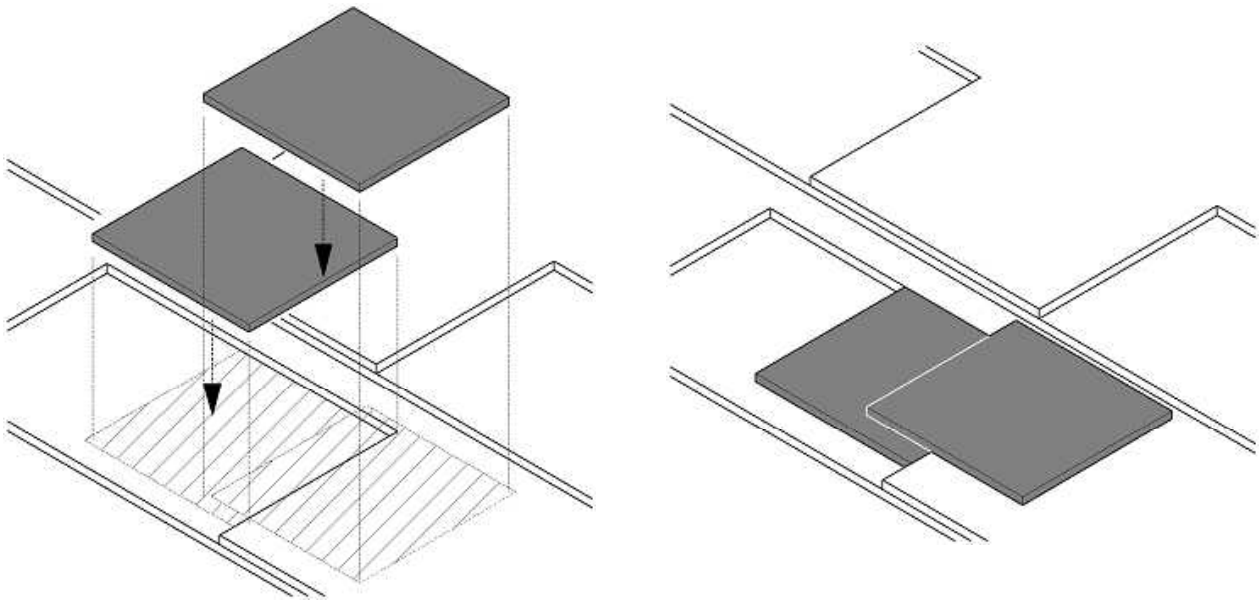


On even surfaces, affix one levelling sheet where the SmartRack® clamp will be fixed.

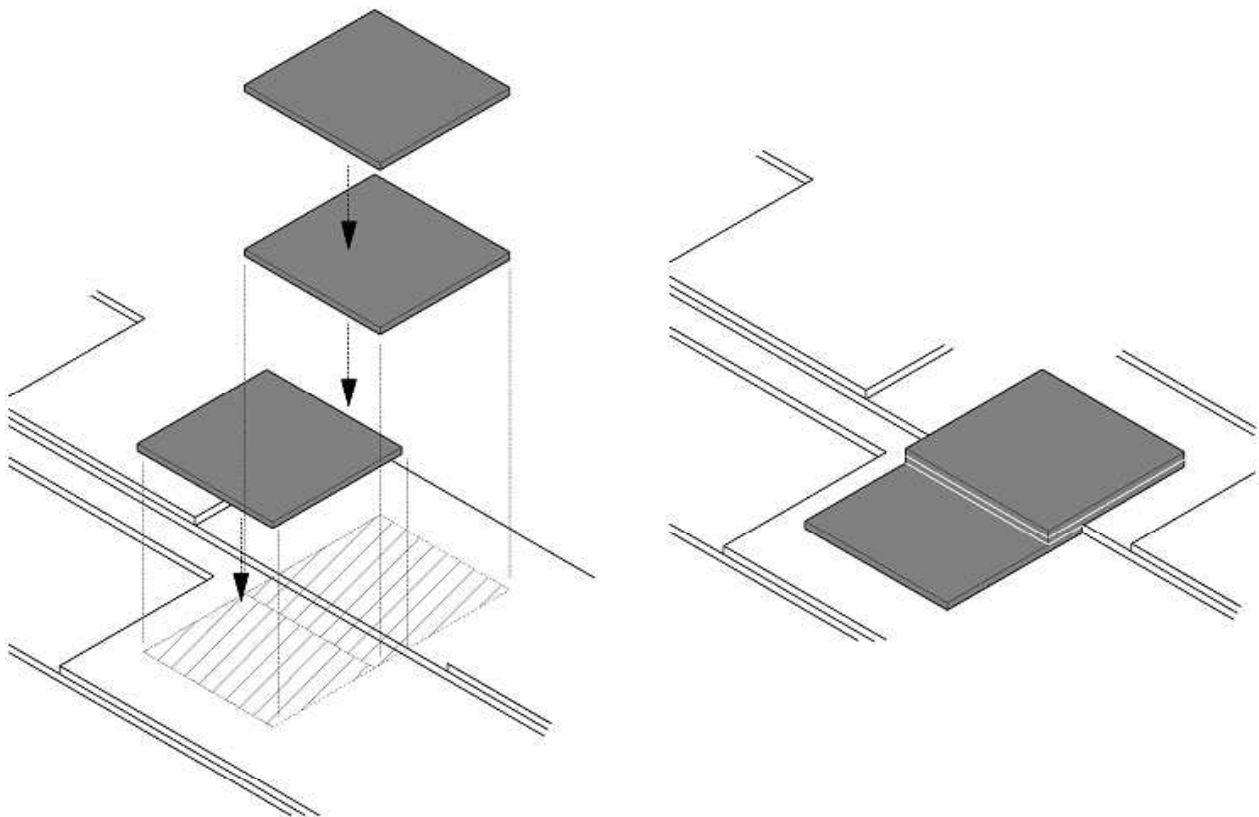
II. Uneven Surfaces



If the position of the SmartRack® clamp falls on the uneven concave part of the asphalt shingle material, affix one levelling sheet to level out the uneven surface, then place another levelling sheet on top.

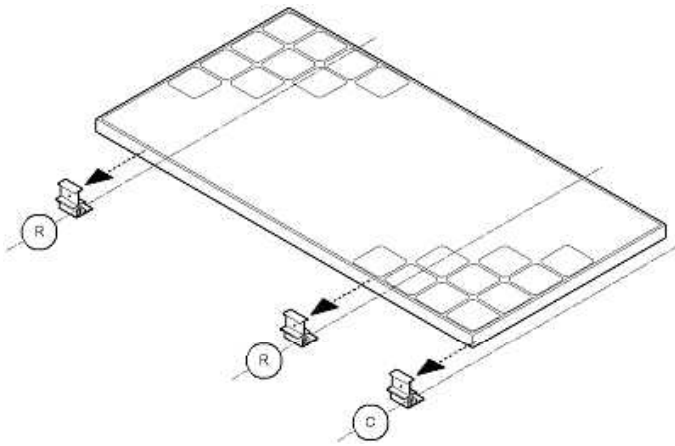


If the position of the SmartRack® clamp falls in between the concave part and the top surface of the asphalt shingle material, affix one levelling sheet to make the surface level with the top surface and then place another levelling sheet where the SmartRack® clamp will be installed.

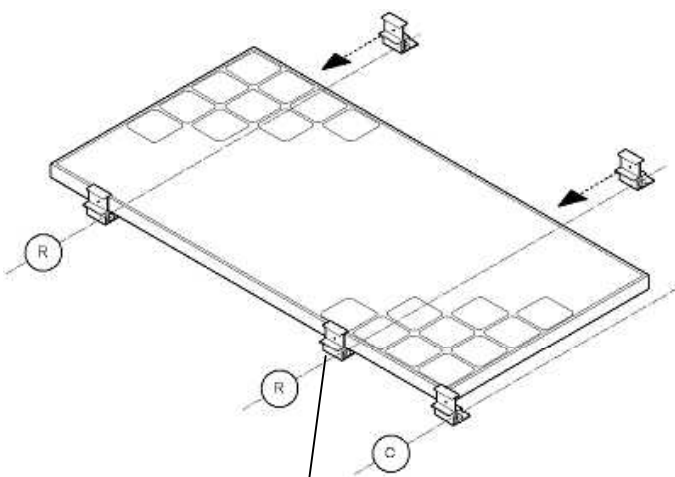
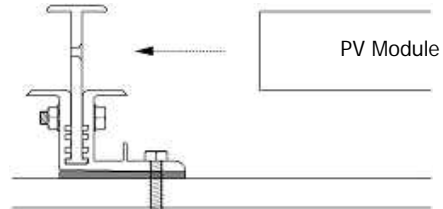


If the position of the SmartRack® clamp falls in between the top surface and overlaps onto the concave part of the next level of asphalt shingle, it is necessary to first affix a levelling sheet on the top surface of the bottom shingle, another on the area that overlaps the two levels and another one directly on top of the second levelling sheet.

SmartRack® Installation (continued...)

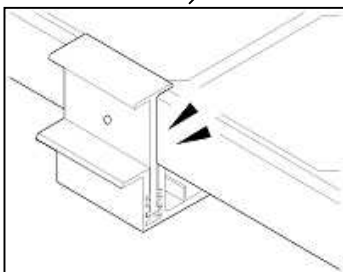


(5) Slide the first row of modules into the first row of SmartRack® clamps from (4).

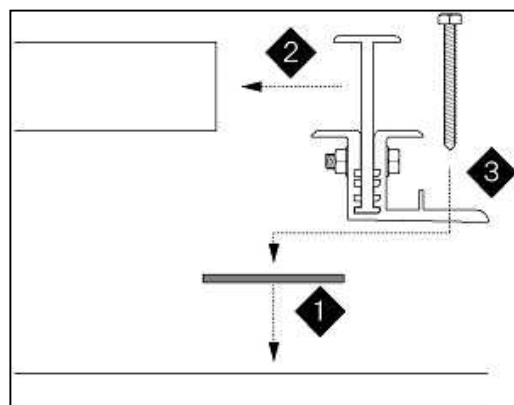


(6) After installing the first module on (5), attach (without fixing) the second row of SmartRack® clamps on the top part of the module to confirm the positioning. Once the spot where the second row of SmartRack® clamps are decided, affix the provided levelling sheet as shown on pages 11-12

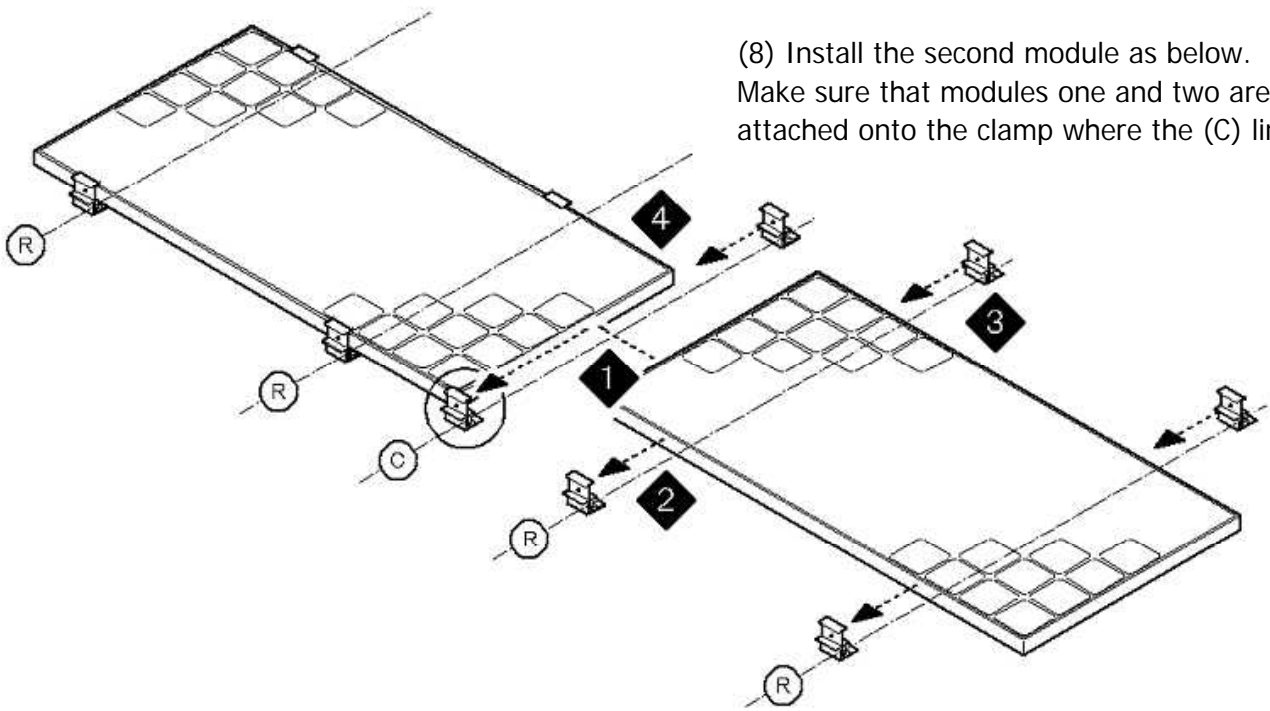
(7) After the levelling sheets are affixed, place the SmartRack® clamps on top of the levelling sheets and fasten the SmartRack® clamps onto the rafters using the provided lag bolts



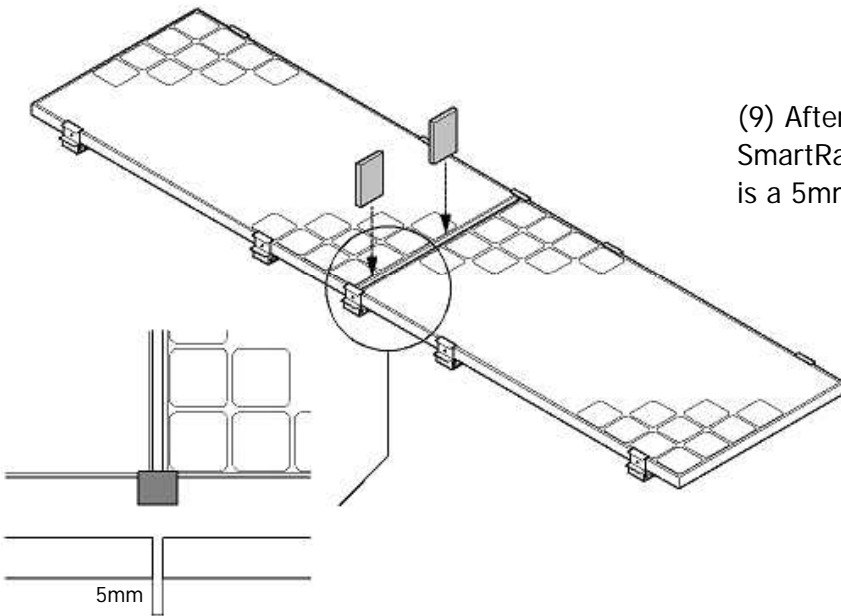
Make sure to confirm that there is no space between the module and the SmartRack® clamp before affixing the second row of clamps



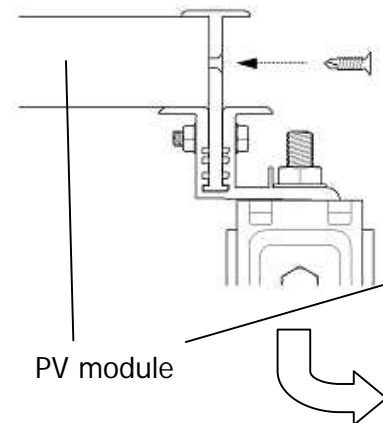
SmartRack® Installation (continued...)



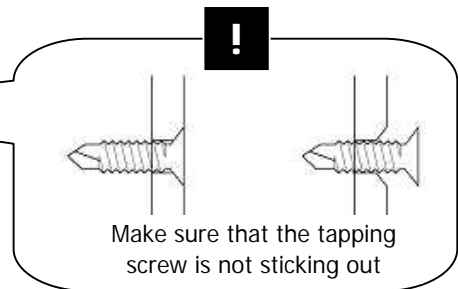
(8) Install the second module as below. Make sure that modules one and two are attached onto the clamp where the (C) line

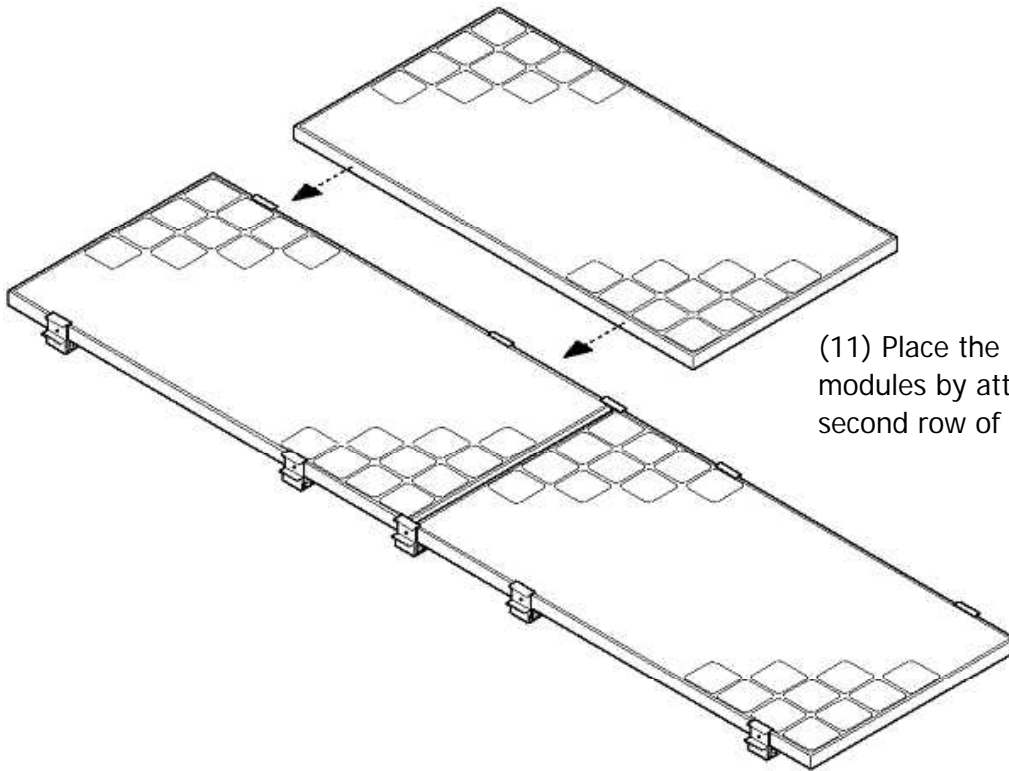


(9) After affixing the second row of SmartRack® clamps, make sure that there is a 5mm space between modules

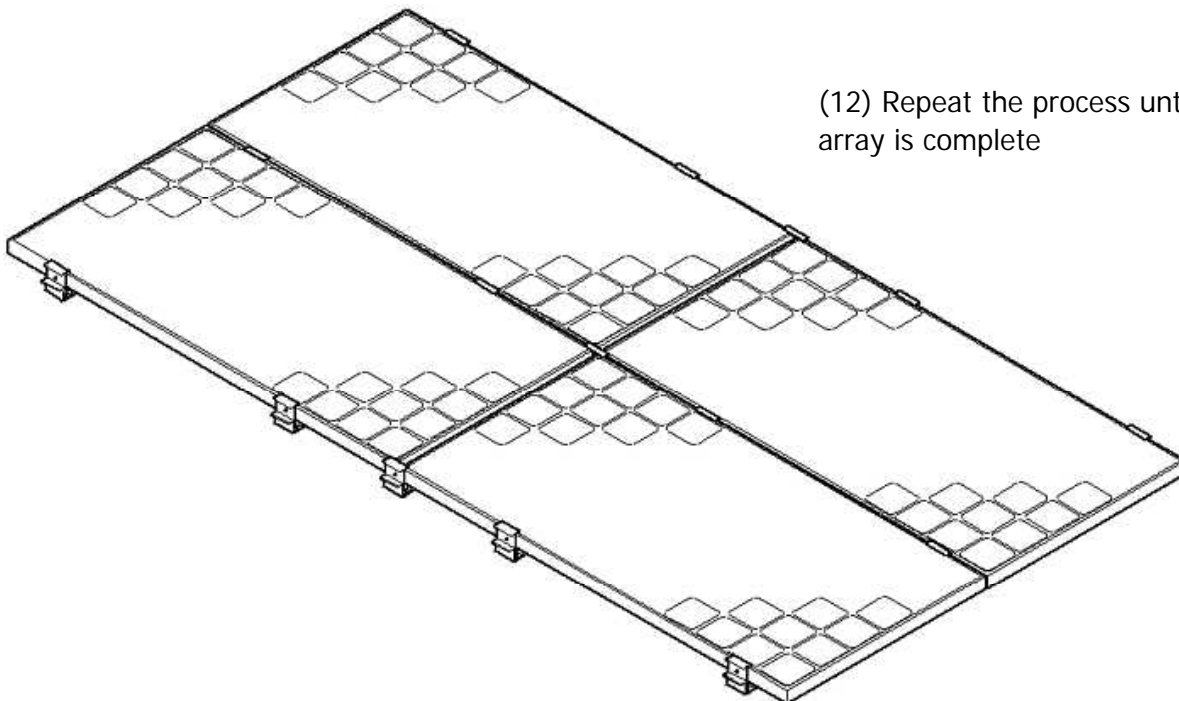


(10) To prevent the modules from unnecessarily shifting, screw in the provided tapping screw in the hole of the T-clamp. Only one (1) screw per module is necessary.





(11) Place the second row of modules by attaching them on the second row of SmartRack® clamps.



(12) Repeat the process until your array is complete

LIMITED WARRANTY

Product Warranty

Takashima & Co., Ltd. ("Takashima") warrants to the original purchaser ("Purchaser") of product that it manufactures ("SmartRack®") at the original installation site that SmartRack® shall be free from defects in material and workmanship for a period of ten (10) years.

Finish Warranty

The above warranty does not apply to the anodized finish, which finish shall be free from visible peeling, or cracking or chalking under normal atmospheric conditions for a period of five (5) years from (a) the date the installation of SmartRack® is completed, or (b) 30 days after the purchase of SmartRack® by the Purchaser.

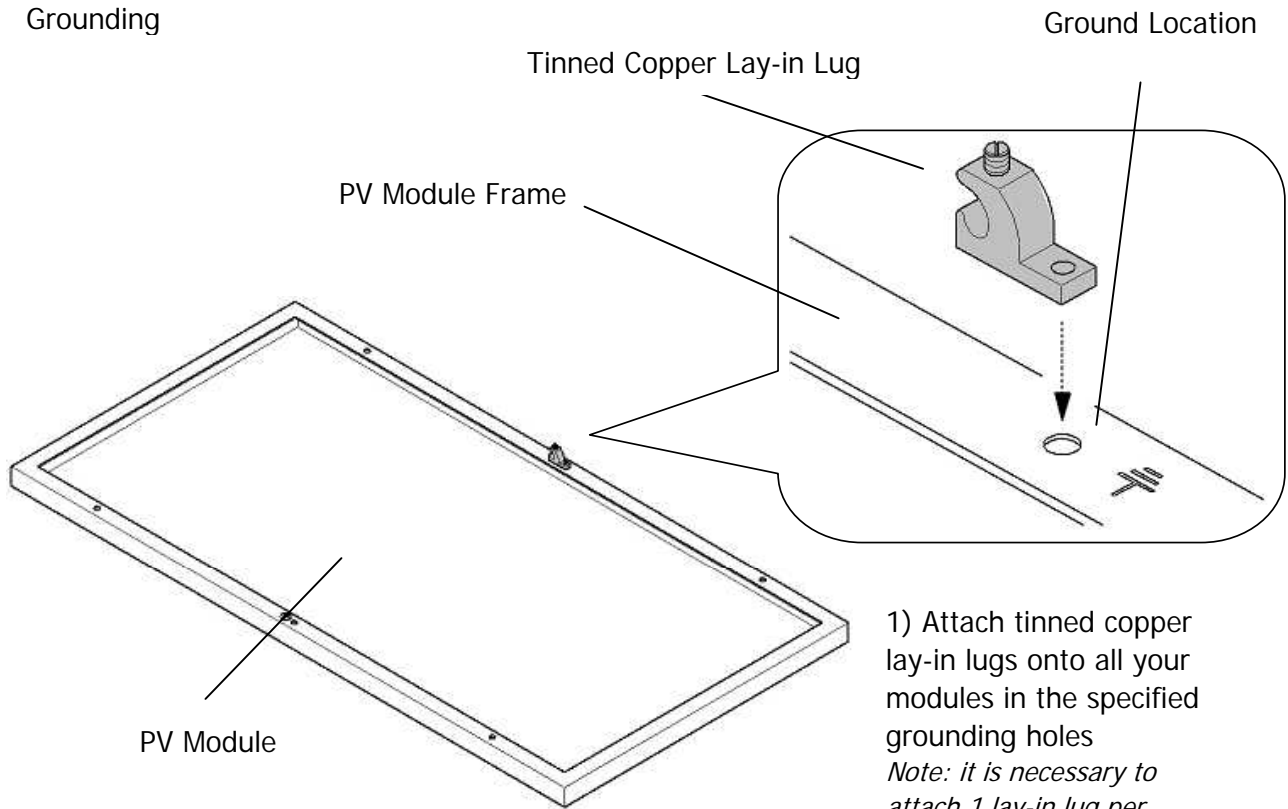
The Finish Warranty does not apply to any foreign residue deposited on the finish. All installations in corrosive atmospheric conditions are excluded. The Finish Warranty is VOID if the practices specified by AAMA 609 & 610-2 ("Cleaning and Maintenance for Architecturally Finished Aluminum, www.aamanet.org) are not followed by Purchaser. This Warranty does not cover damage to SmartRack® that occurs during its shipment, storage, or installation.

This Warranty shall be VOID if installation of SmartRack® is not performed in accordance with Takashima's written installation instructions, or if SmartRack® has been modified, repaired, or reworked in a manner not previously authorized by Takashima IN WRITING, or if SmartRack® is installed in an environment for which it was not designed. Takashima shall not be liable for consequential, contingent or incidental damages arising out of the use of the Product by Purchaser under any circumstances.

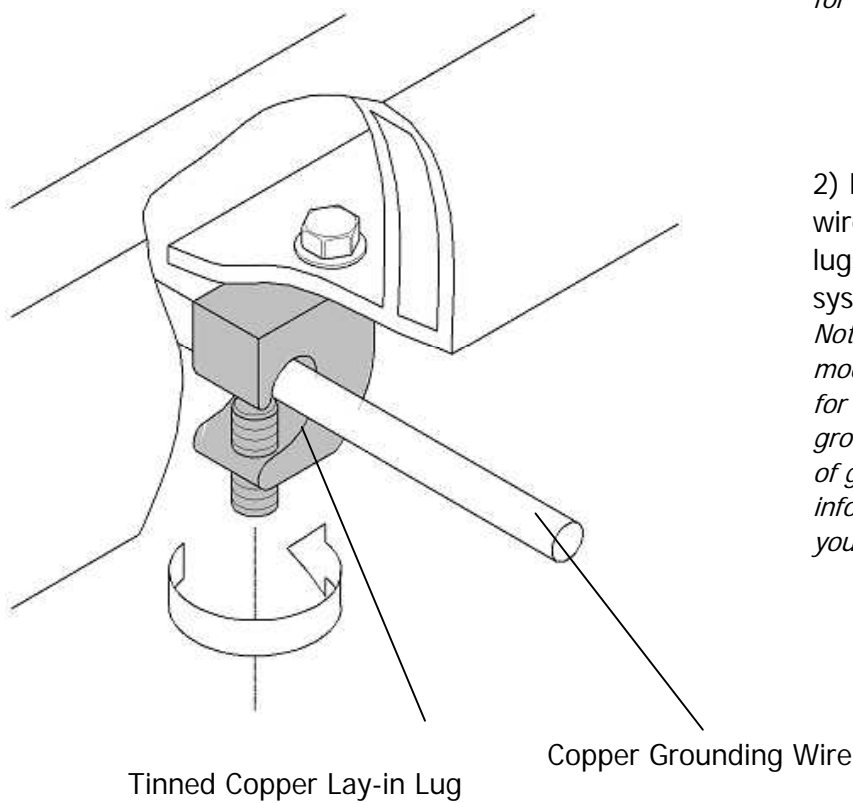
If SmartRack® is found and proven to be defective within the specified Warranty periods, Takashima will, at its own discretion, repair or replace the defective SmartRack®, or any part thereof. Such repair or replacement shall completely satisfy and discharge all of Takashima's liability with respect to this limited Warranty. Under no circumstances shall Takashima be liable for specific, indirect or consequential damages arising out of or related to use by Purchaser of SmartRack®.

Takashima's limited Warranty covers only SmartRack®, and not any related items. Manufacturers of related items, such as PV modules, may provide written warranties of their own.

Grounding



1) Attach tinned copper lay-in lugs onto all your modules in the specified grounding holes
Note: it is necessary to attach 1 lay-in lug per module and best to do this before you start installation for more efficiency



2) Run a copper grounding wire through all the lay-in lugs and ground the system
Note: refer to your PV module installation manual for the type of fasteners, ground wire size, positioning of ground hole, and general information on grounding your system

SMART RACK®

スマートラック

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