



SOLAR ROOF MOUNTING SYSTEM INSTALLATION MANUAL MODEL NAME: TT-ROOF HOOK

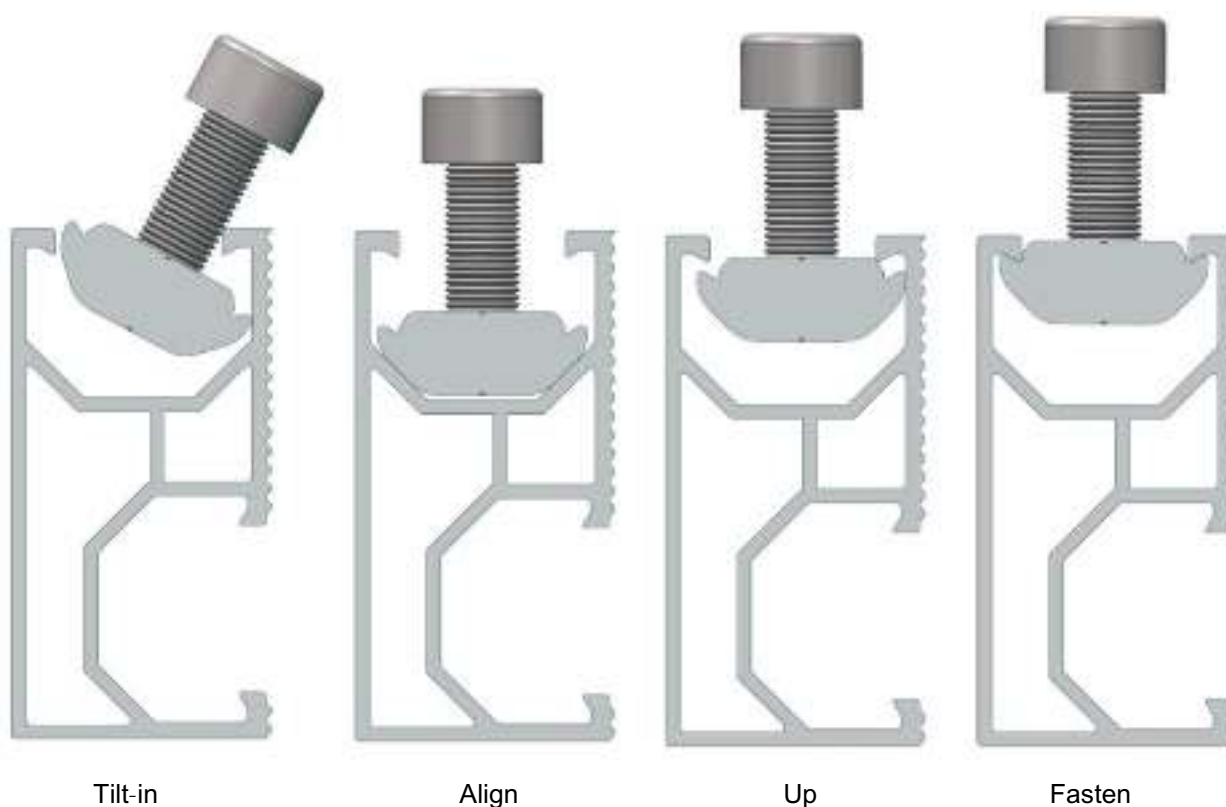
JIANGYIN TITANERGY CO.,LTD

Contents

| Chapter | Title | Page |
|---------|---------------------------------------|------|
| 1 | General Information | 3 |
| 2 | Safety and Installer Responsibilities | 4 |
| 3 | Technical Specifications | 5 |
| 4 | Tools for Installation | 6 |
| 5 | Components Description | 7 |
| 6 | System Overview | 9 |
| 7 | Designing The Module Field | 11 |
| 8 | Planning | 12 |
| 9 | Installation | 15 |
| 10 | Warranty | 21 |
| 11 | Revision History | 22 |

1. General information

Thank you for choosing the Titan solar roof mounting system. Made from custom- built aluminum extrusions and components, Titan Solar's innovated design and improved frame strength greatly simplify solar panel installation. The easy installation four steps make the D-Modules can be put into the D Rail on any position quickly. So, the D-Modules is pre-assembly with the clamp to save your install time.



Easy installation four steps

Titan solar's versatile design makes it suitable for a wide variety of building types and zones including residential, commercial and remote environments.

Titansolar is backed by a 10-year warranty **(Fire Rated:A)**.

2. Safety and Installer Responsibilities

Caution

Installation of this product is to be performed only by professionally trained installers. Any attempt by an unqualified person to install this product could result in death or serious injury.

2.1 Handling and Installing Titan solar

It is critically important that safety practices are observed when installing

- ※ Do not throw or roughly handle any Titan solar components.
- ※ Do not bring Titan solar system into contact with sharp or heavy objects.
- ※ Do not modify Titan solar components in any way. The exchange of bolts, drilling of holes, bending or any other physical changes not described in standard installation procedure will void the warranty.
- ※ It is the installer's responsibility to verify the integrity of the structure to which Titan solar components is fixed. Roofs or structures with rotten/rusted bearers, undersized bearers, excessively spaced bearers, or any other unsuitable substructure cannot be used with Titan solar components, and installation on such structures will void the warranty, and could result in death or serious injury.

2.2 Wind and Climate Design

Determining the wind pressures applies to your Titan solar system install site, taking into account roof shape and geographic location. Sufficient guidance is given in this document, but you may wish to procure a copy of these standards.

- ※ REMEMBER average wind speeds are higher for structures mounted closer to the roof perimeter zone (edge). Refer to 'Fixing within Roof Installation Zone' for more information)
- ※ Make sure your installation complies with local and national building codes. Take into account relevant design parameters (wind speed, exposure and topographic factor) when determining the loading for the installation.
- ※ If alternative fasteners are used to fix the framing to the roof (assuming supplied fasteners are unsuitable for any reason), all screw fasteners must be of equal or greater strength to those supplied with your Titan solar system order.

3. Technical Specifications

3.1 Applications

- ※ Commercial and residential buildings
- ※ Marine applications and remote areas

3.2 Features

- ※ 6005-T5 Aluminum extrusion
- ※ Innovated designed of the D-Modules, which can be pre-assembly with the clamp, make the installation easy and quick.
- ※ Suitable for difference conditions and the most solar panels at present market.
- ※ Significantly higher strength-to-weight ratio than other framing products, providing improved efficiency due to greater frame spans, inherent corrosion resistance resulting in low ongoing maintenance and an extended product life.
- ※ Anodized finish

Caution

Refer to the section “Designing Your System” before attempting installation. Failure to correctly establish the requirement of the proposed installation site is dangerous and will void the framing warranty.

3.3 Material

| Material | Tensile strength | |
|---------------------------|------------------|--------|
| | Ultimate | Yield |
| 6005-T5 Aluminum Extruded | 260MPa | 240Mpa |
| Stainless Steel 304 | 635MPa | 235MPa |
| Stainless Steel A2-70 | 700MPa | 450Mpa |



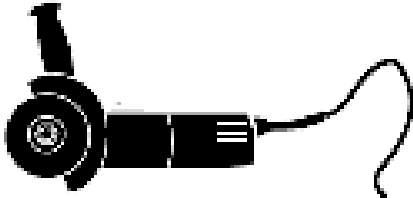




3.4. Installation condition

| | |
|--------------------|--------------------------------|
| Roof slope | 0° to 60° |
| Building height | Up to 20m |
| Mounting structure | Timber |
| Roof types | Flat or pitched steel and tile |
| System angle | Flushed with the roof |

Note: if the condition is over the table list, please contact us to confirm.







4. Tools for Installation



The following tools are required for the installation:

| | |
|--|---|
| ※ 6 mm Allen key or hexagonal driver bit. If using a 6mm driver bit, make sure the cordless power tool used for the driving has a hand-tight clutch setting a fine (soft) impact drive to prevent damage to the fragile glass panels and threads on the Structure. |  |
| ※ Cordless drill; Drill or impact driver for driving roof material fixings |  |
| ※ Angle grinder; For terracotta tile roof installation, and angle grinder fitted with a continuous edge diamond tipped tile cutting blade; gloves, hearing protection, a face protection mask, and a suitably rated breathing protection mask for all people in proximity of grinding |  |
| ※ Gloves; Protect the hazard of the sharp corners. |  |
| ※ Cord or color pen; Mark the installation position; |  |
| ※ Spirit level |  |
| ※ Rule |  |
| ※ If necessary, timber to shim the roof hooks | |

5. Components Description

| <p>TT- Rail</p> <ul style="list-style-type: none">※ hold each panel row※ length can be customized※ 6005-T5 extruded aluminum |  | | | | | | | | | | |
|--|--|------------------------|------------------------|--------------------|-------|--------------------|-------------------|--------------------|-------|--------------------|-------|
| <p>Standard Rail Length</p> | | | | | | | | | | | |
| <table><tr><td>808~826mm wide panels</td><td>990~1020mm wide panels</td></tr><tr><td>2560mm (3 panels)</td><td></td></tr><tr><td>3405mm (4 panels)</td><td>4200mm (4 panels)</td></tr></table> | | 808~826mm wide panels | 990~1020mm wide panels | 2560mm (3 panels) | | 3405mm (4 panels) | 4200mm (4 panels) | | | | |
| 808~826mm wide panels | | 990~1020mm wide panels | | | | | | | | | |
| 2560mm (3 panels) | | | | | | | | | | | |
| 3405mm (4 panels) | 4200mm (4 panels) | | | | | | | | | | |
| <ul style="list-style-type: none">※The length of TT-Rail can be customized.(1.05m~15.90m)※The installation direction of panels can be customized.(horizontal or vertical) | | | | | | | | | | | |
| | | | | | | | | | | | |
| <p>TT Rail Splice Kit</p> <ul style="list-style-type: none">※ Extend TT Rail to any length as required by the quantity or width of the solar panels※ Include 2pcs M8*20 bolts,2pcs M8 spring washers, 2pcs M8,OD18 lock washers |  | | | | | | | | | | |
| <p>Inter Clamp Kit for Framed Modules</p> <ul style="list-style-type: none">※ Fit between two panels※ Fastened with a 6mm Allen key※ Standard pre-assembly for the usual panels with thickness 30, 35, 40, 46, 50, 57mm※ Include 1pc M8 bolt,1pc M8 spring washer,1pc nut | <div><table><tr><th>Type</th><th>Bolt</th></tr><tr><td>Inter clamp kit 35</td><td>M8*45</td></tr><tr><td>Inter clamp kit 40</td><td>M8*50</td></tr><tr><td>Inter clamp kit 46</td><td>M8*55</td></tr><tr><td>Inter clamp kit 50</td><td>M8*60</td></tr></table></div> | Type | Bolt | Inter clamp kit 35 | M8*45 | Inter clamp kit 40 | M8*50 | Inter clamp kit 46 | M8*55 | Inter clamp kit 50 | M8*60 |
| Type | Bolt | | | | | | | | | | |
| Inter clamp kit 35 | M8*45 | | | | | | | | | | |
| Inter clamp kit 40 | M8*50 | | | | | | | | | | |
| Inter clamp kit 46 | M8*55 | | | | | | | | | | |
| Inter clamp kit 50 | M8*60 | | | | | | | | | | |
| <p>End Clamp Kit for Framed Modules</p> <ul style="list-style-type: none">※ Hold the edge of each end panels※ Fastened with a 6mm Allen key※ Standard pre-assembly for the usual panels with thickness 30, 35, 40, 46, 50, 57mm※ Include 1pc M8*25 bolt,1pc M8 spring washer,1pc nut |  | | | | | | | | | | |
| <p>Adjustable End Clamp Kit</p> <ul style="list-style-type: none">※ Hold the edge of each end panels※ Fastened with a 6mm Allen key※ Adjustable for the panels with thickness from 25~60mm※ Include 1pc M8*25 bolt,1pc M8 spring washer,1pc nut |  | | | | | | | | | | |
| <p>Grounding Lug</p> <ul style="list-style-type: none">※ Fix the wire※ Material:Cu※ Include 1pc M8*25 bolt,1pc M8 spring washer, 1pc M8,OD18 lock washer,1pc nut,1pcM6*15 bolt |  | | | | | | | | | | |
| <p>Grounding Clip</p> <ul style="list-style-type: none">※ Electric Conduction※ Material:Stainless steel |  | | | | | | | | | | |
| <p>Rubber Pad</p> <ul style="list-style-type: none">※ Wearing Pads※ Change in time |  | | | | | | | | | | |

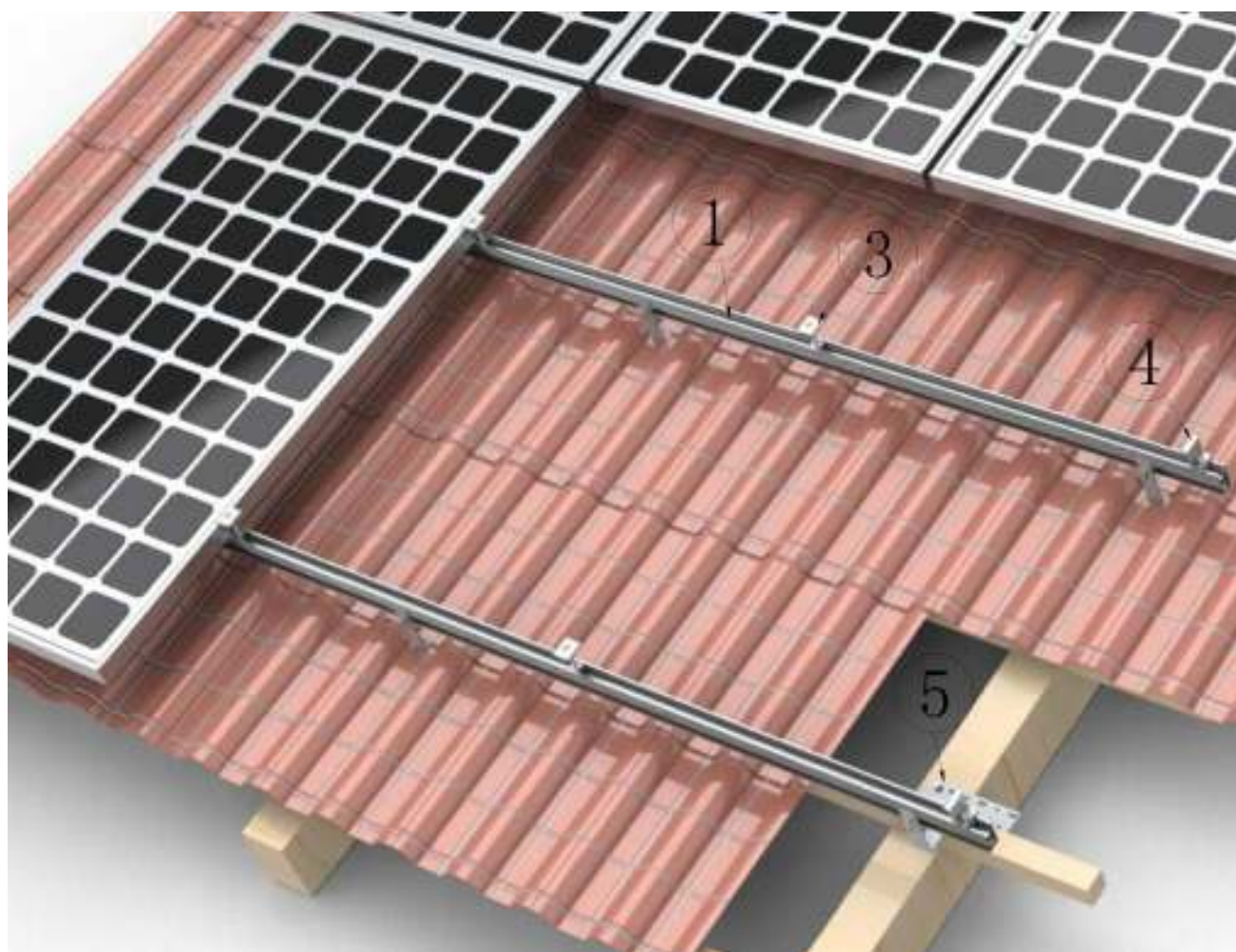
| Variety of Roof Hook | |
|--|--|
| Stainless Steel Roof Hook 1 # ※ Fix to the rafter below Roman tile roof ※ Include 3pcs st6.3x60 wood screws ※ Include 1pc M8*25 bolt, 1pc M8 spring washer, 1pc M8, OD18 lock washer, 1pc nut |  |
| Stainless Steel Roof Hook 2 # ※ Fix to the rafter below flat tile roof ※ Include 2pcs st6.3x60 wood screws ※ Include 1pc M8*25 bolt, 1pc M8 spring washer, 1pc M8, OD18 lock washer, 1pc nut |  |
| Stainless Steel Roof Hook 3 # ※ Side fix to the rafter below Roman tile roof ※ Include 3pcs st6.3x60 wood screws ※ Include 1pc M8*25 bolt, 1pc M8 spring washer, 1pc M8, OD18 lock washer, 1pc nut |  |
| Stainless Steel Roof Hook 4 # ※ Fix to the rafter on slate tile roof ※ Include 3pcs st6.3x60 wood screws ※ Include 1pc M8*25 bolt, 1pc M8 spring washer, 1pc M8, OD18 lock washer, 1pc nut |  |
| Aluminum Tin Roof Hook 5 # ※ Fix to the purlin on tin roof ※ 1pc st6.3*80 wood screw and 1pc rubber pad ※ Include 1pc M8*25 bolt, 1pc M8 spring washer, 1pc M8, OD18 lock washer, 1pc nut |  |
| Stainless Steel Roof Hook 6 # ※ Fix to the rafter below Roman tile roof ※ Include 3pcs st6.3x60 wood screws ※ Include 1pc M8*25 bolt, 1pc M8 spring washer, 1pc M8, OD18 lock washer, 1pc nut |  |

| Variety of Screws | |
|---------------------------------|--|
| Wood Screw ※ With pad |  |
| Socket Head Screw |  |

6. System overview

All components of the system are listed below. The version and quantities of the parts can vary, depending of

- ※ Type of roof
- ※ Type of module
- ※ Number of modules
- ※ Site specifics



| | |
|---------------|-----------------------------|
| ① TT Rail | ② TT Rail Splice (Optional) |
| ③ Inter Clamp | ④ End Clamp |
| ⑤ Roof hook | |

Show Details

①

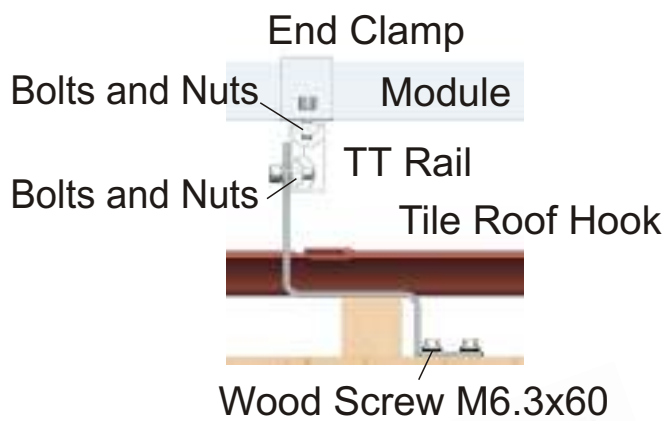


②

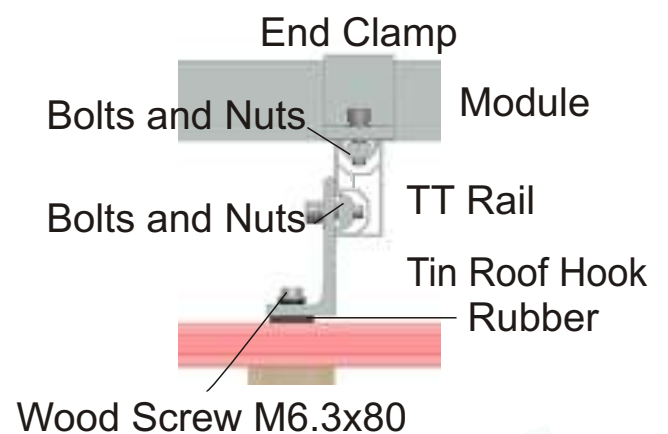


⑤

Tile Roof

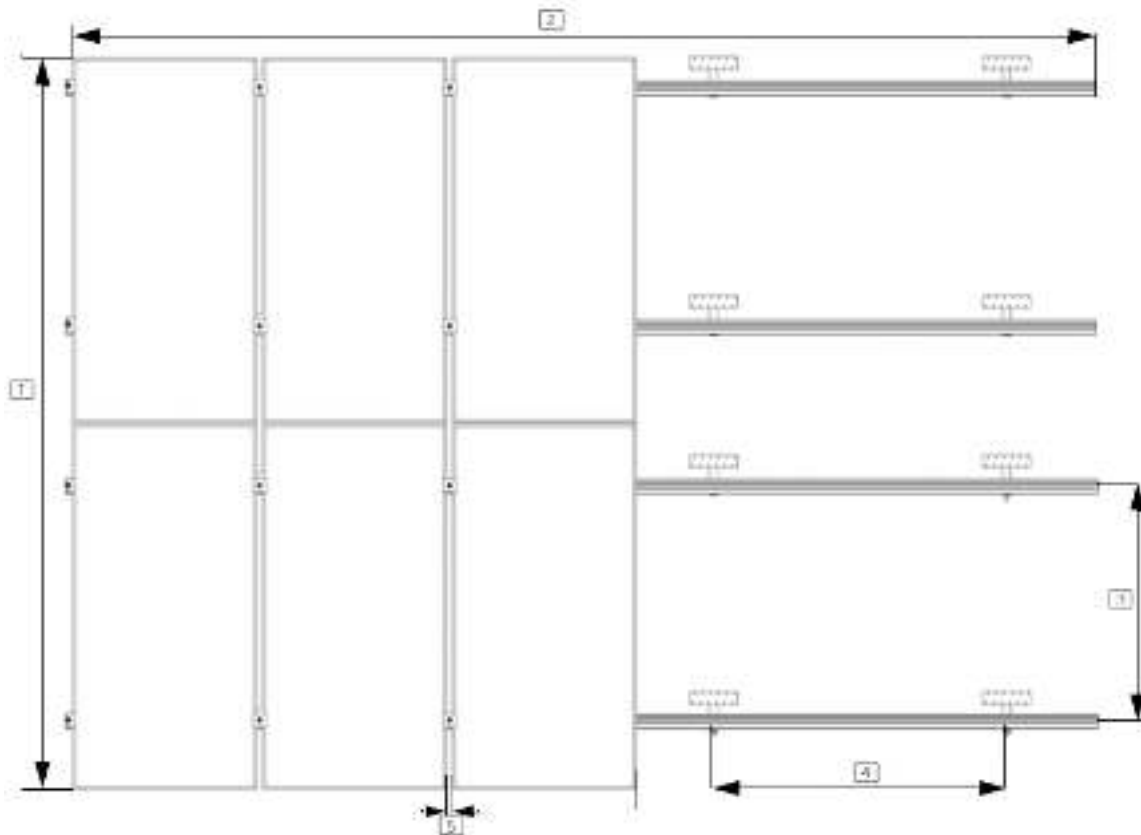


Tin Roof



7. Designing the module field

Below, the distances between roof connections for a portrait installation are specified. Clamp on roof hooks need to be installed in specific distances, depending on the distance of rafters and the stoical conditions.



- 1 Height of the module field: module height x number of modules vertically
- 2 Width of the module field: number of modules horizontally x (width of the module + 18 mm)+32 mm
- 3 Distance between roof connections vertically (according to the clamping points pre-defined by the module producer): Quarter-points of the modules, about 1/2 of module height.
- 4 Distance between roof connections horizontally: Depending on the distance between rafters and on the static requirements (please see the **Chapter 8** on page 11).
- 5 Distance between modules: 17 mm

When positioning the modules, please take into consideration

- ※ That the values above are
- ※ That dimensions of tiles or other roof covering and the position of the rafters define the precise actual horizontal distance between roof connections
- ※ That the distance between roof laths defines the precise actual vertical distance between roof connections.

8. Planning

8.1 Determine the wind region of your installation site

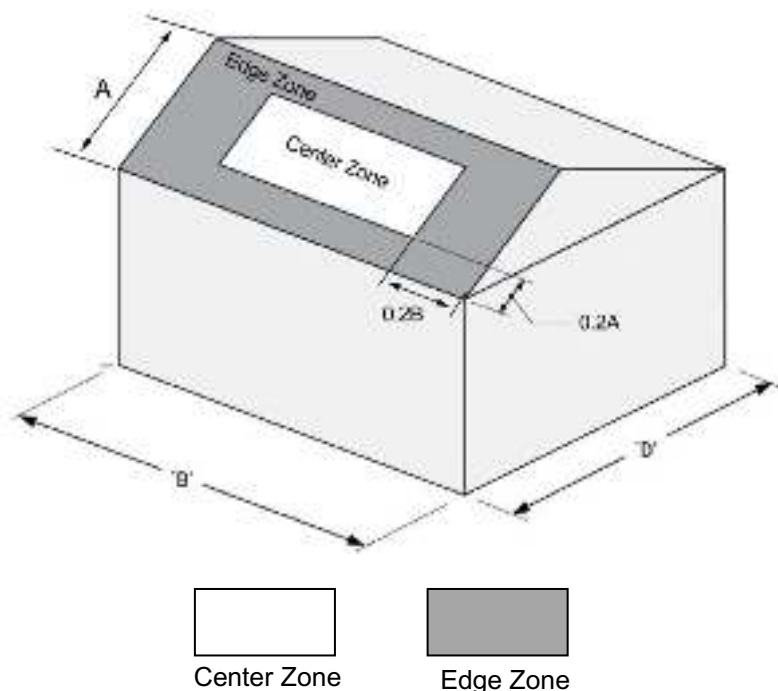
| | |
|----------|--|
| Region A | $A \leq 41\text{msec}$ |
| Region B | $41\text{msec} < B \leq 48\text{msec}$ |
| Region C | $48\text{msec} < C \leq 56\text{msec}$ |
| Region D | $56\text{msec} < D \leq 66\text{msec}$ |

8.2. Determine the height of the of your installation site

This document provides sufficient information for Titan solar system installation height less than 20 meters. If your installation site is more than 20 meters in height, please contact Titan solar to obtain engineering data to support your installation.

8.3 Determine Roof Installation Roof Areas

Titan solar system can be installed anywhere on a roof but fixing centers are required to be reduced at ridges and edges. The diagram below shows the area of higher wind loadings within $0.2A$ and $0.2B$ of a roof edge ridge (where A and B are the planned dimension of the building).



The following table will help you determine the maximum rail support spacing for your project. Also note that if the roof slope is less than 10 degree the reduction on spacing does not apply.

8.4 Determine the Maximum Rail Support Spacing

- a. Please use the following table to determine the TT Rail support spacing for tile roof installations.

| For Up To 1600mm Long Panel (2 Rails) | | | | | | | | |
|---------------------------------------|----------|------|----------|------|----------|------|----------|------|
| Max. Support Spacing (mm) | | | | | | | | |
| Installation | Region A | | Region B | | Region C | | Region D | |
| Height(m) | Center | Edge | Center | Edge | Center | Edge | Center | Edge |
| 5 Meters | 2400 | 1740 | 1710 | 1200 | 1070 | 755 | 660 | 465 |
| 10 Meters | 2050 | 1445 | 970 | 1000 | 965 | 680 | 595 | 420 |

| For Up To 1960mm Long Panel (2 Rails) | | | | | | | | |
|---------------------------------------|----------|------|----------|------|----------|------|----------|------|
| Max. Support Spacing (mm) | | | | | | | | |
| Installation | Region A | | Region B | | Region C | | Region D | |
| Height(m) | Center | Edge | Center | Edge | Center | Edge | Center | Edge |
| 5 Meters | 1980 | 1390 | 1360 | 965 | 855 | 680 | 520 | 370 |
| 10 Meters | 1630 | 1150 | 1130 | 800 | 775 | 545 | 475 | 335 |

- Min.50mm embedment to existing timber rafters.

- b. Please use the following table to determine the base rail support spacing for Tin roof installations.

| For Up To 1600mm Long Panel (2 Rails) | | | | | | | | |
|---------------------------------------|----------|------|----------|------|----------|------|----------|------|
| Max. Support Spacing (mm) | | | | | | | | |
| Installation | Region A | | Region B | | Region C | | Region D | |
| Height(m) | Center | Edge | Center | Edge | Center | Edge | Center | Edge |
| 5 Meters | 1600 | 1220 | 1150 | 845 | 720 | 530 | 450 | 325 |
| 10 Meters | 1350 | 1010 | 950 | 700 | 650 | 475 | 400 | 290 |

| For Up To 1960mm Long Panel (2 Rails) | | | | | | | | |
|---------------------------------------|----------|------|----------|------|----------|------|----------|------|
| Max. Support Spacing (mm) | | | | | | | | |
| Installation | Region A | | Region B | | Region C | | Region D | |
| Height(m) | Center | Edge | Center | Edge | Center | Edge | Center | Edge |
| 5 Meters | 1350 | 975 | 940 | 675 | 600 | 420 | 350 | 260 |
| 10 Meters | 1100 | 810 | 780 | 560 | 530 | 380 | 330 | 235 |

- Min. 35mm embedment to existing timber batten.
- Min. steel batten/ purlin thickness=0.6mm.

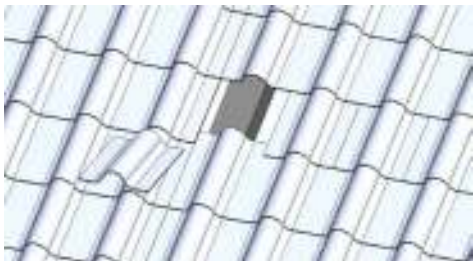


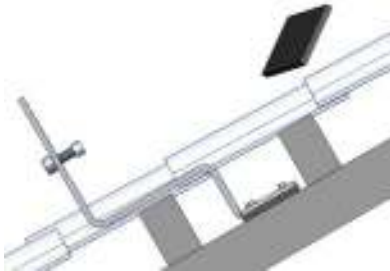



8.5 Verify acceptable Rail End Overhang

Rail End Overhang must equal 50 percent or less of foot spacing. Thus, if foot spacing is 1200mm, the Rail End Overhang can be up to 600mm. In this case, two feet can support a rail of as much as 2400mm (1200mm between the feet and 600mm of overhang at each end).

8.6 Determine Roof Slope

Titan solar system can be used for roof slope up to 60 degrees. Please verify the Installation site roof slope should be between 0 degrees and 60 degrees.

9. Installation

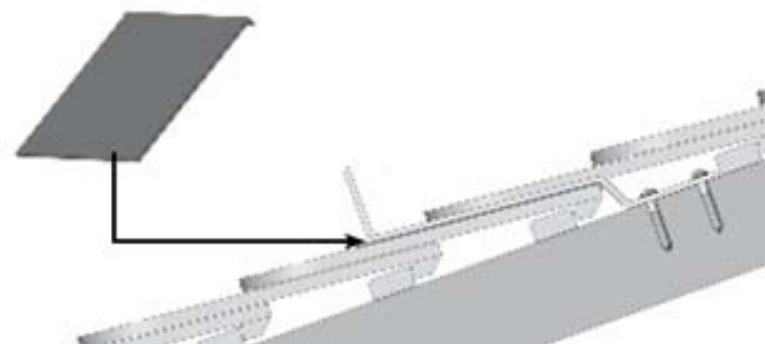
| Install on Roman Tile Roof | |
|--|--|
| 1. Remove the roof tiles at the marked positions or simply lift them up slightly. |  |
| 2. Input the roof hook to the wooden beam. Fix the roof hooks with 3x wood screws (M6.3x60) ※Tighten the screws in the situation when the roof undamaged. |  |
| 3. Cover the hooks by the removed tile |  |
| 4. The roof hook must not press against the roof tile. Place it flat. If necessary, shim the roof hook with wood. | <div style="display: flex; justify-content: space-around; align-items: center;">  <div style="text-align: center;">Wrong</div> </div> <div style="display: flex; justify-content: space-around; align-items: center;">  <div style="text-align: center;">Correct</div> </div> |
| 5. If necessary, use an angle grinder or hammer to cut a concavity in the tile that covers the roof hook at the point where the roof hook comes through. (Caution! Must not use fixed roof hook as a ladder, as this extreme point load could damage the tile below.) | <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> <p>WARNING</p>  <p>TO MINIMIZE RISK OF INJURY, ALWAYS USE PROPERLY OPERATING TOOLS, and follow tool manufacturer's safety instructions. Failure to follow appropriate safety procedures could result in personal injury or damage to property.</p> </div>  </div> |

Install on Plain Tile Roof

6. Mark roof hook installation points, and cut recesses for hooks into plain tiles/slate at each installation point.



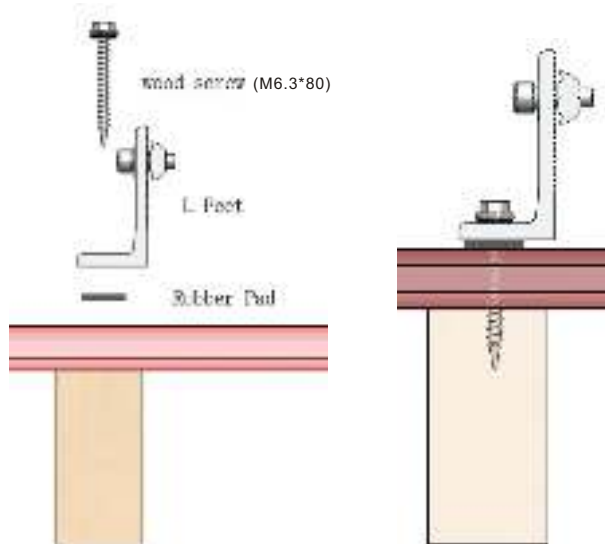
7. Cut titanium zinc metal sheets to fit and install them under the roof hooks. Fix the roof hooks to the rafter using two 6.3 x 60 mm wood screws.



Install on Tin Roof

8. Mark roof hook installation points and use the power tool to drill the wood screw through the point to fasten the L feet with the purlin.

※Tighten the screws in the situation when the roof undamaged.

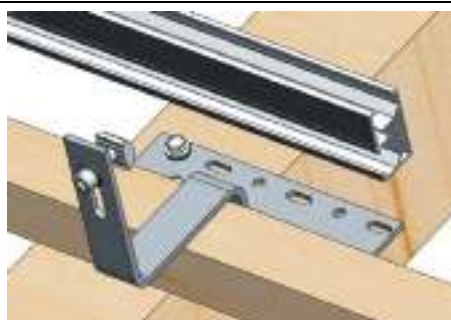


Install The TT -Rail

9. D-Module quick mount.
 Four steps to quick mount the D-Module into TT -Rail channel.
 Move the assembly to it's desired final position, and fastens firmly in place by torque bolt to 10Nm.

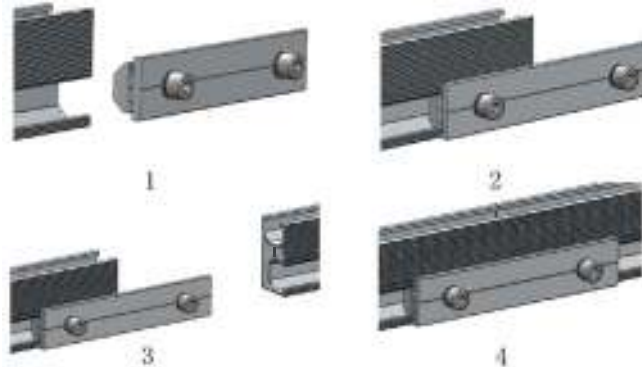


10. Connect the roof hook with the TT Rail.
 a. Insert the D-Module into the side channel of the TT Rail as the step 9 shown.
 b. Adjust the TT Rail to be level.
 c. Fasten the bolt.
 ※ Torsion:23-25N.m



11. TT Rail connect

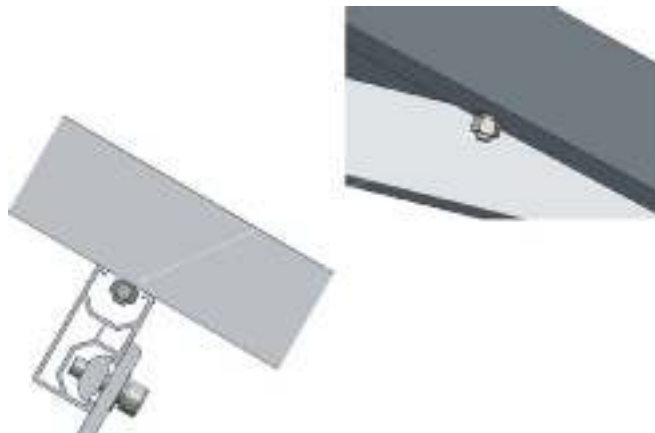
- Put the TT Rail Splice into the side channel of the TT Rail about 75mm, then fasten the M8 Bolt.
 - Put the other TT Rail into the other side of the TT Rail Splice and fasten the other M8 bolt.
- ※ Torsion:23-25N.m



Install the module

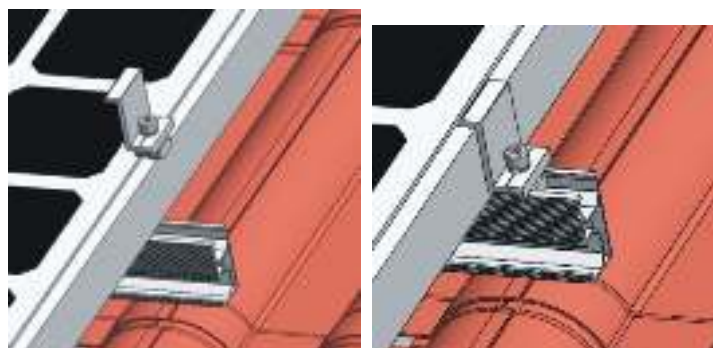
12. Installing anti-slip protection

- The anti-lip protection is only necessary on the lowermost row of modules. At first, fit two bolts M6*20 and nuts into the lower holes of each module. Then place the first module of the bottom row so that the anti-slip protection sits in the rail channel of the lowest row of rails
- ※ Torsion:23-25N.m



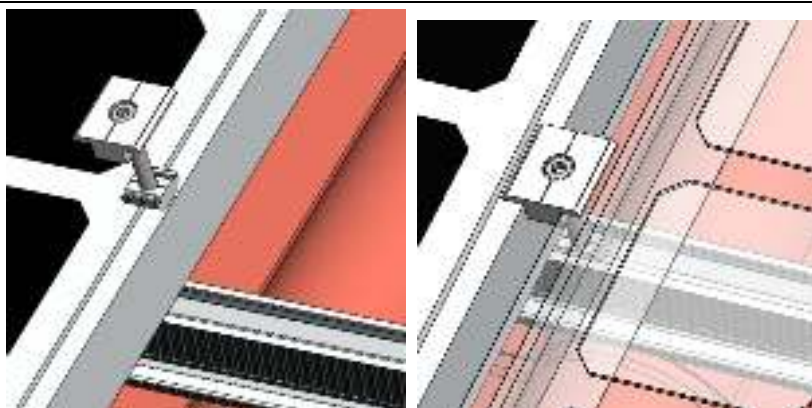
13. Fixing the outer modules by End clamp.

- Put the end clamp kit into the top channel of the TT -Rail as the step 9.
 - Push the side of module to firmly against the end clamp and then fasten the bolt.
- ※ Torsion:23-25N.m

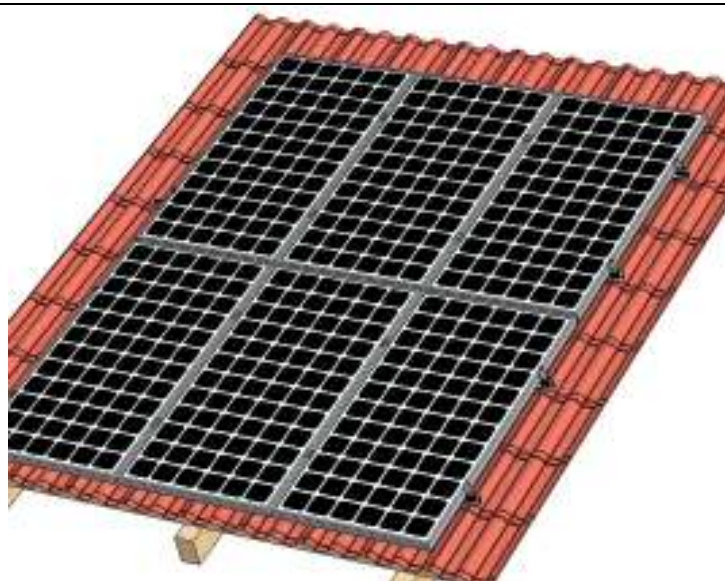


14. Fixing the inter modules by inter clamp.

- Put the inter clamp kit into the top channel of the TT -Rail as the step 9.
 - Push the Inter-module clamp firmly against the already fixed module.
 - Push the next module against the other side of the module-inter clamp.
 - Tighten the bolt
- ※ Torsion:23-25N.m



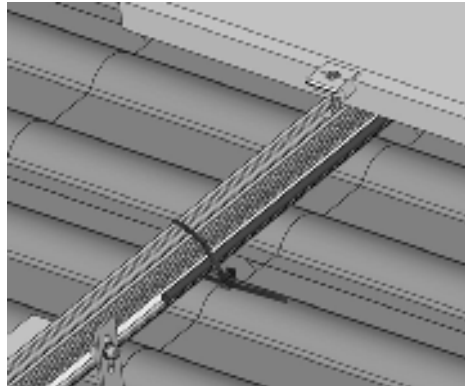
15. Installing the further rows of modules



Cable tie and Grounding

16. Tie cable with the rail

- a. Tie the cable with the rail using the zip tie



17. Grounding

Please see the Titan Solar Grounding System Installation Guide.



10 . Warranty

1. To be used only in combination with modules that include this specific rack system in their installation manual.

Fire Rated: A

The minimum distance between module and roof is 8.5cm.

2.This racking system may be used to ground and/or mount a PV module complying with UL 1703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions.

Jiangyin Titanergy Co., Ltd. warrants that its Titan Solar Panel Mounting System is free from defects in materials and workmanship for a period of 10 years from the date on which the Frame is purchased from Titan Solar, on the terms set out in this warranty.

In the event that the Frame does not conform to this warranty during the Warranty Period, Titan Solar will, at its option, either repair or replace the Frame or pay the cost of having the Frame repaired or replaced. To the extent permitted by law, Titan Solar's total liability under this warranty will in no circumstances exceed the repair or replacement of the Frame or payment of the cost of having the Frame repaired or replaced. In the event of replacement of the Frame, any remaining part of the Warranty Period will be transferred to the replacement Frame.

This warranty will not apply to any defect or damage to the Frame arising directly or indirectly from:

- 1.Shipment or storage of the Frame;
- 2.Improper installation, maintenance, repair or use of the Frame;
3. Normal wear and tear;
4. Misuse, neglect, abuse, accidental damage or modification to the Frame;
5. Failure to observe the instructions set out in the System Manual; or
6. Power failure, power surges, lightning, fire, explosion, flood, extreme weather conditions, environmental disasters or other causes outside Grace Solar's control, as determined by Titan Solar in its sole discretion.

This warranty does not cover, and under no circumstances will Titan Solar be liable for, any costs associated with the removal, shipping, handling or re-installation of the Frame or the costs of sending personnel to any site to repair or replace the Frame. This warranty is only provided to the original purchaser of the Titan Solar panels mounting system (Purchaser) or, where the Purchaser is an installer or builder who on-supplies the Frame to another party, to that other party (End-User). This warranty is not transferable.

Where an End-User wants make a claim under this warranty, the End-User must in the first instance contact the installer or builder from whom the Frame was purchased.

This warranty will not apply to any claims received by Titan Solar after the expiration of the Warranty Period. Titan Solar makes no warranties, express or implied, other than the warranties made herein, and specifically disclaim all other warranties, representations and conditions to the extent permitted by law. To the extent permitted by law, in no circumstances will Titan Solar be liable for direct, indirect, special or consequential damages arising from a defective Frame or for any damage or injury to persons or property. Titan Solar's aggregate liability, if any, in damages or otherwise, will not exceed the invoice value of the Frame at the time of purchase from Titan Solar.

Any provision contained in this warranty which is prohibited or unenforceable in any jurisdiction will be deemed to be ineffective to the extent of such prohibition or unenforceability and will not invalidate the remaining provisions nor affect the validity or enforceability of that provision in any other jurisdiction.

11 . Revision History

Table:Revision History

| Revision Number | Revision Date | Reason for change | Document Author |
|-----------------|---------------|-------------------|-----------------|
| 01 | 2015-10-20 | Initial Release | Josie |