

# Solar Roof Mounting System Installation Manual



XIAMEN GRACE SOLAR TECHNOLOGY CO., LTD.

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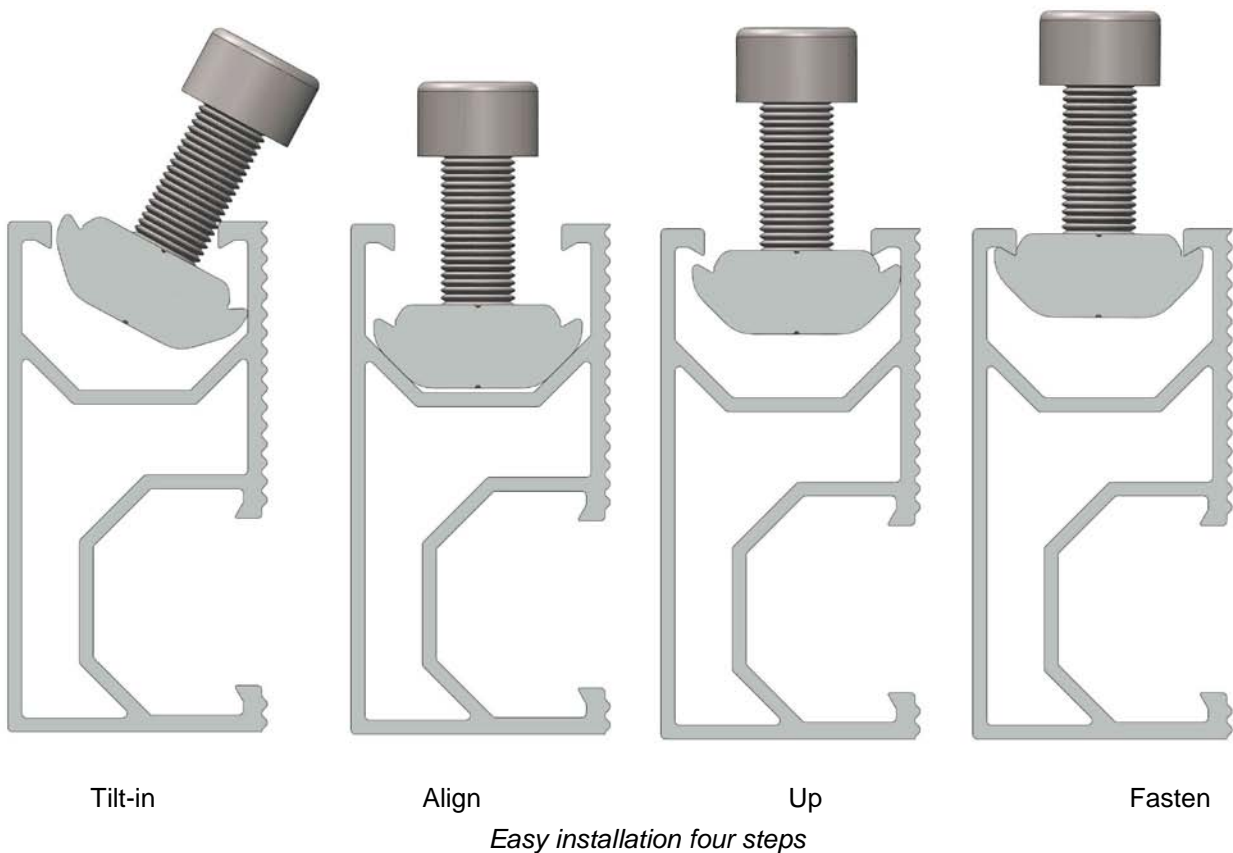
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## 1. GENERAL INFORMATION

Thank you for choosing the Grace solar roof mounting system. Made from custom-built aluminum extrusions and components, Grace 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.



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

Gracesolar is backed by a 10-year warranty and is compliant with the Australian/New Zealand Standard on Wind Actions (AS/NZS1170.2.2011).



## 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 Grace solar

It is critically important that safety practices are observed when installing

- ✓ Do not throw or roughly handle any Grace solar components.
- ✓ Do not bring Grace solar system into contact with sharp or heavy objects.
- ✓ Do not modify Grace 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 Grace 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 Grace 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

AS/NZS1170.2.2011 provides guidance on determining the wind pressures applicable to your Grace 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 if your company installs Australia/New Zealand wide.

- ✓ 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 conform to corrosion resistance Class 4 Australian Standard AS3566 and be of equal or greater strength to those supplied with your Grace solar system order.

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## 3. TECHNICAL SPECIFICATIONS

### 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.

### 3.1 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.
- ✓ Complies with Australian/New Zealand Standard on Wind Actions, AS/NZS1170.2.2011
- ✓ Anodized finish

### 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.

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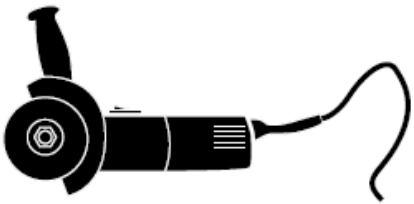




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## 4. TOOLS FOR INSTALLATION

The following tools are required for the installation:

<p>✓ 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.</p>	
<p>✓ Cordless drill; Drill or impact driver for driving roof material fixings</p>	
<p>✓ 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</p>	
<p>✓ Gloves; Protect the hazard of the sharp corners.</p>	
<p>✓ Cord or color pen; Mark the installation position;</p>	
<p>✓ Spirit level</p>	
<p>✓ Rule</p>	
<p>✓ If necessary, timber to shim the roof hooks</p>	

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## 5. COMPONENTS DESCRIPTION

<p><b>GD-Rail</b></p> <ul style="list-style-type: none"> <li>✓ hold each panel row</li> <li>✓ length can be customized</li> <li>✓ 6005-T5 extruded aluminum</li> </ul>	
<p>Standard Rail Length</p>	
<p>808~826mm wide panels</p>	<p>990~1020mm wide panels</p>
<p>2560mm</p>	
<p>3405mm</p>	<p>4200mm</p>
<p><b>GD Rail Splice Kit</b></p> <ul style="list-style-type: none"> <li>✓ Extend GD Rail to any length as required by the quantity or width of the solar panels</li> </ul>	
<p><b>Inter Clamp Kit for Framed Modules</b></p> <ul style="list-style-type: none"> <li>✓ Fit between two panels</li> <li>✓ Fastened with a 6mm Allen key</li> <li>✓ Standard pre-assembly for the usual panels with thickness 30~35, 35~40, 45~50, 57~60mm</li> </ul>	
<p><b>End Clamp Kit for Framed Modules</b></p> <ul style="list-style-type: none"> <li>✓ Hold the edge of each end panels</li> <li>✓ Fastened with a 6mm Allen key</li> <li>✓ Standard pre-assembly for the usual panels with thickness 30, 35, 40, 46, 50, 57mm</li> </ul>	

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<b>Variety of Roof Hook</b>	
<p><b><i>Stainless Steel Roof Hook 1 #</i></b></p> <ul style="list-style-type: none"> <li>✓ Fix to the rafter below Roman tile roof</li> <li>✓ Include 3pcs st6.3x60 wood screws</li> </ul>	
<p><b><i>Stainless Steel Roof Hook 2 #</i></b></p> <ul style="list-style-type: none"> <li>✓ Fix to the rafter below flat tile roof</li> <li>✓ Include 2pcs st6.3x60 wood screws</li> </ul>	
<p><b><i>Stainless Steel Roof Hook 3 #</i></b></p> <ul style="list-style-type: none"> <li>✓ Side fix to the rafter below Roman tile roof</li> <li>✓ Include 3pcs st6.3x60 wood screws</li> </ul>	
<p><b><i>Stainless Steel Roof Hook 4#</i></b></p> <ul style="list-style-type: none"> <li>✓ Fix to the rafter on slate tile roof</li> <li>✓ Include 3pcs st6.3x60 wood screws</li> </ul>	
<p><b><i>Aluminum Tin Roof Hook 5#</i></b></p> <ul style="list-style-type: none"> <li>✓ Fix to the purlin on tin roof</li> <li>✓ Include 1pcs st6.3x80 wood screws</li> </ul>	
<p><b><i>Stainless Steel Roof Hook 6#</i></b></p> <ul style="list-style-type: none"> <li>✓ Fix to the rafter below Roman tile roof</li> <li>✓ Include 3pcs st6.3x60 wood screws</li> </ul>	



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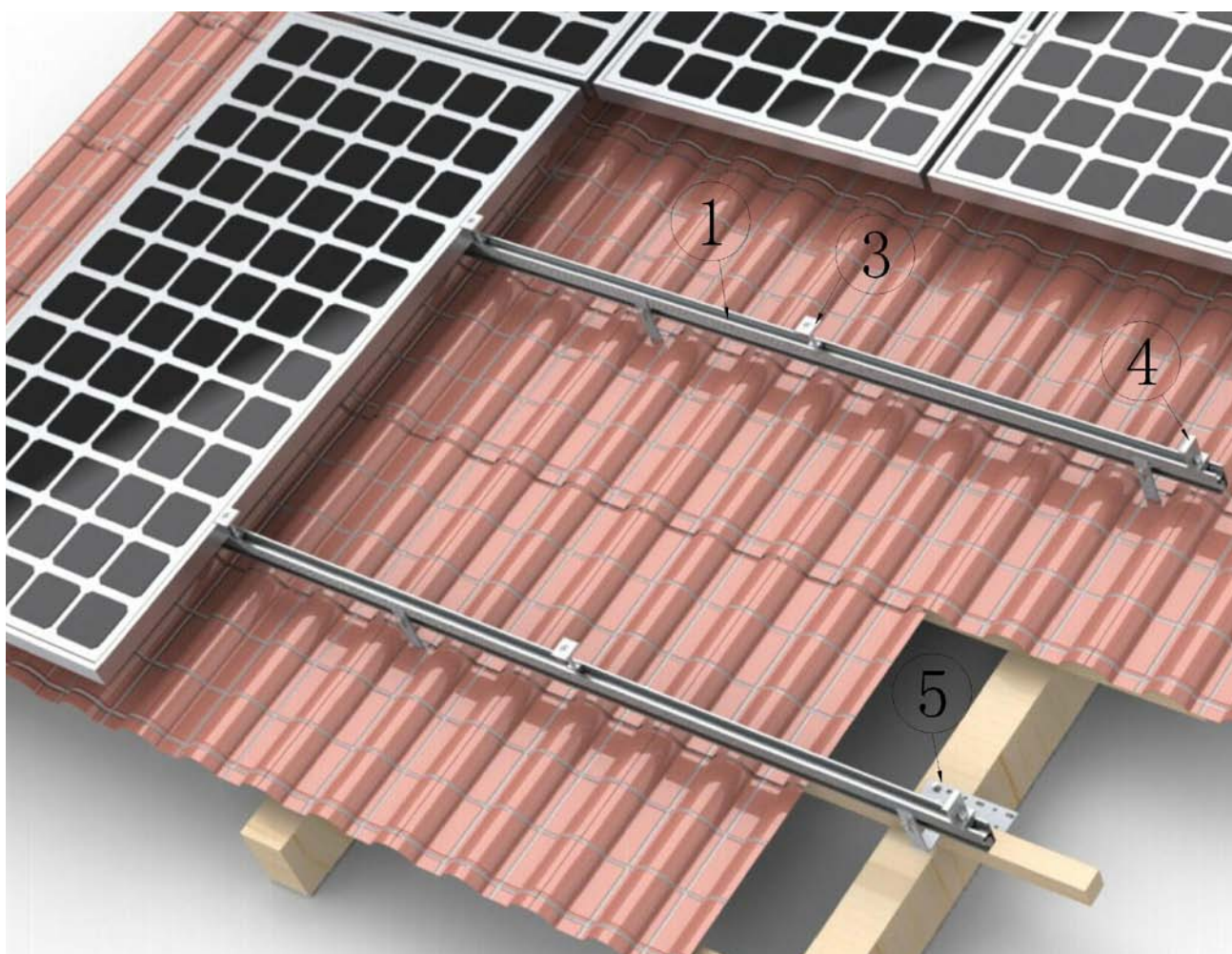
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## 6. SYSTEM OVERVIEW

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

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

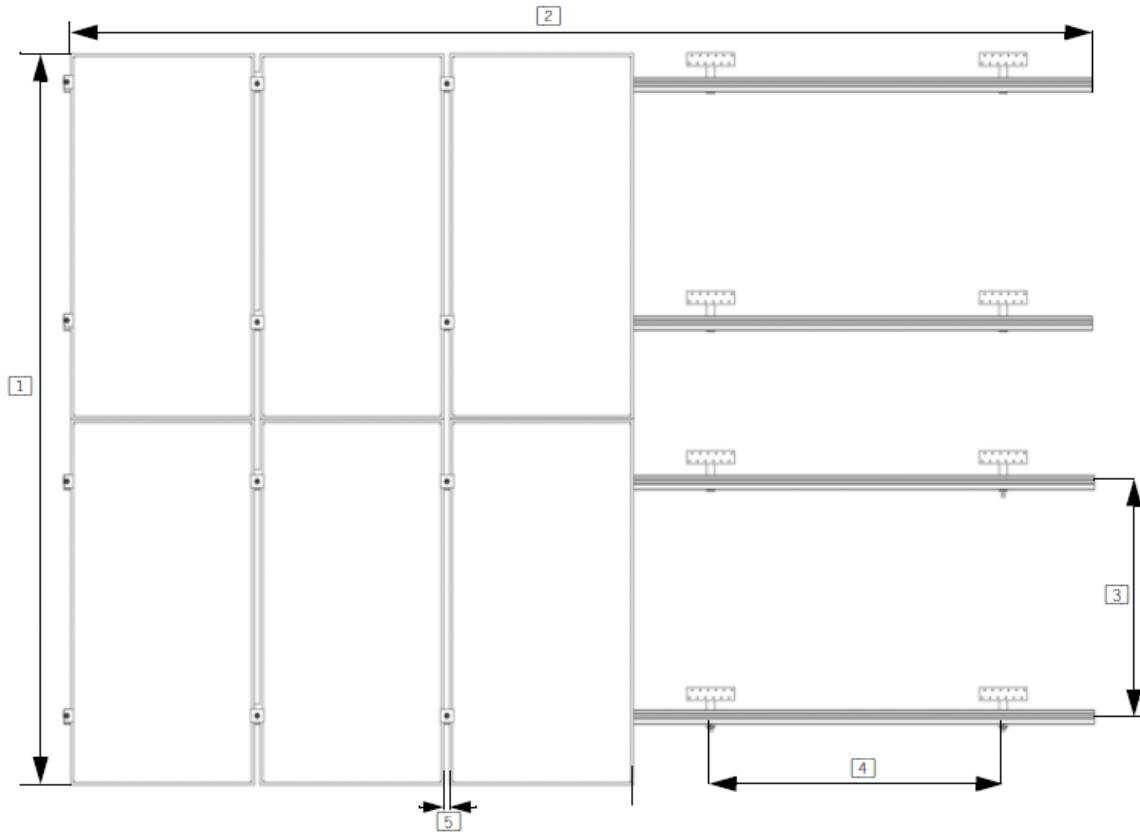


① GD Rail	② GD Rail Splice (Optional)
③ Inter Clamp	④ End Clamp
⑤ Roof hook	



## 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.

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## 8. CODE-COMPLIANT AS/NZS 1170 PLANNING

### 8.1 Determine the wind region of your installation site

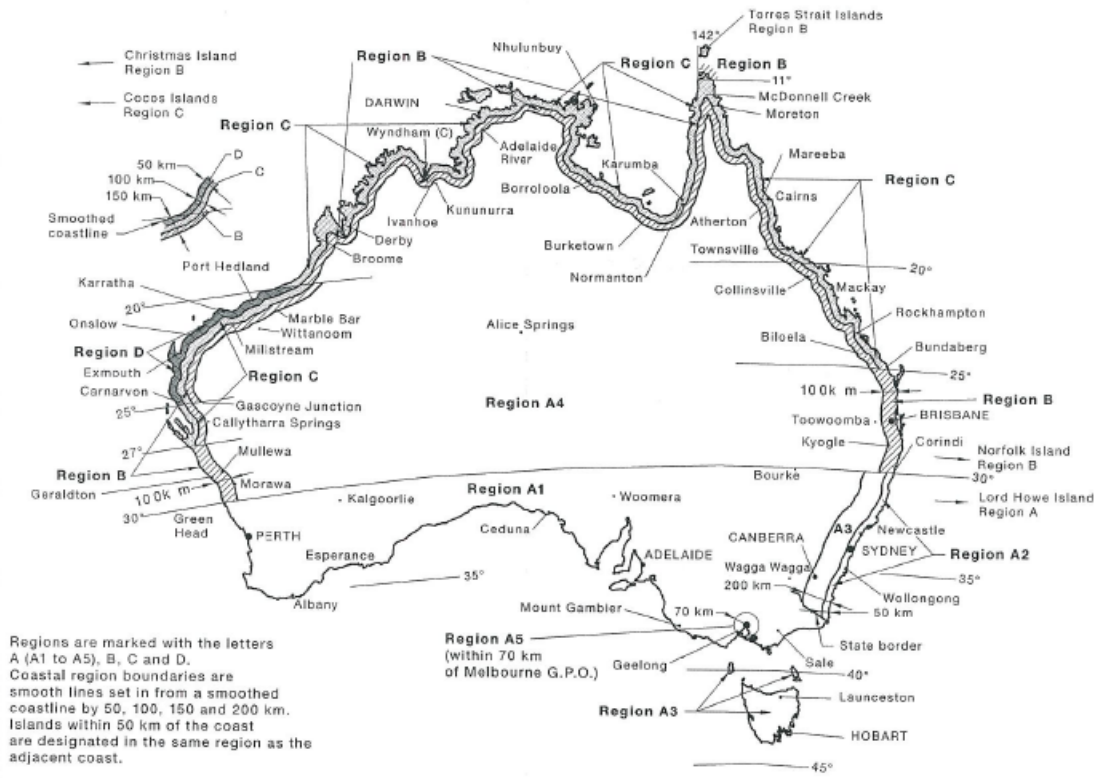


FIGURE 3.1(A) WIND REGIONS

#### Region Definition:

Wind regions are pre defined for all of Australia by Australian Standard 1170. The Wind Region has nothing to do with surrounding topography or buildings.

- Most of Australia is designated Region A which indicates a Regional Ultimate Basic Wind Velocity of 45msec.
- Some areas are designated Region B (57msec). Local authorities will advise if this applies in your area.
- Region C areas (66msec) are generally referred to as Cyclonic and are generally limited to northern coastal areas. Most Region C zones end 100km inland.
- Region D (80msec) Australia's worst Cyclonic Region between Carnarvon and Pardoo in Western Australia.

### 8.2. Determine the height of the of your installation site

This document provides sufficient information for Grace solar system installation height less than 10 meters. If your installation site is more than 10 meters in height, please contact Grace solar to obtain engineering data to support your installation.



### 8.3 Determine Roof Installation Roof Areas

The use of this Paragraph (D6) shall be limited to the calculation of wind loads on solar panels with the following restrictions:

- (a) Panels attached to enclosed building with aspect ratios  $h/d \leq 0.5$  and  $h/b \leq 0.5$ .
- (b) Panels be attached parallel to the roof plane.
- (c) Panels with a gap of between 50mm and 300mm between the underside of the panel and the roof(s) (no pitched frames).
- (d) Panels with a minimum distance between panel and roof edge of  $2s$  where  $s$  is the gap between the underside of the panel and the roof surface, as shown in Figure D8 (roof edge includes ridges with  $\text{pitch} \geq 10^\circ$ ).

The aerodynamic shape factor ( $C_{fig}$ ) for calculation net pressures for solar panels satisfying the above conditions, as shown in Figure D8, is given in Table D11. The aerodynamic shape factor ( $C_{fig}$ ) contains local pressure and area reduction effects for calculating net loads on individual panels installed as part of an array of panels in the areas of the roof identified in Figure D9.



FIGURE D8 PANEL MOUNTED PARALLEL TO ROOF PLANE

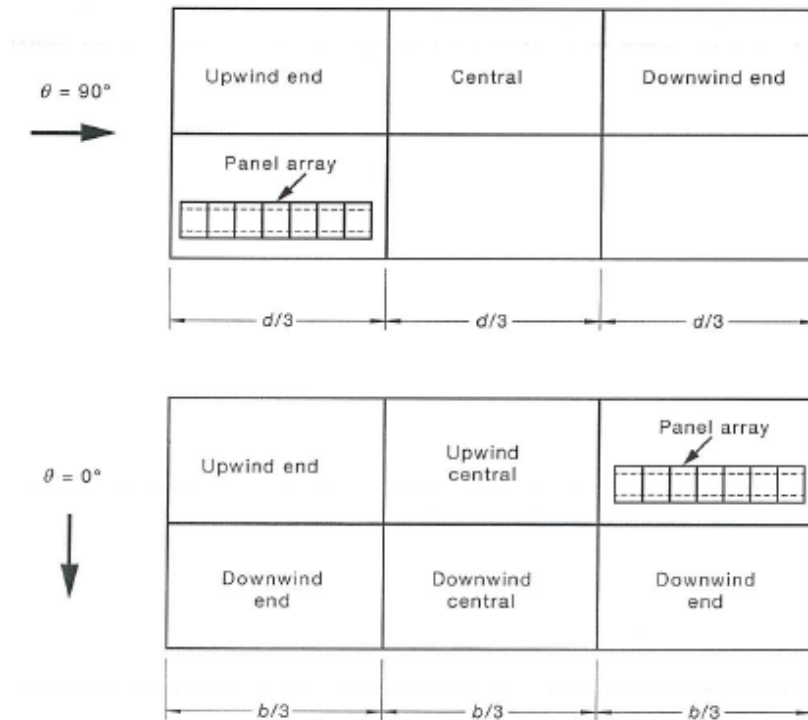


FIGURE D9 ROOF ZONES FOR PANEL ARRAY

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## 8.4 Determine the Maximum Rail Support Spacing

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

1970mm Long Panels fixed to Tiled Roof								
Installation Height	Region A (mm)		Region B (mm)		Region C (mm)		Region D (mm)	
Max area of one panel	3.0m <sup>2</sup>		2.5m <sup>2</sup>		2.0m <sup>2</sup>		1.5m <sup>2</sup>	
Roof Area	Center Zone	Edge Zone	Center Zone	Edge Zone	Center Zone	Edge Zone	Center Zone	Edge Zone
5 Meters	2010	1420	1390	980	870	610	530	380
10 Meters	1660	1170	1150	810	780	550	480	340

- ✓ The above figures are based on modules lengths of up to 1970mm, maximum weight of 15Kg/m<sup>2</sup>
- ✓ The above spacing applies for fixing through thin sheet purlins (greater than 1.0mm thickness) or a minimum embedment of 50mm into timber purlins.
- ✓ Tile brackets should be fixed to the rafter using two 12g mounting screws (M6x60mm)
- ✓ For 35mm embedment into timber of fixings into 0.55mm thickness steel for regions A+B remain unchanged. For regions C reduce the spacing by 15%. For region D reduce the spacing by 35%.
- ✓ In case the wooden rafters/trusses you wish to mount on are too thin and the screws would be too close to the edge of the rafters please pre-drill with a 3-4mm drill in order to avoid the splitting of the timber ( or use the side mount roof hook).

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

1970mm Long Panels fixed to Tin Roof								
Installation Height	Region A (mm)		Region B (mm)		Region C (mm)		Region D (mm)	
Max area of one panel	3.0m <sup>2</sup>		2.5m <sup>2</sup>		2.0m <sup>2</sup>		1.5m <sup>2</sup>	
Roof Area	Center Zone	Edge Zone	Center Zone	Edge Zone	Center Zone	Edge Zone	Center Zone	Edge Zone
5 Meters	985	695	680	480	610	430	370	260
10 Meters	815	575	565	400	550	390	340	240

- ✓ The above figures are based on modules lengths of up to 1970mm, maximum weight of 15Kg/m<sup>2</sup>
- ✓ The above spacing applies for fixing through thin sheet purlins (greater than 0.75mm thickness) or a minimum embedment of 50mm into timber purlins.
- ✓ The L Feet should be fixed to the purlins under using one 12g mounting screw (M6x80mm) through sheet metal roofs with desk rubber.
- ✓ For 35mm embedment into timber of fixing into 0.55mm thickness steel the max panel length should be reduced to 1700mm and the max spacing reduced by 20%.
- ✓ Please note that the screws provided with our products are designed for mounting into wooden structures.

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## **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**

Grace 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.

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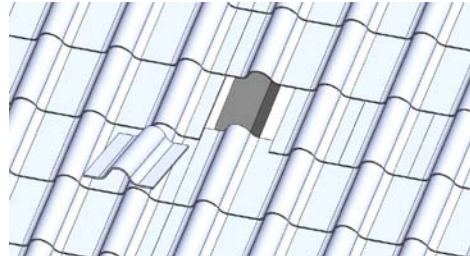
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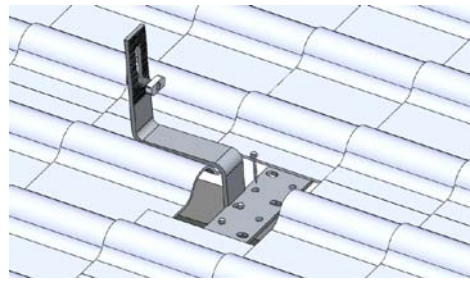
## 9. INSTALLATION

### Install on Roman Tile Roof

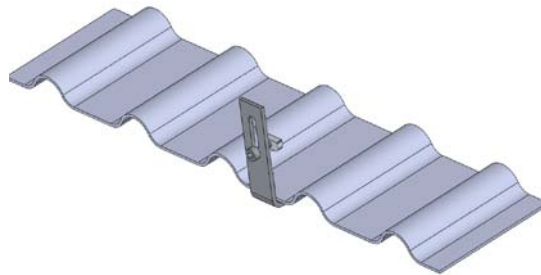
1. Remove the roof tiles at the marked positions or simply lift them up slightly.



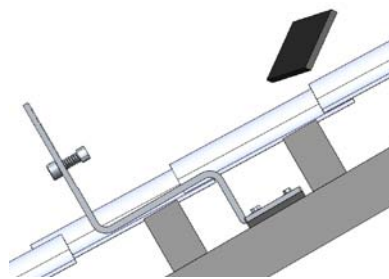
2. Input the roof hook to the wooden beam. Fix the roof hooks with 3x wood screws (M6x80).



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.



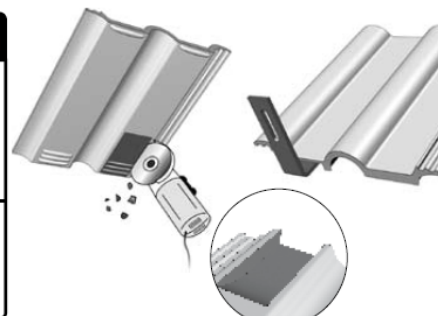
Wrong

Correct

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.)

**WARNING**

To minimize risk of injury, exercise caution when operating tile cutting tool, and follow tool manufacturer's safety instructions. Failure to follow appropriate safety procedures could result in severe lacerations or dismemberment.



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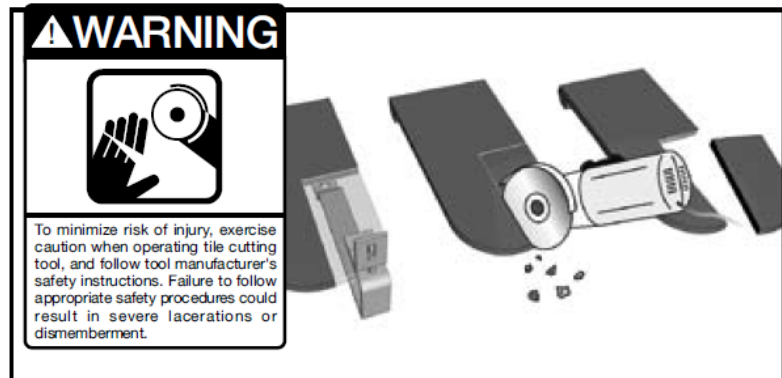
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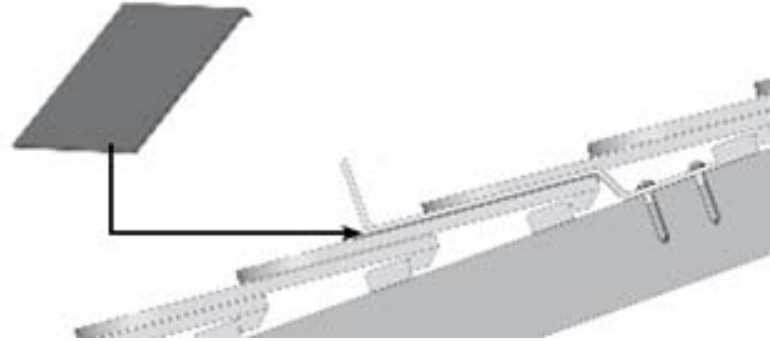


## Install on Plain Tile Roof

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

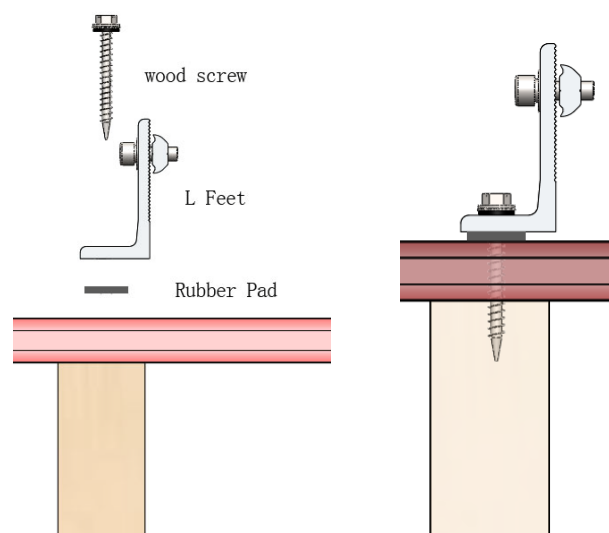


7. Cut titanium zinc metal sheets to fit and install them under the roof hooks. Fix the roof hooks to the rafter using two 6 x 80 mm wood screws.



## 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.





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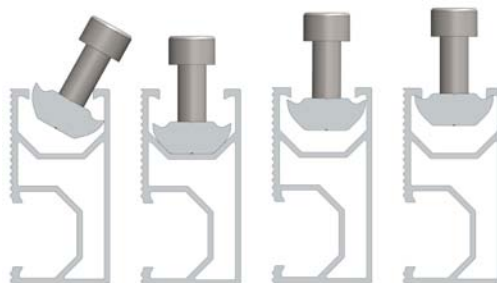
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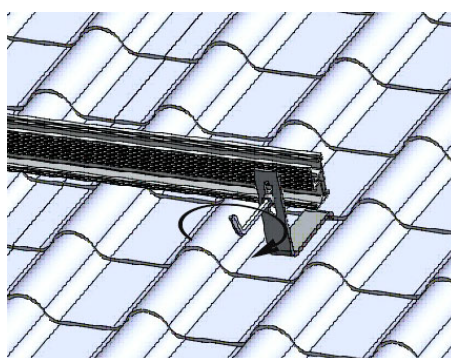
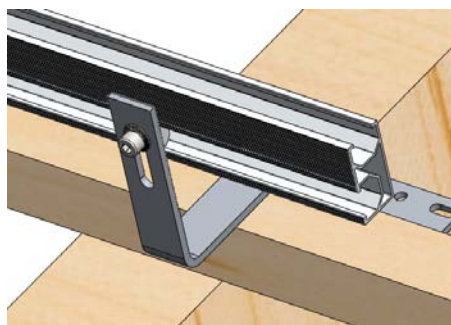
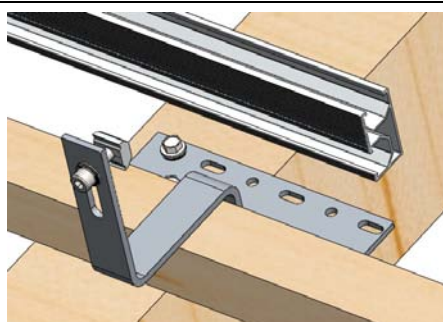
## Install The GD-Rail

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



10. Connect the roof hook with the GD Rail.

- a. Insert the D-Module into the side channel of the GD Rail as the step 9 shown.
- b. Adjust the GD Rail to be level.
- c. Fasten the bolt.



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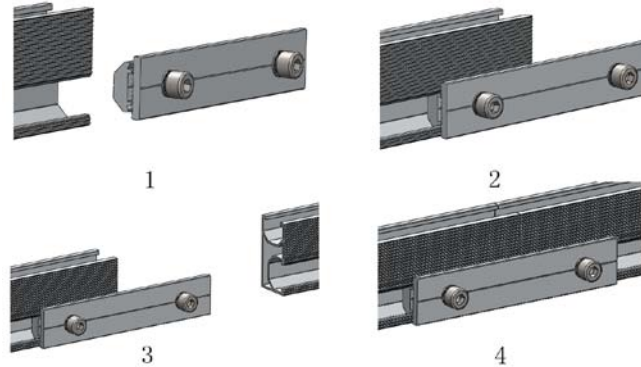
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## 11. GD Rail connect

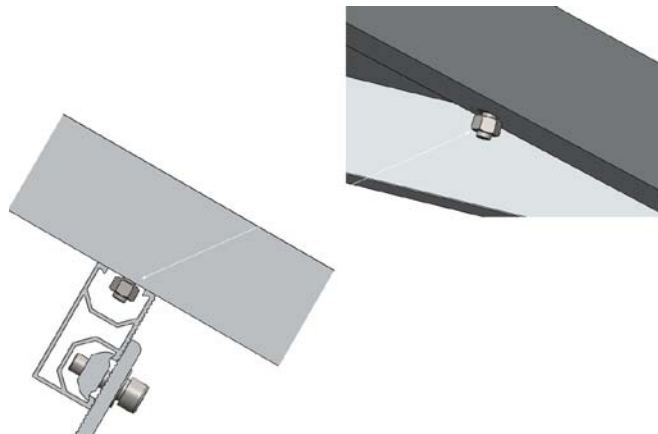
- a. Put the GD Rail Splice into the side channel of the GD Rail about 75mm, then fasten the M8 Bolt.
- b. Put the other GD Rail into the other side of the GD Rail Splice and fasten the other M8 bolt.



## Install the module

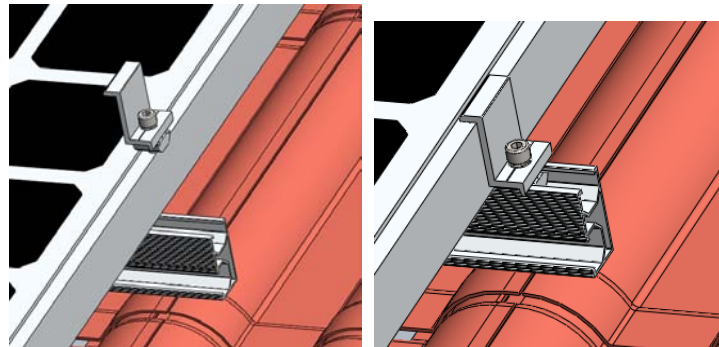
### 12. Installing anti-slip protection

The anti-slip 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



### 13. Fixing the outer modules by End clamp.

- a. Put the end clamp kit into the top channel of the GD-Rail as the step 9.
- b. Push the side of module to firmly against the end clamp and then fasten the bolt.



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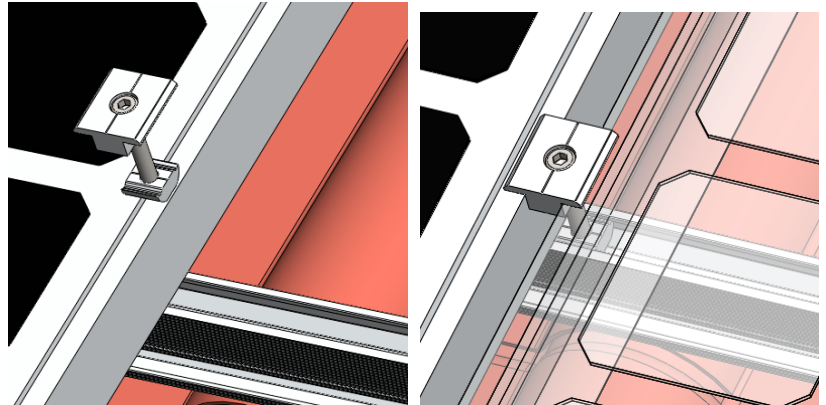
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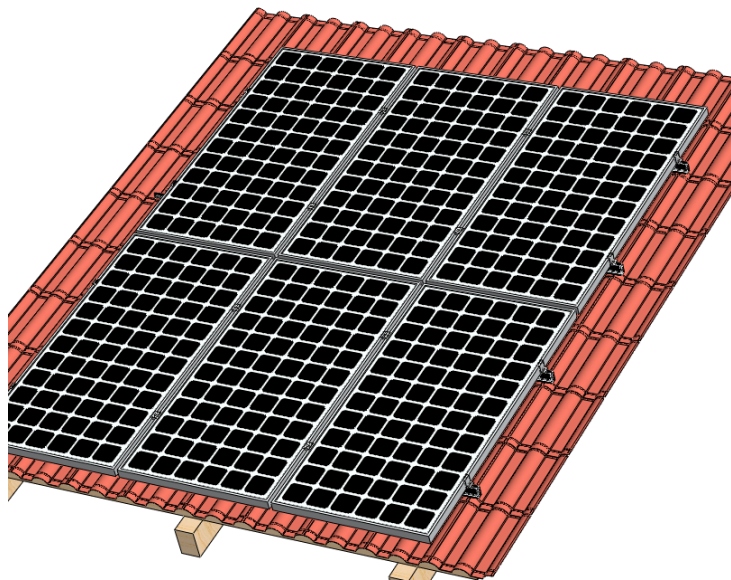
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14. Fixing the inter modules by inter clamp.
- Put the inter clamp kit into the top channel of the GD-Rail as the step 9.
  - Push the Inter-module clamp firmly against the already fixed module.
  - Push the next module against the other side of the module-inter clamp.
  - Tighten the bolt



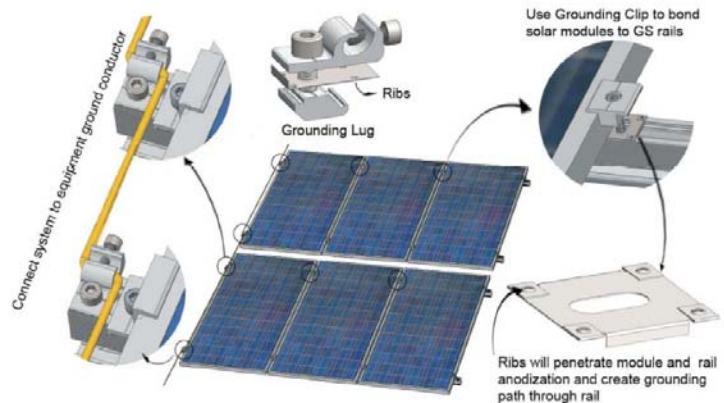
15. Installing the further rows of modules



## Cable tie and Grounding

16. Grounding

Please see the *Grace solar Grounding System Installation Guide*



# Solar Roof Mounting System Installation Manual



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## 10. WARRANTY

Xiamen Grace Solar Technology Co., Ltd. warrants that its Grace 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 Grace 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, Grace 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, Grace 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 Grace Solar in its sole discretion.

This warranty does not cover, and under no circumstances will Grace 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 Grace 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 Grace Solar after the expiration of the Warranty Period.

Grace 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 Grace 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. Grace 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 Grace 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.