GS ROOF

TILE ROOF

PUB22 JAN22

INSTALLATION GUIDE

Fastensol
Smarter Energy

INDEX

Part I. Safety and Installer Responsibilities. 2

Part II. Tools Required for Installation. 3

Part III. System overview&Components list 4

Part IV. Planning and preparation. 6

Part V. Installation Instruction

[5.1] Designing the Module Field. 13

[5.2] Tile Bracket Installation. 14

[5.3] Rail Installation 20

[5.4] Mid Clamp&End Clamp Installation 20

[5.5] Module Installation 20

[5.6] Accessory Installation 21

Part VI . Others

Warranty. 22

MCS Certificate 23

Consumer Guarantees. 26

Contact Details 26

Thank you for choosing the Fastensol solar panel roof mounting system. Made from custom-designed aluminium extrusions and components, Fastensol's streamlined design and improved frame strength greatly simplify solar panel installation.

Offering a high level of adjustability for module width and depth Fastensol's versatile design makes it suitable for a wide variety of building types and zones including residential, commercial and remote environments.

Fastensol is backed by a 12-year warranty and is compliant with the MCS certification.

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.

Part I. SAFETY AND INSTALLER RESPONSIBILITIES

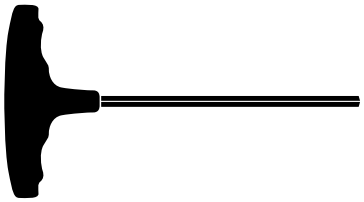
Handling and Installing Fastensol

It is critically important that safety practices are observed when installing

- ✓ Do not throw or roughly handle any Fastensol components.
- ✓ Do not bring Fastensol system into contact with sharp or heavy objects.
- ✓ Do not modify Fasten 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 Fastensol components is fixed. Roofs or structures with rotten/rusted bearers, undersized bearers, excessively spaced bearers, or any other unsuitable substructure cannot be used with Fastensol components, and installation on such structures will void the warranty, and could result in death or serious injury.

Part II. TOOLS REQUIRED FOR INSTALLATION

✓ **T-bar Allen Key or 6 mm hexagonal driver bit**
If using a 6 mm driver bit, make sure the cordless power tool used for driving has a hand-tight clutch setting and a fine (soft) impact drive to prevent damage to the fragile glass panels and threads on the framing.



✓ **Cordlessdrill**
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**

Part III. System overview&Components list

[3.1]System overview

[3.2]Components list

Standard Rail

Rail splice

Mid Clamp

End Clamp

Grounding Lug

Grounding clip

Bonding Jumper

Rail clamp

Components list

Pantile roof hook

Pantile roof hook

Pantile Roof Hook

Adjutable Pantile Roof Hook

Pantile Roof Hook

Plain Tile Roof Hook-Portrait

Slate Tile Roof Hook-Portrait

Adjutable Pantile Roof Hook

180° Pantile roof hook

180° Double adjustable pantile roof hook

180° Double adjustable pantile roof hook

180° Plain roof hook

180°Plain roof hook

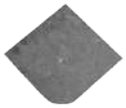
Slate tile roof hook

Part IV. Planning and preparation

[4.1]Hook selecting

TILE TYPE	ROOF HOOKS						
	TH01	TH02	TH04	TH05	ATH05	TH06	TH07
 Hollow tile	●			●	●	●	●
 Flat roof tile	●			●	●	●	●
 Standard tile	●			●	●	●	●
 Double slot tile	●			●	●	●	●
 Roman tile	●			●	●	●	●
 Plain tile		●					●
 Scale tile		●					●
 Slate tile			●				
 Spanish tile				●	●		●
 Coppo tile					●		●

Part IV. Planning and preparation

TILE TYPE	ROOF HOOKS						
	TH01	ATH01	TH12	TH13	TH14	TH15	ATH15
							
 Hollow tile	●	●				●	●
 Flat roof tile	●	●				●	●
 Standard tile	●	●				●	●
 Double slot tile	●	●				●	●
 Roman tile	●	●				●	●
 Plain tile			●	●			
 Scale tile			●	●			
 Slate tile					●		
 Spanish tile						●	
 Coppo tile							●

[4.2]Determine the basic wind velocity of your installation site

Before proceeding, please note the following:

- This document addresses wind and snow actions. A combination of dead, wind and snow will produce the maximum action on an installation. These loads are considered to act on the entire projected area.
- Please verify that the installation site has a roof slope of between 0-1 5° and 60°, if not the purchaser should contact Fastensol to obtain engineering data to support the installation.

The following information will be required to enable you to complete the whole installation:

- Building height in metres*
- Building length in metres*
- Building width in metres*
- Building location, Countryside / Town*
- Site altitude in metres* AOD
- Roof construction type, monopitch/duopitch / hipped*
- Roof pitch in degrees from horizontal*
- Roof area, (see Fig 4)
- Basic wind velocity, (see Fig 1)
- Distance in kilometres (max 100km) from site to nearest show line in prevailing wind direction*
- Distance in kilometres (max 20km) from site location to edge of urban development in prevailing wind direction*
- Exposure correction factor C.(z), (see Fig 2)
- Exposure correction factor c., T, (see Fig 3)

[4.2.1]Wind action

The wind map below (Fig 1) shows the "fundamental values of basic wind velocity" in m/sec before an altitude correction factor, directional factor, seasonal factor and probability factor has been applied

BS EN 1991-1-4:2005 and the National Annex provide differing values for the directional factor, seasonal factor and probability factor. However, they also allow the use of a conservative value of 1.0 for each of these; which will result in a worst case value being achieved, therefore use :

- Directional factor C_d= 1.0
- Seasonal factor C_{season} = 1.0
- Probabilty factor C_{prob} = 1.0

By reference to the wind map the basic wind velocity for Sheffield is interpolated as 22.2m/sec. Therefore the fundamental wind velocity for the two sites are as follows
For buildings with height to eaves less than 10m

$$v_b = v_{b,map} \times (1 + 0.001A) \times c_{dir} \times c_{season} \times c_{prob}$$

Where A in the equation is the altitude of the site in metres AOD.

For buildings with at height to eaves greater than 10m.

$$v_b = v_{b,map} \times \left(1 + 0.001A \times (10/z)^{0.2}\right) \times c_{dir} \times c_{season} \times c_{prob}$$

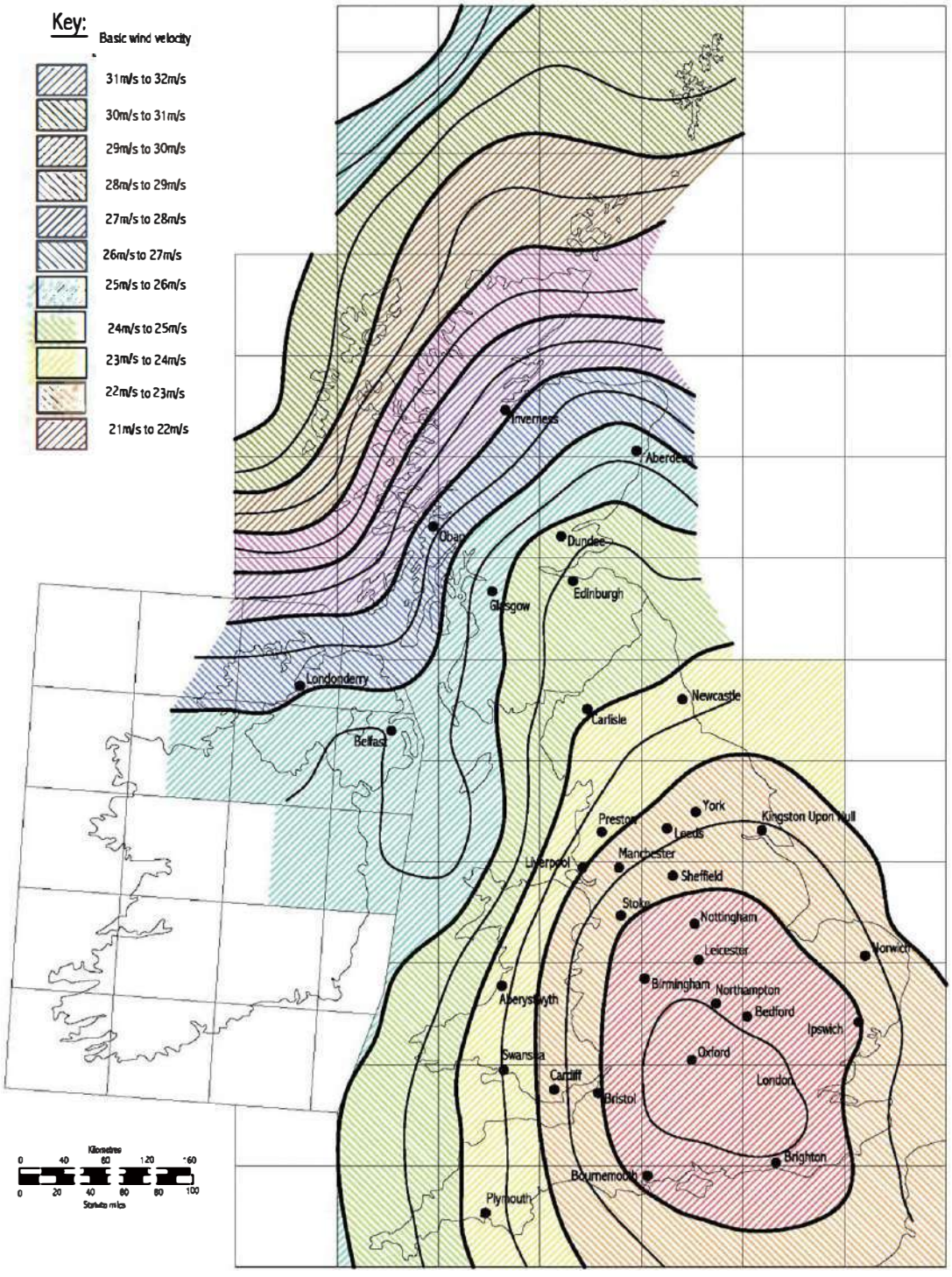


Fig 1. Value of fundamental basic wind velocity map, $v_{b,map}$

[4.2.2] Determine the wind action onto the roof of your installation

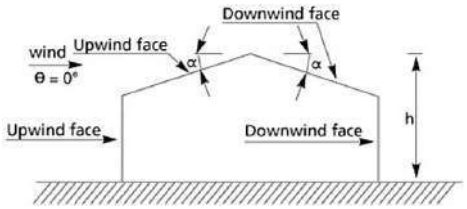
The wind load onto the roof can be derived by multiplying the peak velocity pressure by an external pressure coefficient. This value is dependant on the type of roof construction and the degree of pitch for the roof.

The types of roof construction considered in this document are monopitch, duopitch with a positive angle only and hipped which will cover the majority of roofs.

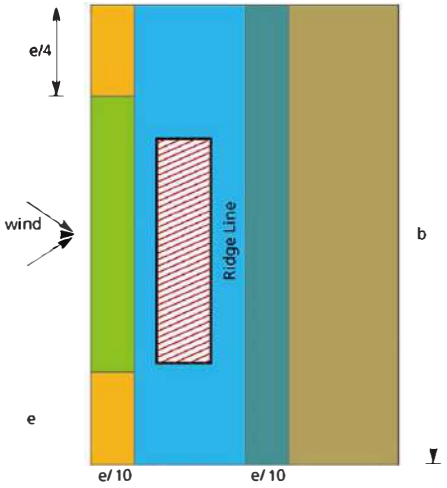
From Fig 4 we can see that area H is to be used. This uses an external pressure coefficient (C_{pe} suction) of -0.2 and (C_{pe} pressure) of 0.4 with internal pressure coefficients of (C_{pi} suction) of 0.2 and (C_{pi} pressure) of -0.3

$$W_{kv} = q_p \times (C_{pe} - C_{pi})$$

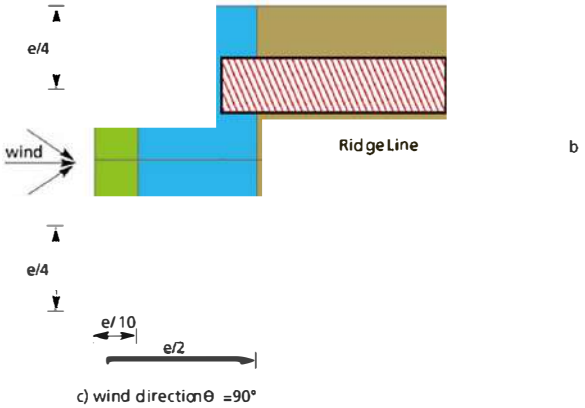
- Wind action, $W_{kv\ suction}$ = 0.53x(-0.2-0.2) = -0.21kN/m²
- Wind action, $W_{kv\ pressure}$ = 0.53x(0.4- -0.3) = 0.37kN/m²
- Wind action, $W_{kv\ suction}$ = 0.91x(-0.2-0.2) = -0.36kN/m²
- Wind action, $W_{kv\ pressure}$ = 0.91x(0.4- -0.3) = 0.64kN/m²



a) General



b) wind direction θ = 0°



c) wind direction θ =90°

Colour Key:

- Roof Area F
- Roof Area G
- Roof Area H
- Roof Area I
- Roof Area J

Notes:
e = b or 2h (whichever is the smaller)
b = crosswind dimension

C_{pe} (suction)

Pitch Angle α	Zone for wind direction Y = 0°				
	$C_{pi,10}$ F	$C_{pi,10}$ G	$C_{pi,10}$ H	$C_{pi,10}$ I	$C_{pi,10}$ J
5°	-1.7	-1.2	-0.6	-0.6	-0.6
15°	-0.9	-0.8	-0.3	-0.4	-1.0
30°	-0.5	-0.5	-0.2	-0.4	-0.5
45°	-0.0	-0.0	-0.0	-0.2	-0.3
60°	+0.7	+0.7	+0.7	-0.2	-0.3

C_{pe} (pressure)

Pitch Angle α	Zone for wind direction Y = 0°				
	$C_{pi,10}$ F	$C_{pi,10}$ G	$C_{pi,10}$ H	$C_{pi,10}$ I	$C_{pi,10}$ J
5°	0.0	0.0	0.0	-0.6	-0.6
15°	0.2	0.2	0.2	0.0	0.0
30°	0.7	0.7	0.4	0.0	0.0
45°	0.7	0.7	0.6	0.0	0.0
60°	0.7	0.7	0.7	-0.2	-0.3

Denotes PV modules in relation to the wind direction

Fig 4. Wind area location and external pressure coefficients for duopitch roofs

[4.3]Determine the basic Snow velocity of your installation site

[4.3.1]Snow Action

The snow map below (Fig 5) shows the characteristic ground snow action zones and is used along with the site altitude to determine the characteristic value of ground snow loading for the installation site

$$s_k = \left[0.15 + \left(0.1Z + 0.05\right)\right] + \left(\frac{A-100}{525}\right)$$

Where A in the equation is the site altitude in metres AOD and Z is the snow zone number from the map.

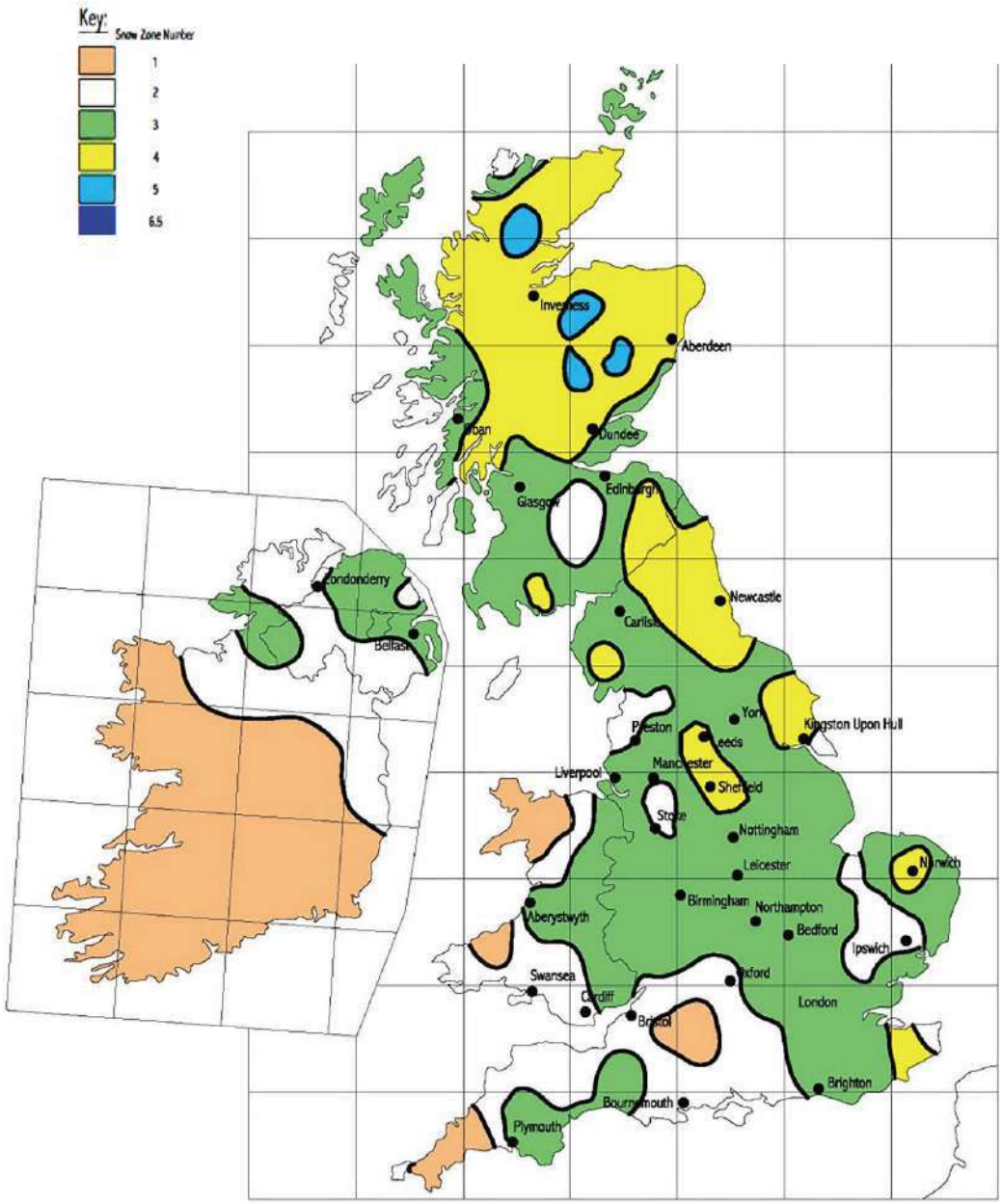


Fig 5. Snow zone locations.

[4.3.2]Determine characteristic snow load on roof for your installation site

This document recognises that snow can be deposited on a roof in many different patterns and that there are several other factors which contribute to the different patterns being caused.

This document assumes that the persistent/transient design situation will govern and that the drifted snow load shape coefficient μ_1 is equal to:

- Angle of roof pitch 0° to 15° = 0.8
- Angle of roof pitch 15° to 30° = 0.8 + 0.4(a- 15)/ 15
- Angle of roof pitch 30° to 60° = 1.2(60 - a)/ 30

Whereain the equation is the pitch of the roof in degrees

Therefore the vertical and horizontal roof snow action for both buildings is equal to:

$$s_{k,v} = \mu_1 \times c_e \times c_t \times s_k \times \cos\alpha$$

$$s_{k,h} = \mu_1 \times c_e \times c_t \times s_k \times \sin\alpha$$

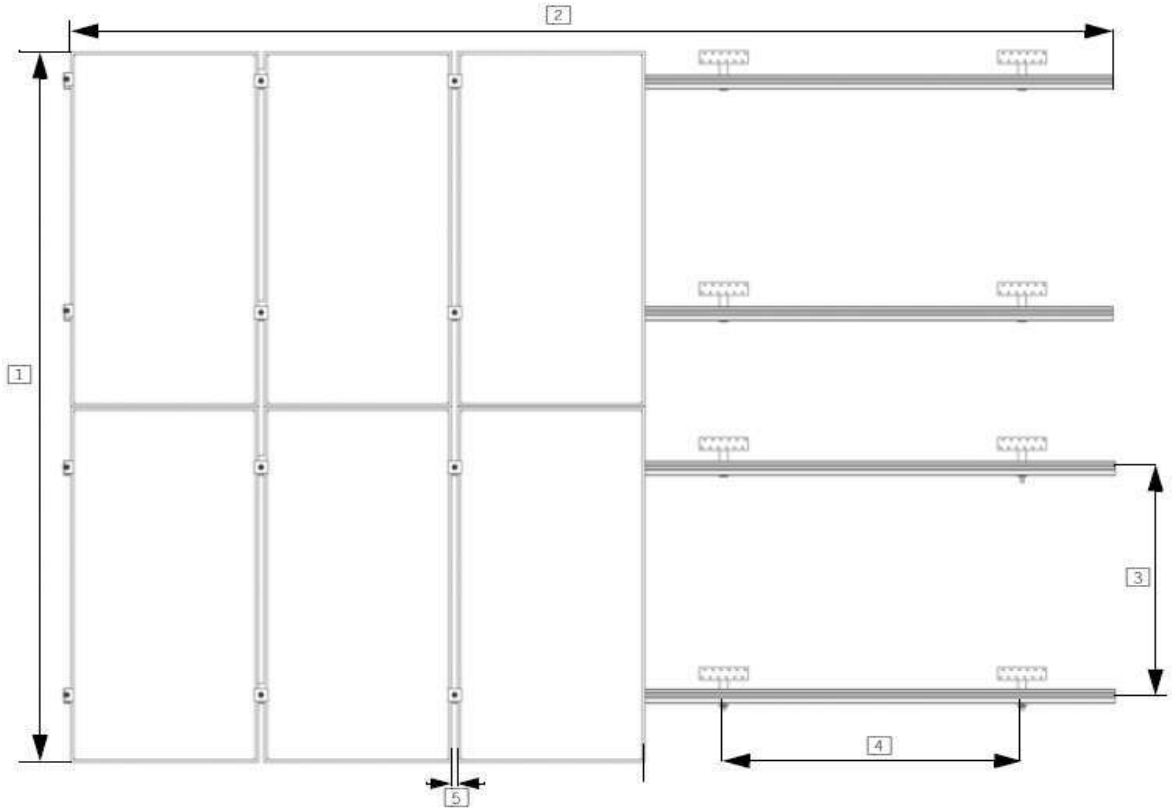
This document has assumed the following values for :

- Exposure coefficient, C_e= 1.0
- Thermal coefficient, C_t= 1.0

Part V. Installation

[5.1]Designing the module field

According to the specification of modules, calculate the length of rails, distance and span between two hooks. Details and drawings is as below:



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)+50 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 .
5. Distance between modules: 18 mm

When positioning the modules, please take into consideration

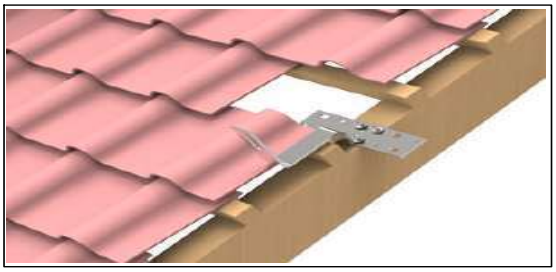
- That the values above are
- That dimensions of tiles or other roof covering and the position of the rafters define the precise actual horizontal distance between roof connections
- That the distance between roof laths defines the precise actual vertical distance between roof connections.

[5.2] Tile Bracket Installation

[5.2.1]Pantile roof hook-Portrait

Determine the positions of the Roof Hooks according to your plans. Remove the roof tiles at the marked positions or simply lift them up slightly. Input the roof hook to the wooden beam. Fix the roof hooks with 3pcs wood screws (st6.3x80).

Note: Minimum 2 pcs wooden screws



Cover the hooks by the removed tile

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.

⚠ 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 of dismemberment.

[5.2] Tile Bracket Installation

[5.2.2]Pantile roof hook-Landscape

Determine the positions of the Roof Hooks around installation area according to your plans. Remove the roof tiles at the marked positions or simply lift them up slightly. Input the roof hook to the wooden beam. Fix the roof hooks with 3pcs wood screws (st6.3x80).

Note: Minimum 2 pcs wooden screws

Cover the hooks by the removed tile

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.

⚠ 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 of dismemberment.

[5.2] Tile Bracket Installation

[5.2.3]Adjustable pantile roof hook

Determine the positions of the Roof Hooks according to your plans. Remove the roof tiles at the marked positions or simply lift them up slightly.

Locate and mark rafters, adjust arm-base bolts position as needed. Drill 3 pilot holes and Input the roof hook to the wooden beam. Fix the roof hooks with 3pcs wood screws (st6.3x80).

Note: Minimum 2 pcs wooden screws

Replace the hooks by the removed tiles

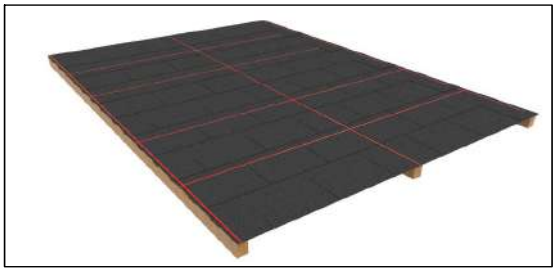
If necessary, use an angle grinder or hammer to cut a concavity in the tile that covers the roof hook at the point where the roof hook comes through.(Caution! Must not use fixed roof hook as a ladder, as this extreme point load could damage the tile below.

⚠ 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 of dismemberment.

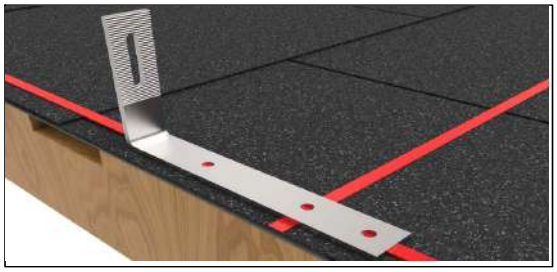
[5.2] Tile Bracket Installation

[5.2.4] Slate tile roof hook

According to the site construction drawings, determine the positions of the Roof Hooks and draw a line at the installation position.

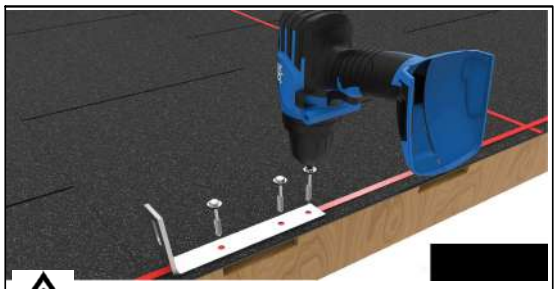


Input the roof hook to the marked position on the main beam. Fix the roof hooks with 3pcs wood screws (st6.3x80).



Note: Minimum 2 pcs wooden screws

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.



⚠ 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 of dismemberment.

[5.2] Tile Bracket Installation

[5.2.5] Plain tile roof hook

Determine the positions of the Roof Hooks according to your plans. Remove the roof tiles at the marked positions or simply lift them up slightly.

Input the roof hook to the wooden beam. Fix the roof hooks with 3pcs wood screws (st6.3x80).

Note: Minimum 2 pcs wooden screws

Cover the hooks by the removed tile

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.

⚠ 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 of dismemberment.

[5.2] Tile Bracket Installation

[5.2.6] Pantile roof hook

Determine the positions of the Roof Hooks according to your plans. Remove the roof tiles at the marked positions or simply lift them up slightly.

Input the roof hook to the wooden beam. Fix the roof hooks with 3pcs wood screws (st6.3x80).

Note: Minimum 2 pcs wooden screws

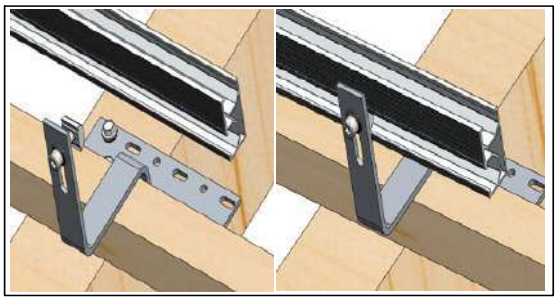
Cover the hooks by the removed tile

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.

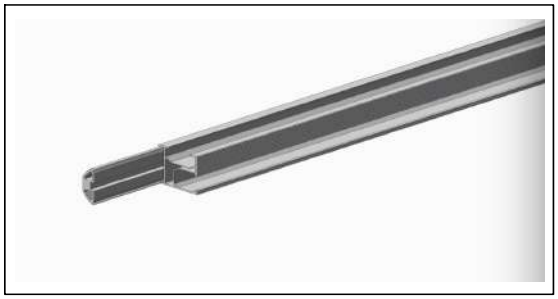
⚠ To minimize risk of injury, exercise caution when operating tile cutting tool, and follow tool manufacturer's safety instructions. Failure to follow appropriate safety procedures could result in severe lacerations of dismemberment.

[5.3] Rail installation

Fix the rail to hook by inserting the T bolt into the rail channel, and then fasten the flange nut. The rail can be adjusted vertically within the roof attachment slot when bolts are loosely fastened.



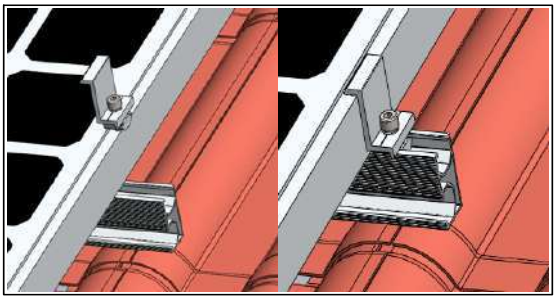
Installation of the splice to connect multiple rails together. Slide the splices on the rear side of the pre-assembled rails halfway to the side. Fasten the first M8 bolt firmly using the Allen key. Now slide the next rail segment into the splice. Tighten the second M8 bolt .The connection is finished.



[5.4] Mid Clamp&End Clamp Installation

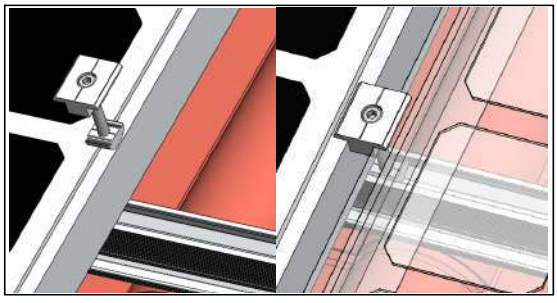
Step 1. Installing the End Clamp

Insert T bolt of the end clamp into the rail channel. Using a 10 mm hex driver, secure the first solar panel to the railing starting as close to the end of the row as possible. A minimum of 50 mm between the end of the rail and edge of the first solar panel is required (recommended torque is 15-20Nm).



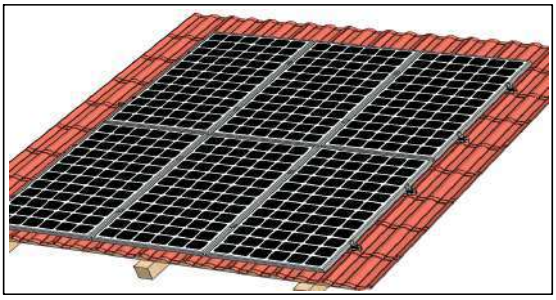
Step 2. Installing the Mid Clamp

Insert the T-clip of the mid clamp into the rail channel and position the clamp against the first panel frame. Hand-tighten the screw 2-3 turns to loosely hold the clamp in position. Ensure the EarthLock washer is placed between the rail and the frame of the panel. ***(pls refer to the chapter [5.6] if you have any questions about the grounding installation).***



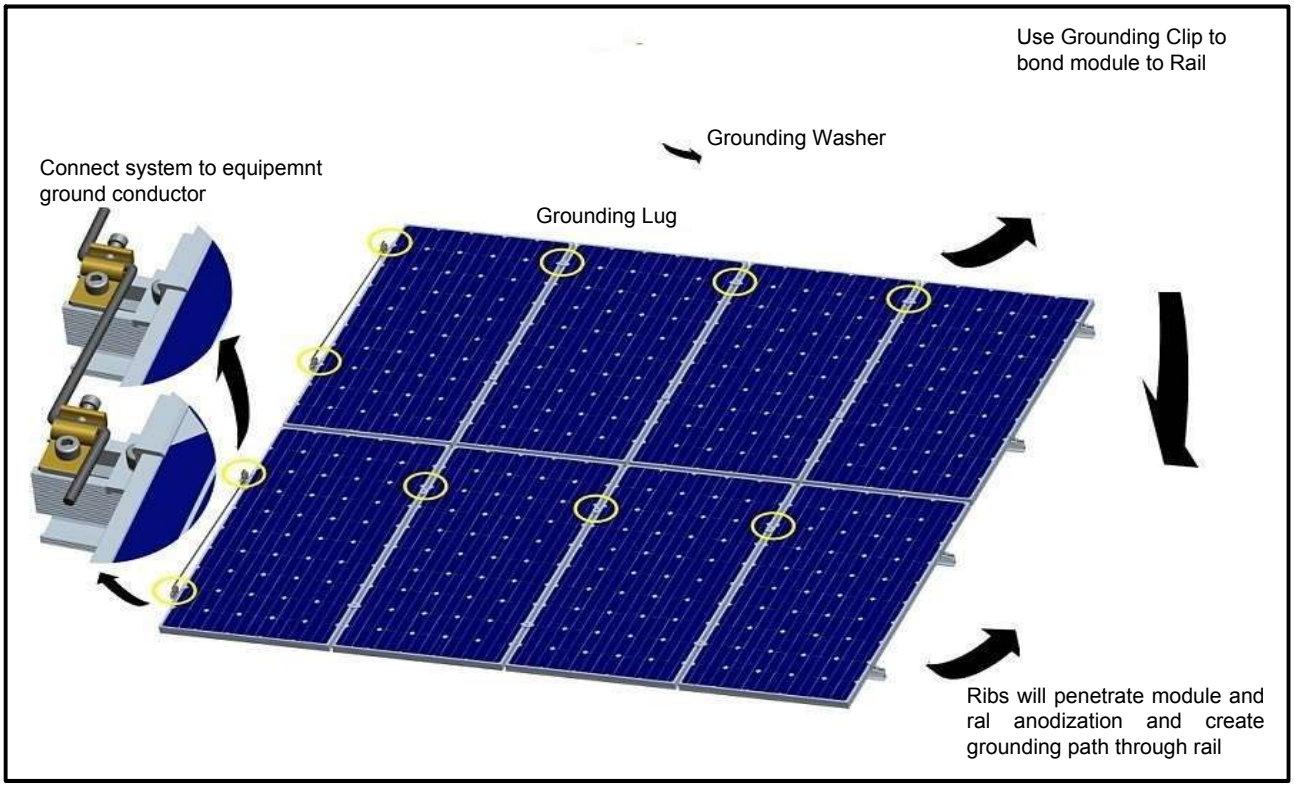
[5.5] Module Installation

Repeat doing last step till finish installing all the panels. Check the whole system and re-fix all outer screws after finish installing the panels.

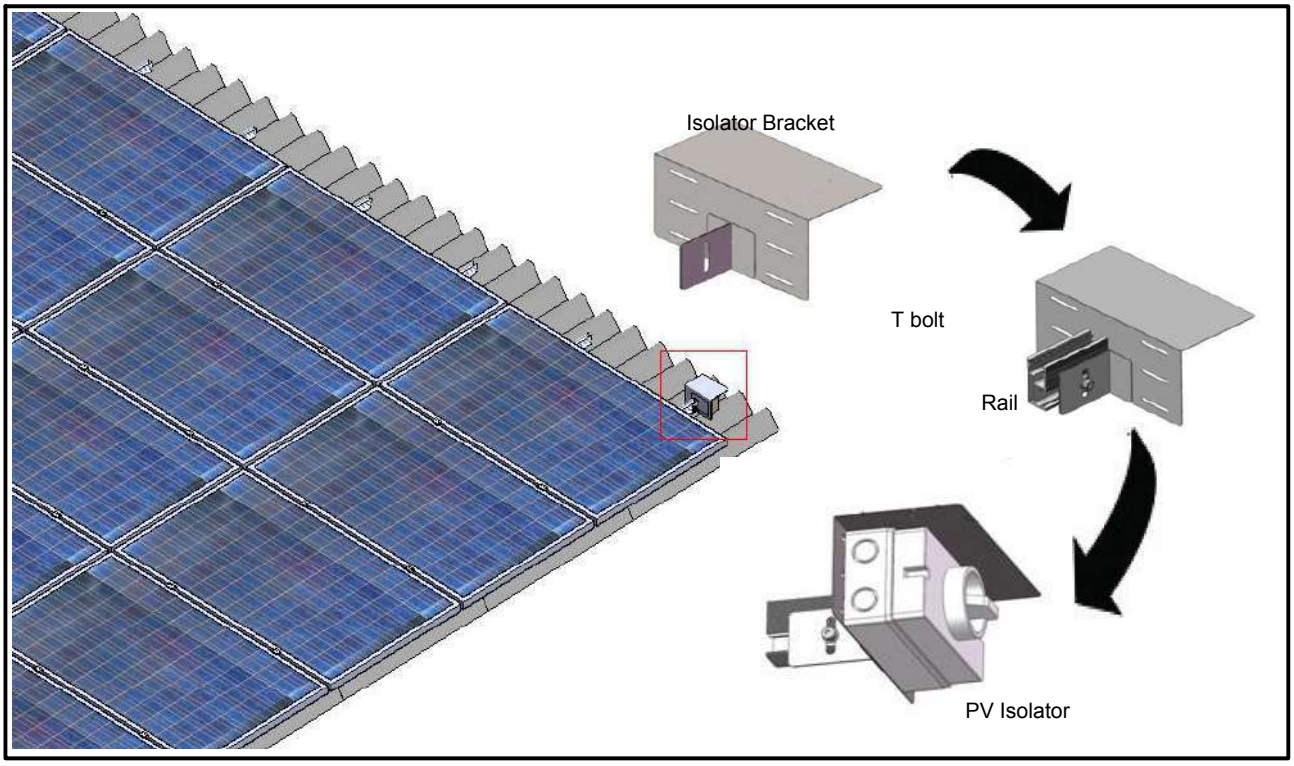


[5.6] Accessory Installation

Step1. Grounding lug&grounding clip



Step2. Installing Isolator Bracket



Part VI. OTHERS

WARRANTY

12 years limited Product Warranty, 5 years limited Finish Warranty

Fastensol co. Ltd warrants to the original purchaser ("Purchaser") of product(s) that it manufactures ("Product") at the original installation site that the Product shall be free from defects in material and workmanship for a period of twelve (12) years, except for the anodised 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 the earlier of 1) the date the installation of the Product is completed, or 2) 30 days after the purchase of the Product by the original Purchaser ("Finish Warranty").

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 & 610-02 – "Cleaning and Maintenance for Architecturally Finished Aluminum" (www.aamanet.org) are not followed by Purchaser. This Warranty does not cover damage to the Product that occurs during its shipment, storage, or installation.

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

If within the specified Warranty periods the Product shall be reasonably proven to be defective, then Fastensol shall repair or replace the defective Product, or any part thereof, in Fastensol's sole discretion. Such repair or replacement shall completely satisfy and discharge all of Fastensol's liability with respect to this limited Warranty. Under no circumstances shall Fastensol be liable for special, indirect or consequential damages arising out of or related to use by Purchaser of the Product.

Manufacturers of related items, such as PV modules and flashings, may provide written warranties of their own. Fastensol's limited Warranty covers only its Product, and not any related items.

Certificate of Approval

Certificate Number: MCS IK0251 Issue: 01

Xiamen Fasten Solar Technology Co., Ltd.
4F, No.31, Xiangxing 1st Road,
Huli District,
Xiamen 361006,
People's Republic of China

having complied with the requirements of the following:

MCS 010: Issue 1.5
Generic Factory Production Control (FPC) Requirements
and
MCS 012: Issue 2.1
Product Certification Scheme Requirements: Pitched Roof Installation Kits

is authorised to use the BRE Global Certification Mark and the MCS Certification Mark in association with the following products:

Products

Please see Appendix for details

This certificate and appendix is maintained and held in force through periodic review and verification

The products listed in this certificate and appendix are certified through the agreement between BRE Global Ltd. and TÜV Rheinland Energie und Umwelt GmbH

Signed for BRE Global Ltd.	Laura Critien Operations Manager, MCS	25 August 2017 Date of Issue	25 August 2017 Date of First Issue

BRE Global Ltd., Garston, Watford WD25 9XX.
T: +44 (0)333 321 8811 F: +44 (0)1923 664603 E: enquiries@breglobal.com

MCS is the Certification Mark for Onsite Sustainable Energy Technologies

Don Moore & Associates
Consulting Structural & Civil Engineers

20 April, 2016 Reference 2169.15

Xiamen Fasten Solar Technology Co., Ltd
31 Xiangxing 1st Road
Huli District 361006 Xiamen
China

Dear Sirs

FASTEN SOLAR T RAIL 2 FOR PITCHED ROOFS

As requested we have calculated the Maximum Fixing Spacing's for Fasten Solar Rail 2 as outlined in the attached Tables.

The tables have been calculated for Australian conditions based on the following criteria:-

- Wind Loads are in accordance with AS Code 1170.2:2011.
- Wind average recurrence interval of 500 years.
- Wind Terrain Category 2.
- Shielding and topographic multipliers, Ms and Mt taken as unity.
- Racks mounted on roofs of enclosed buildings of nominal rectangular shape.
- Roof slopes from 0 degrees up to 45 degrees from horizontal.
- Maximum solar panel length of 2.00 metres.
- Maximum solar panel width of 1.20 metres.
- Minimum of 2 rails per panel.
- Maximum panel weight of 15 kilograms per square metre.
- Roof structure to be checked and certified as suitable for applied rack loads prior to installation.
- Solar panels to be certified by Manufacturer as able to resist wind loads in accordance with AS Code 1170.2:2011.

I certify that that installations in accordance with these attached Tables will be structurally sufficient for Australian conditions provided the above conditions are adhered to.

Yours faithfully,

Don Moore FIE Aust. FIStructE. CPEng. NER.
Registered Building Practitioner No. EC-1106

11 Oak Street, Hawthorn Victoria 3122 Australia • **Telephone:** 03 9853 2323 • **Facsimile**: 03 9853 2324
• **Email:** dmoore@donmooreassociates.com.au • **Web:** www.donmooreassociates.com.au • **Mobile:** 0412 392 933
Charlett & Moore Pty Ltd ABN 27 004 859 956

CONSUMER GUARANTEES

In addition to our Warranty against Defects, the Frame also comes with guarantees that cannot be excluded under the United Kindom Consumer Law (**Consumer Guarantees**).

In the event that the Frame fails to satisfy a Consumer Guarantee, you are entitled to a replacement or refund for a major failure and compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the Frame repaired or replaced if the Frame fails to be of acceptable quality and the failure does not amount to a major failure.

Please note that in addition to the rights and remedies set out in this document, you may also have other rights and remedies available to you under the law.

CONTACT DETAILS

Xiamen Fasten Solar Technology Co.,ltd
Address: *4F No.31st Xiangxing 1st Road, Huli Bonded District, Huli District, Xiamen, China 361006*
Sales and Service: 00*86-592-5665910*

Email: *info@fastensolar.com*