



Report

ClickFit Mounting structure

Order number: 0104-B-12/2 Ref.: ARH/AW

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Reference principal : 11-B-0885; Esdec B.V.

Subject : determination of the wind uplift resistance

Order date : 2012.04.04

Report date : 2012.08.02

Rapporteur : A.R. Hameete

Authorisation : J. Sanders

Initials :



Pages : 9
Tables : 2
Annexes : 2



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1

Introduction

By order of BDA Dakadvies B.V. BDA Keuringsinstituut B.V. has determined the wind uplift resistance of the **ClickFit Mounting Structure**.

On 13 April 2012 the samples, ClickFit Mounting Structure and tiles, were delivered at BDA Keuringsinstituut B.V. by Esdec B.V.

On the samples the following data were found.

Description

- * Product : ClickFit Mounting Structure
- * Producer : Esdec B.V.



See annex B for photos of the products and further package data.



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Construction of the test specimen

On 31 May 2012 the test specimens have been built up by Mr V. de Vogel and Mr T. Smidt of Esdec B.V. in the presence of Mr A.R. Hameete of BDA Keuringsinstituut B.V.

The specimens have been built up according to the prescription of the principal from below upwards:

- * Substructure : Wooden substructure of rafters, dimensions 150 mm × 55 mm, the centre to centre distance of the rafters is 600 mm. On top of the rafters, battens are placed, dimensions 46 mm × 21 mm, the centre tot centre distance of the tile laths is 330 mm. The battens are fastened to the rafters with screws, dimensions 5,0 mm × 50 mm.
- * Tiles : Lafarge, concrete 'fast cover' tiles.
- * ClickFit Montage Systeem : consist of the following elements:
 - adjustable roof hook
 - support rail
 - module clamp
 - end clamp
 - mounting screw





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Investigation

The determination of the wind uplift resistance has been performed in coherence with the stipulations mentioned in:

- * EN 14437:2004 – Determination of the uplift resistance of installed clay or concrete tiles for roofing – Roof system test method.
- * TNO report: Proposal for Pre-Standardization of Active Roof Components – Solar Energy Systems – IFD guideline drawn up in the framework of the EUR-ACTIVE ROOFer Project (WPH Deliverable DH1-6, version June 2008).

The determination of the wind uplift resistance has been performed on two systems.

- * The first system contains the ClickFit Mounting Structure fastened with eight adjustable roof hooks (four hooks for each solar module) with on top of the system two solar modules.
- * The second system contains the ClickFit Mounting Structure fastened with six adjustable roof hooks (three hooks for each solar module) with on top of the system two solar modules.

At both systems the solar modules have been replaced by wooden dummies. All the other parts are the original parts as used in practice. The dimensions of the dummies are 1600 mm × 800 mm × 40 mm. The mass of the dummies is 27,3 kg per dummy. The type of roofing tiles that has been used are the concrete 'fast cover' tiles from Lafarge.



The determination of the wind uplift resistance has been determined in triplicate. The test has been performed at a slope of 45°. Preceding to the actual test an explanatory pre-test has been performed to obtain an indication of the strength of the system and the corresponding collapse image.



According to the prescription of the principal the system is considered to be collapsed in case one of the following criterions occur:

- * breakage of the mechanical fixing to the batten;
- * bulging out or breakage of any part of the mounting structure of the solar module;
- * breakage of the solar module;
- * a maximum displacement of any part in the system exceeding the value of 100 mm;
- * a remaining displacement of any part in the system, after releasing the force to zero exceeding the value of 100 mm.



As appears from the pre-test, the remaining displacement is the most critical point in the system.

By request of the principal there has been decided to measure the displacement at the following points:

- * L = on the dummy, directly beside the end clamp, which has been placed on the left / lower side of the system;
- * M = on the dummy, directly beside the lower module clamp;
- * R = on the dummy, directly beside the end clamp, which has been placed on the right / lower side of the system;
- * O = on the lower side against the adjustable roof hook in the middle of the batten.

On 31 May 2012 the tests have been performed in the laboratory of BDA Keuringsinstituut B.V. (NL-4202 MS/24) by Mr A.R. Hameete of BDA Keuringsinstituut B.V in the presence of Mr V. de Vogel and Mr T. Smidt of Esdec B.V.

In annex A a photo report of the test and the test results is given.



The mean value and the standard deviation of the resistance from all tests have been calculated by:

$$R_x = \frac{1}{n} \sum R_{r,i}$$

$$s_x^2 = \frac{1}{n-1} \sum (R_{r,i} - R_x)^2$$

Where:

R_x = is the mean uplift resistance;

$R_{r,i}$ = is the force preceding the force at which one mentioned collapse events occur;

n = the number of tests that has been performed.

The characteristic value of the wind uplift resistance has been calculated by:

$$R_k = R_x - k_n s_x$$

Where :

R_k = the characteristic value of the wind uplift resistance;

k_n = the factor depending on the number of tests;

R_x = the mean value of the wind uplift resistance from all tests;

s_x = the standard deviation of the wind uplift resistance from all tests.





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Results

Tabel 1 – ClickFit Mounting Structure fastened with eight adjustable roof hooks (four hooks for each solar module)

Force ¹⁾ [N]	Movement [mm]											
	Test 1				Test 2				Test 3			
	L	M	R	O	L	M	R	O	L	M	R	O
0	0	0	0	0	0	0	0	0	0	0	0	0
3818	1,24	0,71	0,38	0,02	1,15	0,76	0,64	0,29	1,34	0,57	0	0,18
4118	1,44	0,92	0,45	0,20	1,35	0,97	0,97	0,29	1,59	0,74	0,15	0,16
4418	1,67	1,22	0,91	0,48	1,71	1,27	1,37	0,10	1,83	0,97	0,51	0,64
4718	1,98	1,49	1,26	0,99	2,04	1,45	1,60	0,86	1,83	1,05	0,69	1,29
5018	2,40	1,80	1,69	2,21	2,36	1,73	2,13	1,85	2,02	1,56	1,64	2,61
5318	2,76	2,18	2,31	3,53	2,73	2,10	2,64	3,16	2,15	2,03	2,38	3,74
5618	3,45	2,88	2,54	5,47	3,28	2,56	3,38	4,86	2,58	2,75	3,69	5,78
5918	4,30	3,62	4,73	7,21	4,14	3,53	5,03	7,00	-	-	-	-
5618	5,01	4,55	6,52	9,39	-	-	-	-	-	-	-	-

¹⁾ The mentioned force is the required force excluded the force needed to lift the dummies. In consultation with principal the weight of the dummies has been reduced to the total force.

The collapse force is 5618 N, 5918 N en 5618 N for the tests 1, 2 en 3 respectively.

The mean uplift resistance is $(5318 \text{ N} + 5618 \text{ N} + 5318 \text{ N}) : 3 = 5418 \text{ N}$.

The factor depending on the number of tests is 3,37 (3 tests).

The standard deviation s ($\sigma_{(n-1)}$) is 173 N.

The characteristic value of the wind uplift resistance is 4835 N ($5418 \text{ N} - (3,37 \times 173 \text{ N})$).





Tabel 2 – ClickFit Mounting Structure fastened with six adjustable roof hooks (three hooks for each solar module)

Force ¹⁾ [N]	Movement [mm]											
	Test 1				Test 2				Test 3			
	L	M	R	O	L	M	R	O	L	M	R	O
0	0	0	0	0	0	0	0	0	0	0	0	0
2768	0,61	0,36	0,40	0,08	0,86	0,57	0	0,80	1,01	0,55	0	0,02
2993	0,72	0,22	0,24	0,03	1,34	0,88	0,26	0,44	1,42	0,76	0,10	0,28
3218	0,97	0,41	0,39	0,40	1,65	1,04	0,50	1,24	1,80	1,00	0,37	0,72
3443	1,21	0,57	0,47	1,10	1,81	1,18	0,86	2,05	2,28	1,33	0,74	1,78
3668	1,51	0,88	0,98	2,18	2,01	1,31	1,18	2,94	2,46	1,61	1,39	2,94
3893	2,03	1,50	2,10	4,10	2,30	1,59	1,75	4,16	2,68	1,85	2,00	3,97
4118	2,34	1,83	2,74	5,09	2,60	2,01	2,58	5,68	3,02	2,30	2,89	5,46

¹⁾ The mentioned force is the required force excluded the force needed to lift the dummies. In consultation with principal the weight of the dummies has been reduced to the total force.

The collapse force is 4118 N, 4118 N en 4118 N for the tests 1, 2 en 3 respectively.

The mean uplift resistance is $3893 \text{ N} + 3893 \text{ N} + 3893 \text{ N} : 3 = 3893 \text{ N}$.

The factor depending on the number of tests is 3,37 (3 tests).

The standard deviation s ($\sigma_{(n-1)}$) is 0 N.

The characteristic value of the wind uplift resistance is 3893 N ($3893 \text{ N} - (3,37 \times 0 \text{ N})$).





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Remark:

The results are only related to the investigated samples, products and/or systems. BDA Keuringsinstituut B.V. is not liable for interpretations or conclusions that were made in consequence of the results obtained. In case the sampling has not been performed by BDA Keuringsinstituut B.V., no judgement can be given with regard to the origin and representativity of the samples.

Gorinchem, 2012.08.02
The laboratory
A.R. Hameete



BDA Keuringsinstituut B.V.
C.W. van der Meijden BSc

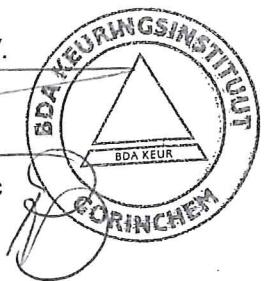


Photo 1

The support rail is being placed.



Photo 2

Detail of the connection of the adjustable roof hook and the support rail.

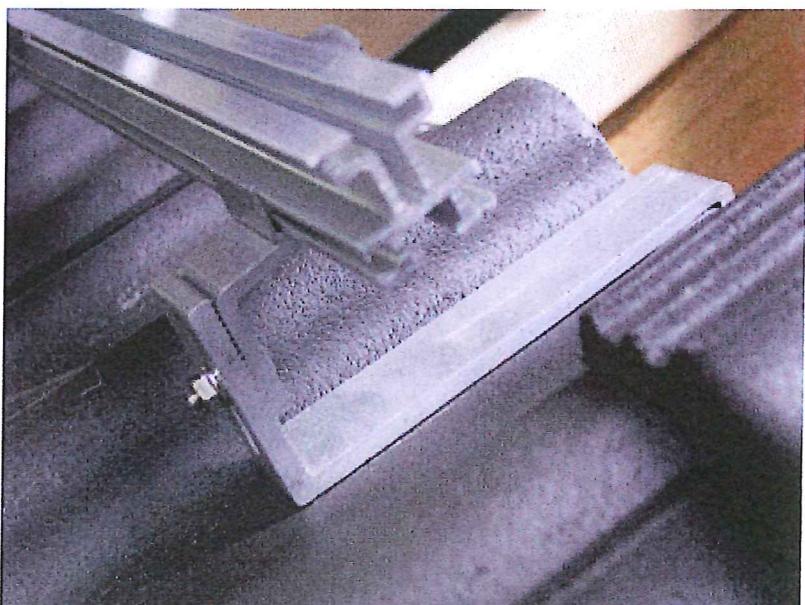


Photo 3

Detail of the connection of the adjustable roof hook and the batten.

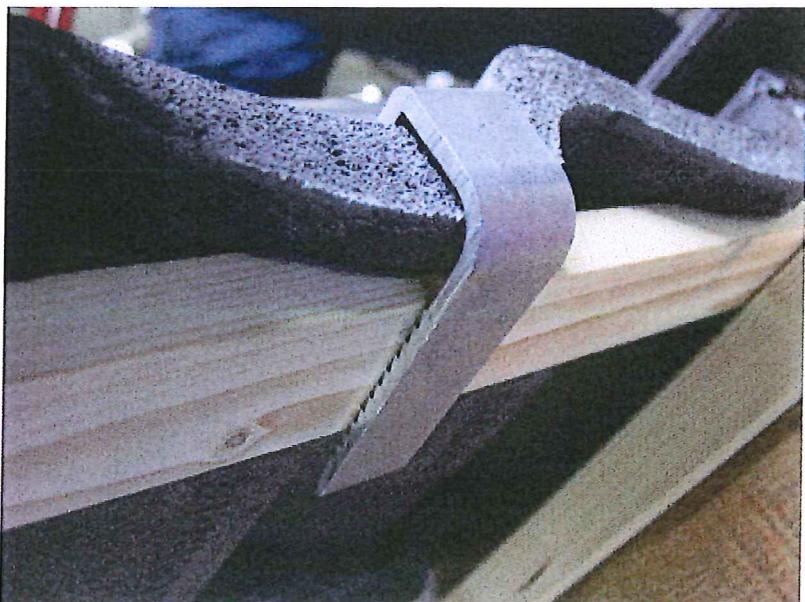


Photo 4

Overview of the system with 4 hooks for each solar module.



Photo 5

Overview of the system with 3 hooks for each solar module.



Photo 6

Overview of the system inclusive dummies.

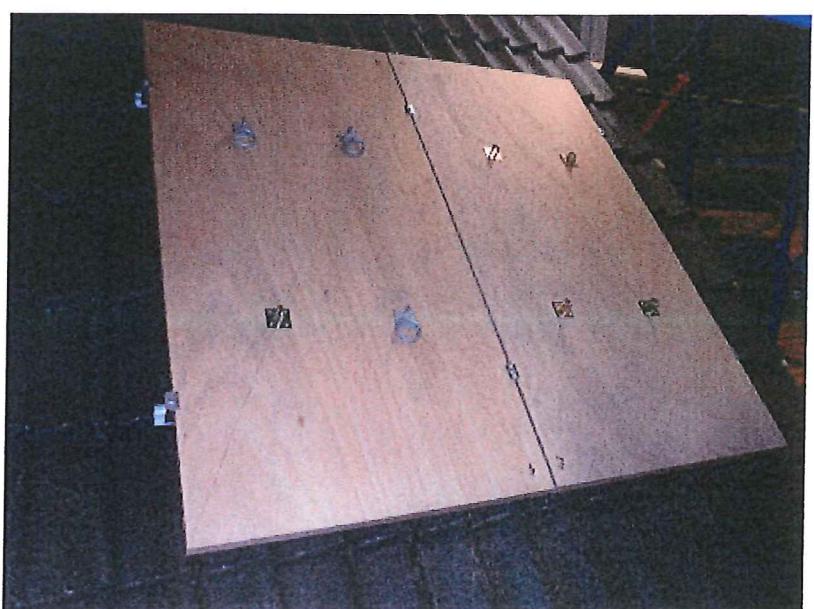




Photo 7
Detail of the end clamp.

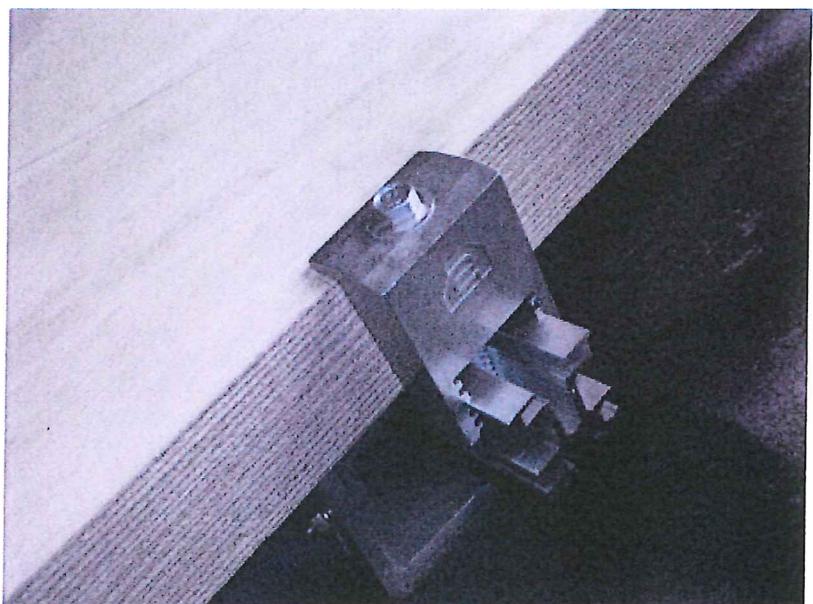


Photo 8
Detail of the module clamp.

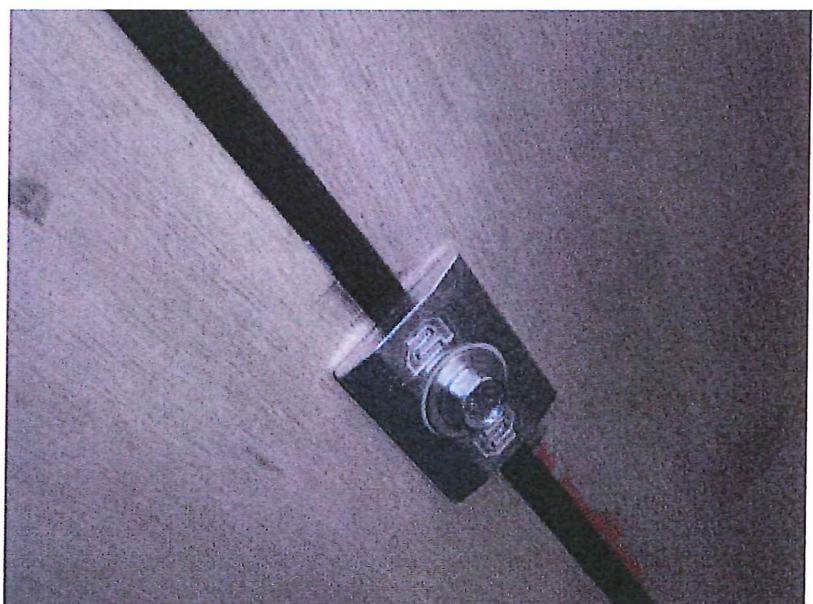
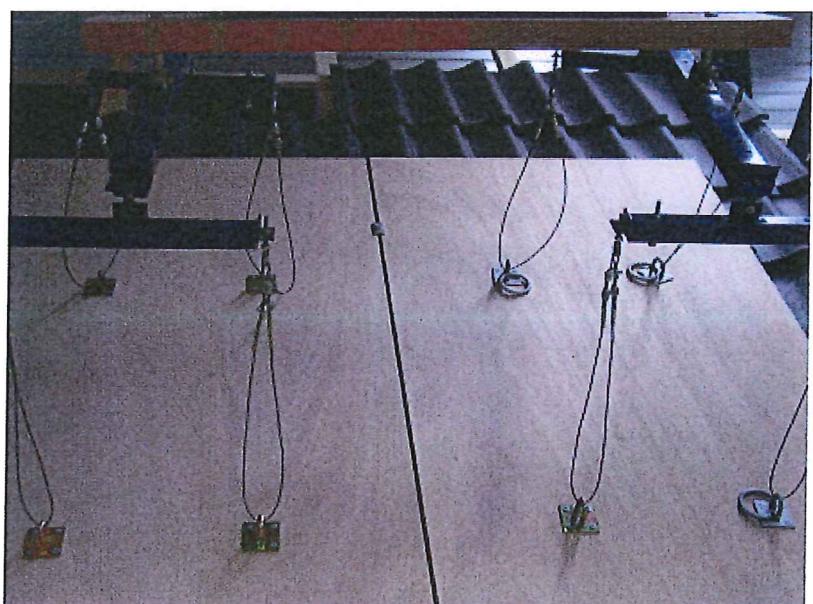


Photo 9
The system is ready to be tested.

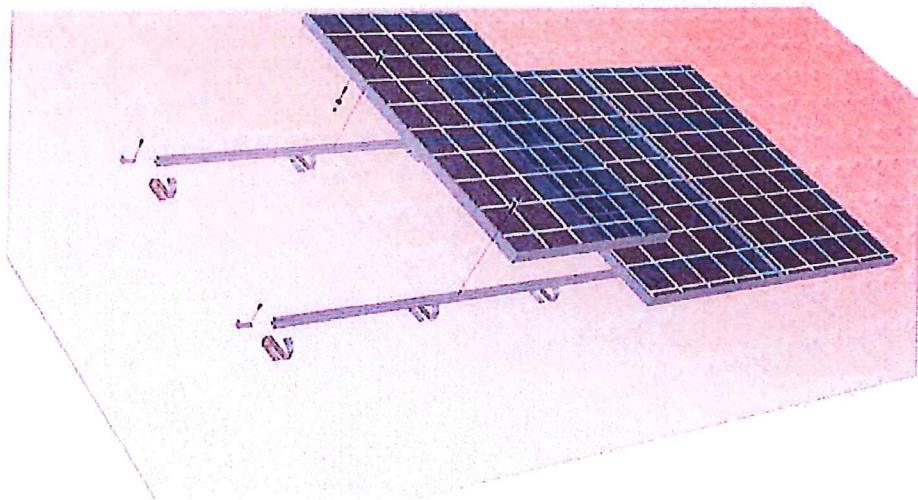




Package data

The ClickFit installation guide for tiled roofs

More Info | www.click-fit.com



Material

A ClickFit assembly set contains the following items:

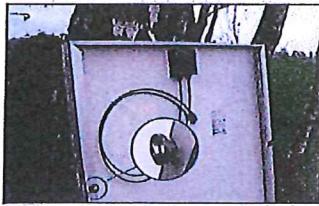
- | | |
|-------------------------------|------------------------------|
| 1 roof hooks | 4 end clamp with screws |
| 2 mounting rail | 5 module clamps with screws |
| 3 coupling strips with screws | 6 Nylon sleeves with srcrews |

Tools needed

- 1 Ratchet with socket 10

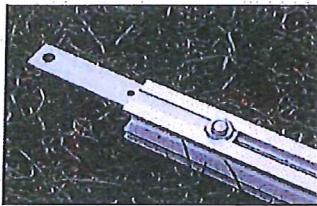
The ClickFit installation guide for tiled roofs

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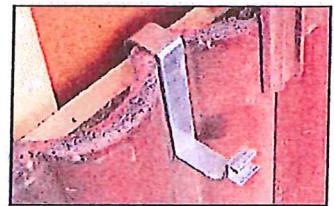
1. Preassembly of the nylon sleeves

Use the holes in the frame of the solar module to fix the nylon sleeves. Use the M6 nut and bolt to fixate the sleeves onto the solar panel at the same side as the connection box. The solar panel is temporarily mounted on the rail with the nylon sleeves. (see point 5.)



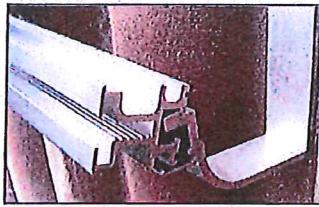
2. Preassembly of coupling strips

When combining multiple rails you have to use the coupling strips to extend the mounting rails. You simply slide the coupling strip in the side of the mounting rail and fixate it with the short mounting screws.



3. Placing the roof hooks

Divide the roof hooks evenly over the mounting rails. It is advised to place an extra roof hook in edge or corner zones. The roof hooks are placed over the battens and the roof tiles. Most of the times the roof tiles easily slide upwards underneath the upper laying roof tile. This gives you enough space to fixate the roof hook onto the batten in the lower part of the roof tile. This will fit in most of the times. In some occasions the roof tile needs to be grinded down a bit to make a snug fit. When the roof hooks are fixated slide the roof tile back into place. The next step is to determine where the next mounting rail will be mounted and place the roof hooks accordingly. The mounting rails are placed at $\frac{1}{4}$ from the bottom and top of the solar module.



4. Fixating the mounting rails

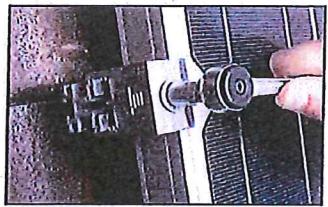
Hang the rails on the roof hooks. Click the mounting rail onto the roof hooks. Make sure that it Click is made firmly. It can be handy to use the mounting wedge which is placed between the roof hooks and the roof tile. This makes it easier to Click.

Make sure that the mounting rails are aligned in one line above each other



5. Hang the solar module on the rail

Temporarily hang the solar module on the rail with the nylon sleeves. As a result you have both hands free when mounting the solar modules.



6. Mounting the first panel on the mounting rails

You can now fixate the first module. Hang the module on to the mounting rail on the preassembled nylon sleeves. Slide the solar module to the side towards the end of the mounting rail. Slide the end clamp onto the mounting rail. Make sure you choose the right slot for the particular solar module frame height. Now fixate the solar module with the long mounting screws.



7. Mounting the other solar panels

Hang the second solar panel on the rail and slide it towards the first until a gap remains of about 7mm. Now fix the panel with the long screw and the module clamps. Make sure that the solar panels are aligned before tightening the screws. Repeat this with the remaining solar panels. For the mounting of the last solar panel see 6.



8. Mounting more rows of solar modules underneath each other

To get one solid surface of solar panels when there are multiple rows, you can slide the solar panels up after you hanged them on the sleeves against the upper row of solar panels. Now fixate the solar modules on the rails with the long mounting screws and the brackets.



The ClickFit mounting structure for tiled roofs consists of patented roof hooks, a mounting rail, and small components to mount solar modules onto a tiled roof. The system is designed for every type of tiled roof, regardless of the tile type.

ClickFit for tiled roofs:
The mounting structure is composed of the patented roof hooks, mounting rail and small components to mount the solar modules on to the mounting rail. The system can be used for every type of tiled roof irrespective of the type of roof tile.

Roof connection:
The roof hooks are fixed on the battens. The location of the modules on the roof can be chosen freely because the roof hooks are not fixed on the rafters or trusses. Height variations in the roof can easily be levelled with use of the height adjustment piece or the adjustable roof hook.

Mounting of the rail:
The rail is fixed on the roof hooks through a click joint. No further tools or hardware are needed.

Mounting of the solar modules:
Nylon sleeves which are fixed on the solar module make the installation of the solar modules on the rail easy. The modules are being fixed on the mounting rail with the use of universal module clamps, end clamps and mounting screws. The mounting screws are screwed directly into a special formed thread in the mounting rail.

Needed tools:
Ratchet 10mm

ClickFit für Ziegeldach:
Das System ist aufgebaut aus patentierten Dachhaken und Schienen und die benötigte Kleinteile um die Module zu montieren. Das ClickFit Montagesystem für Ziegeldach kann für alle Ziegeldächer benutzt werden unabhängig der Ziegelfarbe.

Dachmontage:
Die Dachhaken werden an die Lattung befestigt. Dadurch dass die Dachhaken nicht an die Sparren montiert werden ist man frei die Platz von den Solarmodulen zu wählen. Höhenausgleich ist einfach durch ein spezielles Höhenausgleichsstück oder durch die verstellbaren Dachhaken.

Befestigung von der Schiene:
Der Schiene wird an die Dachhaken befestigt durch einen Klick Verbindung. Hierzu braucht man keine Werkzeuge oder Kleinteile.

Kreuzschlensensystem:
Das ClickFit System kann auch als Kreuzschlensensystem benutzt werden für zum Beispiel waagerechte Montage von den Modulen. Man benutzt ein Kreuzverbinder für die Verbindung von den Schienen.

Benötigte Werkzeuge:
Ratsche 10mm

ClickFit voor pannendak:
Het montagestelsel is opgebouwd uit de gepatenteerde dakhaken, montagerails en de benodigde montagematerialen om de zonnepanelen op de montagerail te monteren. Het ClickFit montagestelsel voor pannendak kan voor alle type pannendaken worden gebruikt ongeacht het type dakpan.

Dakbevestiging:
De dakhaken worden aan de panlagen bevestigd. Doordat de dakhaken niet worden bevestigd aan de dakspanten kunnen de plaats van de zonnepanelen op het dak vrijelijk bepaald. Hoogte verschillen in het dak kunnen eenvoudig worden uitgemaakt doormiddel van een speciaal opklap blokje of door gebruik van de verstelbare dakhaken.

Bevestiging van de montagerail:
De montagerail wordt aan de dakhaken bevestigd middels een klikverbinding. Hiervoor zijn geen verdere materialen of gereedschappen nodig.

Bevestiging van de panelen:
De handige montagehulp draagt bij aan de snelle en volle montage en dient tevens als afsluit bevestiging. De zonnepanelen worden vastgezet door middel van een universele paneelclamp, eindclamps en montage schroeven. De montage schroeven worden direct in de montagerail geschoond waarin een speciale schroefdraad is aangebracht.

Benodigde gereedschappen:
Ratsche 10mm.

Tiled roof, 8kWp





**01 Art. nr. 100-2001
ROOF HOOIC MEDIUM (40-50mm)
DACHHÄKEN STANDAARD (30-39mm)
DACHHÄKKE STANDARD (30-39mm)**

**Art. nr. 100-2010
ROOF HOOIC MEDIUM (40-50mm)
DACHHÄKEN MEDIUM (40-50mm)
DACHHÄKKE MEDIUM (40-50mm)**

**Art. nr. 100-2020
ADJUSTABLE ROOF HOOIC*
standard (30-39mm)
VERSTELLBARE DACHHÄKEN
standard (30-39mm)
VERSTELbare DACHHÄKKE
standard (30-39mm)**

**Art. nr. 100-2011
ADJUSTABLE ROOF HOOIC*
medium (40-50mm)
VERSTELLBARE DACHHÄKEN
medium (40-50mm)
VERSTELbare DACHHÄKKE
medium (40-50mm)**

**Art. nr. 100-2021
ADJUSTABLE ROOF HOOK*
wide (51-63mm)
VERSTELLBARE DACHHÄKEN
breit (51-63mm)
VERSTELbare DACHHÄKKE
breit (51-63mm)**

**03 Art. nr. 100-3005
HEIGHT ADJUSTMENT PIPE (16mm)
HÖHE AUSGLEICHTEIL (16mm)
OPROOG BLOKJE (16mm)**

**04 Art. nr. 100-1001
MOUNTING RAIL,
TRÄ GEPROFILIERT
MONTERAGURU**

**05 Art. nr. 100-2080
CROSS CONNECTOR
QUERVERBINDER
KRUISVERBINDER**

**06 Art. nr. 100-3040
COUPLING STRAP
SCHEIBENVERBINDER
KOPPLUNGSSTRIP**

**07 Art. nr. 100-3020
MODULE CLAMP (bracket)
MITTELKLEMME
MODULE KLEMMLAT**

**08 Art. nr. 100-3003
END CLAMP CFA
ABSCHLUSSKLEMME CFA
EINDKLEM CFA**

Frame: 50,49 - 40,45 - 42,41
39,37 - 34,33 - 30,29mm

**09 Art. nr. 100-3004
END CLAMP CFD
ABSCHLUSSKLEMME CFD
EINDKLEM CFD**

Frame: 52,61 - 40,47 - 44,43
40,39 - 38,35 - 32,31mm

**10 Art. nr. 100-65 **
MOUNTING SCREW
MONTAGESCHRAUBE
MONTAGESCHROEF**

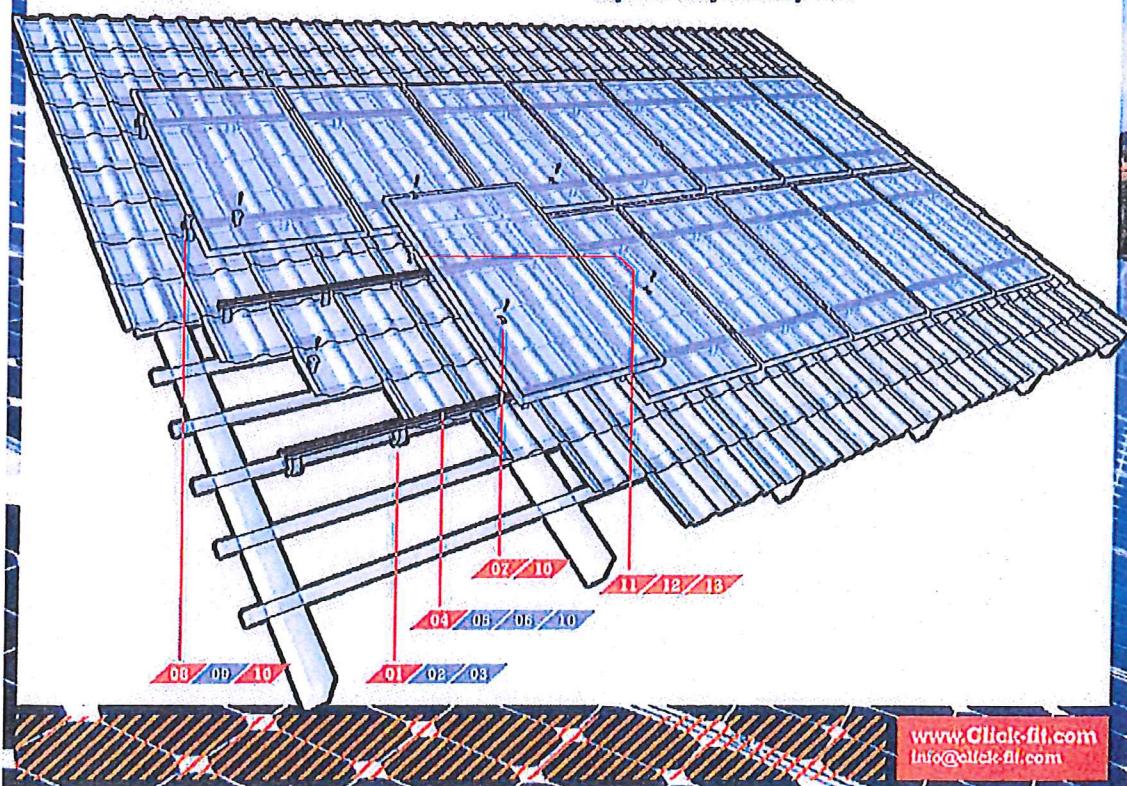
**11 Art. nr. 100-0001
NYLON SLEEVE
AUTÄHNG BUCHSE
NYLON OPHANGBUIS**

**12 Art. nr. 100-0020
M6X20 STAINLESS STEEL BOLT
M6X20 EDELSTAHL SCHRAUBE
M6X20 IWS DOUT**

**13 Art. nr. 100-0600
M6 STAINLESS STEEL NUT
M6 EDELSTAHL MUTTER
M6 IWS MOER**

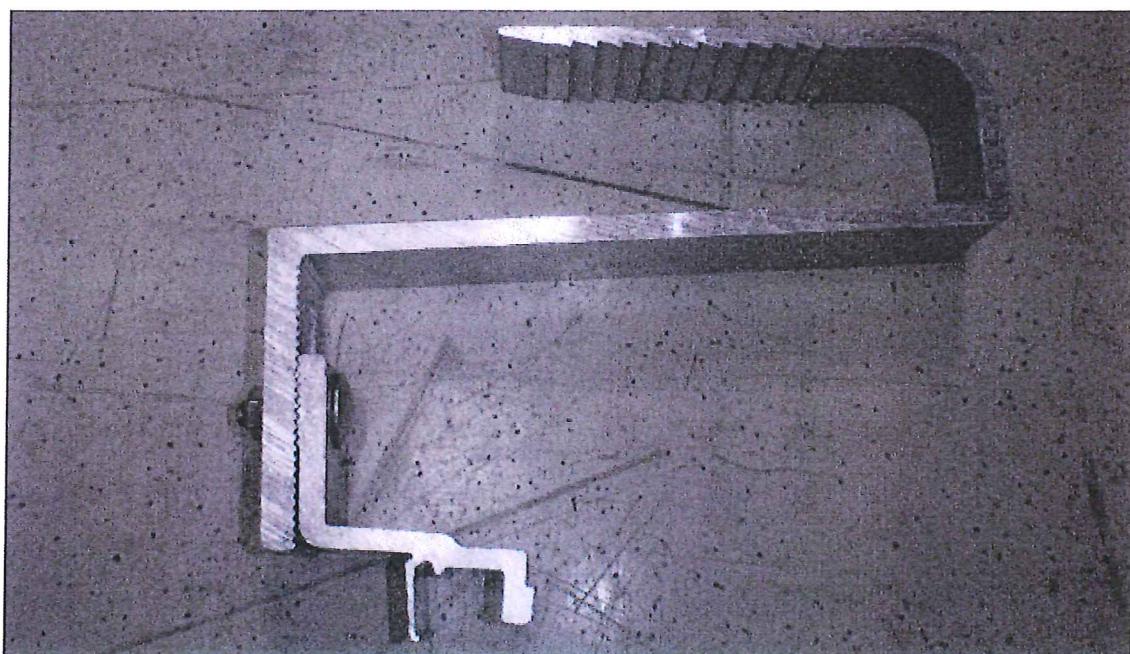
* Also available with hole / Auch Lieferbar mit Loch / Ook leverbaar met gat
standard/standard: 100-2003 / medium: 100-2012 / wide/breit/necrof: 100-2022

** Length in mm / Länge in mm / lengte in mm



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Info@click-fit.com

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