



ZES Systems

Solar Panel Mounting System – Slanted Tiled Roof



INSTALATION MANUAL

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1. Introduction

The mounting system is intended for attaching solar panels to **slanted tiled roofs**. The system is fixed to the roof by means of brackets that are hooked onto the roofing battens (roofing lath) behind the roof tiles. This manual serves as a guide to illustrate and explain how the system is assembled and installed, as well as the conditions and layout for installation.

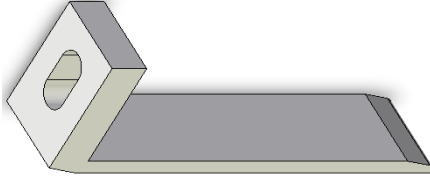
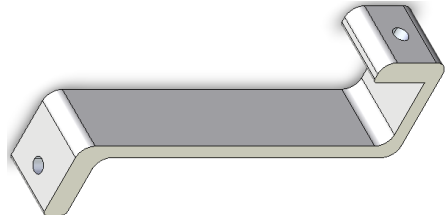
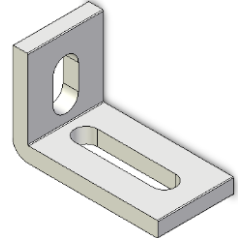
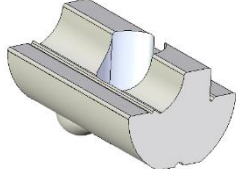
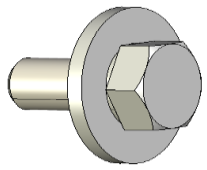
2. System parts and components

The mounting system essentially consists of two main parts that fit together. Each of these parts consists of various components. The two main parts are:

- Brackets
- Mounting profiles

2.1. Bracket

Each individual Bracket consists of the following components:

Component	Depiction	Quantity
Hook Back Piece		1
Hook Front Piece		1
Hook Connector		1
Sliding Nut		1
Hex Bolt with washer - M8 A2-70		1

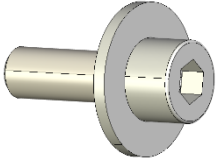
Socket Cap Bolt with washer- M8 A2-70		2

Table 1 - Bracket Components

2.2. Mounting profile

Each individual Mounting Profile consists of the following components:

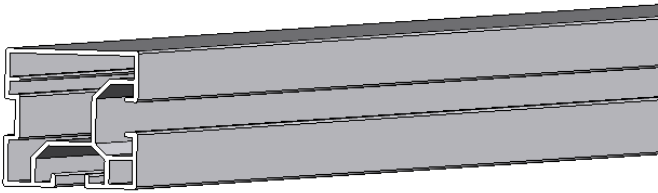
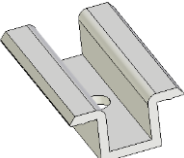
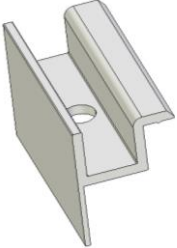
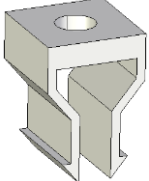
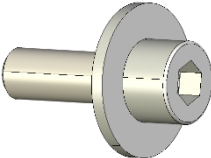
Component	Depiction	Quantity
Extruded Profile		TBD
Mid Clamp		TBD
End Clamp		TBD
Clamp Connector		TBD
Socket Cap Bolt with washer - M8 A2-70		TBD

Table 2 - Mounting Profile Components

Note: TBD indicates that the quantity of each of these components varies according to the dimensions of the solar panels, and the number of solar panels. It is therefore not constant for each individual Mounting Profile.

3. Installation Layout

The mounting system can accommodate four different installation configurations. It is advised that the desired configuration be established from the beginning, as this will have a big influence on the complete system and the number of each of its components.

3.1. Portrait Horizontal

In this configuration, the solar panels are mounted in a portrait orientation onto the system. The Extruded Profiles of the mounting system, on which the solar panels are mounted, will run horizontally along the panels.

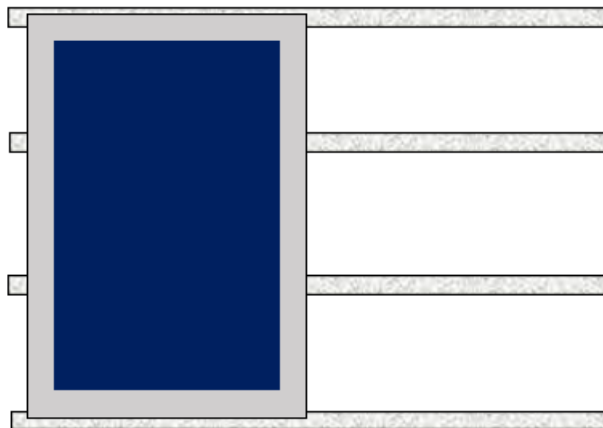


Figure 1 - Portrait Horizontal

3.2. Portrait Vertical

In this configuration, the solar panels are mounted in a portrait orientation onto the system. The Extruded Profiles of the mounting system, on which the solar panels are mounted, will run vertically along the panels.

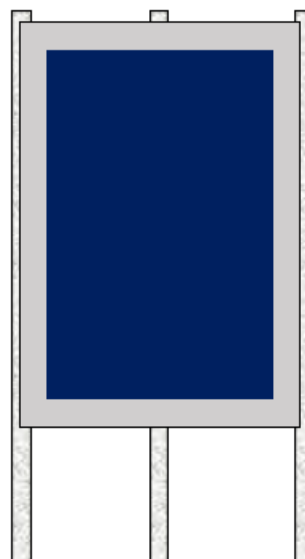


Figure 2 - Portrait Vertical

3.3. Landscape Horizontal

In this configuration, the solar panels are mounted in a landscape orientation onto the system. The Extruded Profiles of the mounting system, on which the solar panels are mounted, will run horizontally along the panels.

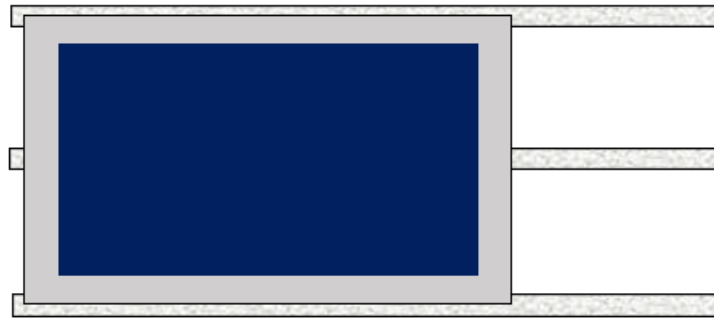


Figure 3 - Landscape Horizontal

3.4. Landscape Vertical

In this configuration, the solar panels are mounted in a landscape orientation onto the system. The Extruded Profiles of the mounting system, on which the solar panels are mounted, will run vertically along the panels.

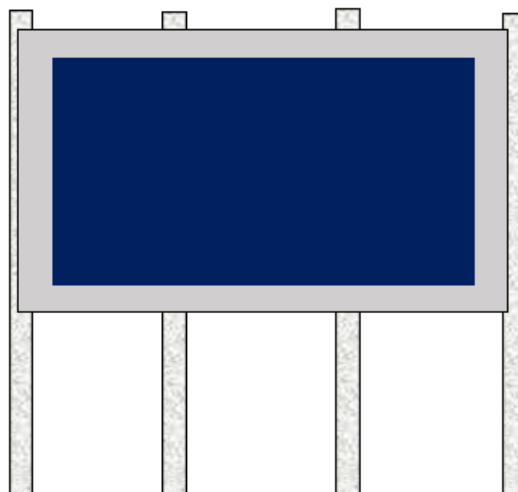


Figure 4 - Landscape Vertical

4. Installation Conditions

4.1. Clamp conditions

When using this mounting system, there is a minimum requirement for the number of clamps to be used for each solar panel. A minimum of 6 clamps must be used at all times to support each panel, at least one along the width of the panel (the two shorter sides) and at least two along the height of the panel (the two longer sides).

Using more than the minimum number of clamps for each side is always allowed, but the minimum number of clamps for each side should never be subceeded.

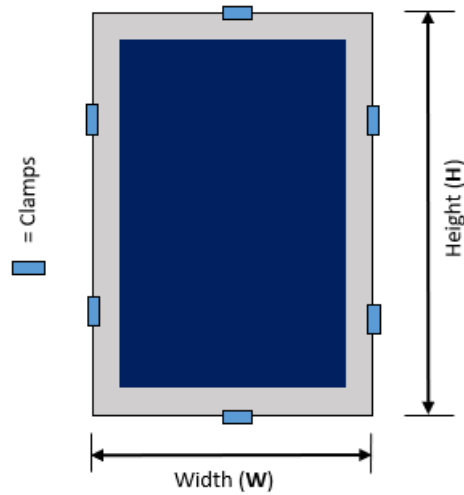


Figure 5 - Clamp Conditions

4.2. Bracket conditions

When using this mounting system, there are some spacing and location restrictions, with regards to the brackets, that should always be adhered to. These restrictions are as follow:

Condition 1: The maximum distance between the end of an extruded profile and the closest bracket to that end, is 150mm. This means that the two brackets on the ends of the extruded profile may not be placed more than 150 mm away from the end. Placing them closer than 150mm from the ends (and directly on the ends) is always allowed, but never more than 150mm

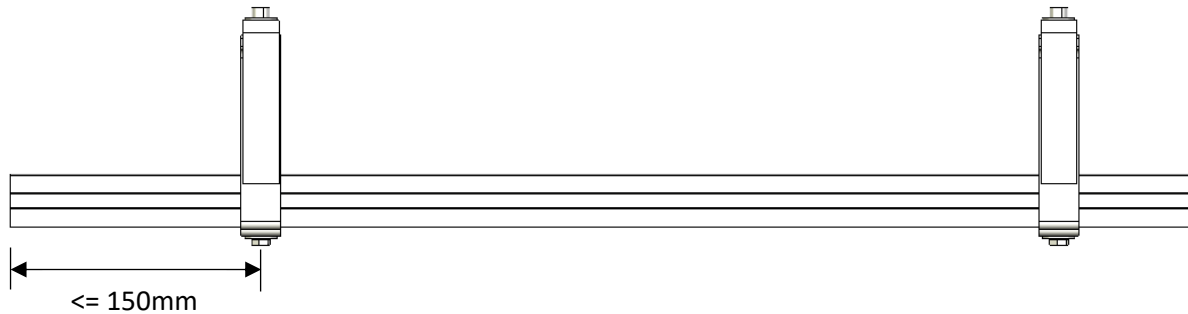


Figure 6 - Bracket Condition 1

Condition 2: The maximum distance between brackets along the same extruded profile is 600mm. This means that after each bracket along the same extruded profile, the next bracket may not be more than 600mm away. Placing brackets closer than 600mm from each other is always allowed, but never more than 600mm.

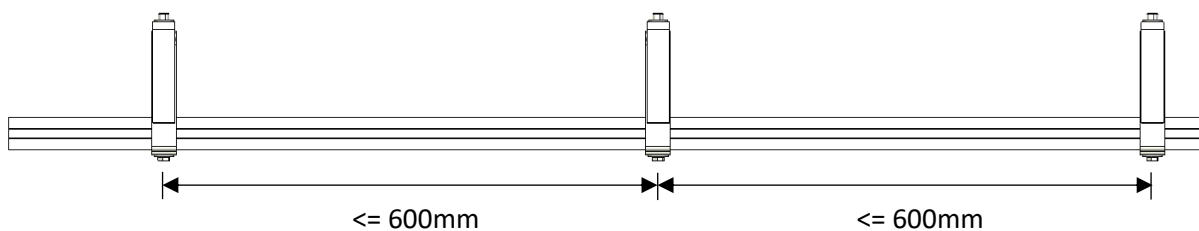


Figure 7 - Bracket Condition 2

Condition 3: This is a variation of Condition 2 that is only applicable when the mounting system will be installed in a certain region (next to the coast) as well as in specific circumstances (in unbuilt locations). Consult **APPENDIX A** to determine whether your configuration should meet the requirements stated in Condition 2 or Condition 3.

Condition 3 is very similar to Condition 2, with the only difference being that the maximum distance between brackets along the same extruded profile is 300mm.

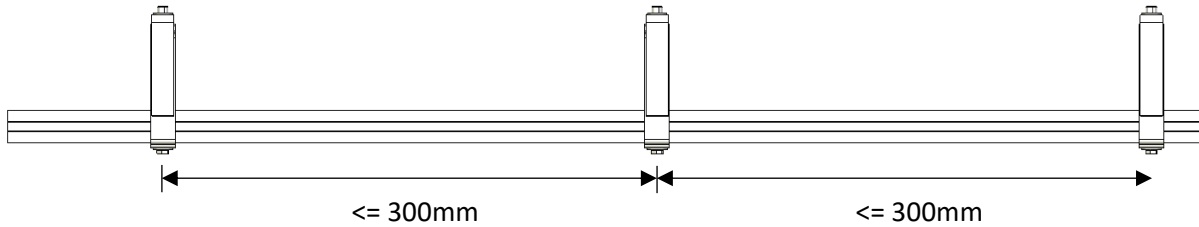


Figure 8 - Bracket Condition 3

5. Installation and Assembling

5.1. Bracket Assembly

The following steps describe how to assemble each individual bracket:

Step 1: Join the Hook Back Piece and Hook Front Piece together using a Socket Cap Bolt. The Hook Back Piece has a slotted hole which allows the spacing of the hook to be adjusted according to the size of the battens. The hole in the Hook Front Piece is threaded and therefore eliminates the need for a nut.

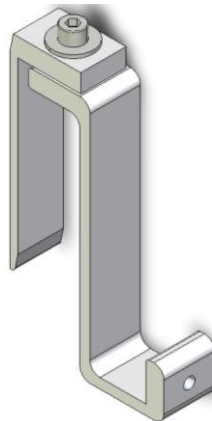


Figure 9 - Bracket Assembly Step 1

Step 2: Join the Hook Front Piece and Hook Connector together using a Socket Cap Bolt. The Hook Connector has a slotted hole which allows you to adjust the fastening position according to your desired spacing or configuration. The hole in the Hook Front Piece is threaded and therefore eliminates the need for a nut. It is important to note that the Hook Connector can be rotated before fastening, to accommodate both horizontal and vertical mounting positions. The desired orientation should be established before fastening.

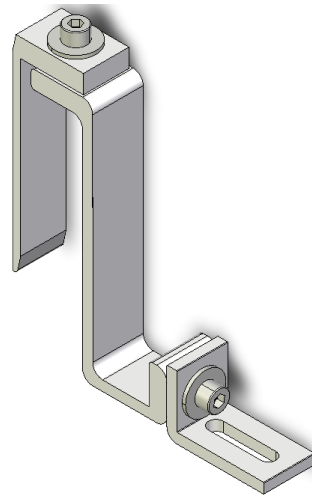


Figure 10 - Bracket Assembly Step 2

Step 3: Attach a Sliding Nut to the Hook Connector using a Hex Bolt. **DO NOT** tighten the Hex Bolt, only ensure that the Sliding Nut is loosely screwed onto the Hex Bolt and that the tread of the Hex Bolt isn't protruding through the other end of the Sliding Nut. The Hex Bolt will be tightened later (see Step 1 in 5.2 below). A Hex Bolt is used due to the possible space constraint which might not allow for the use of an Allan-key.

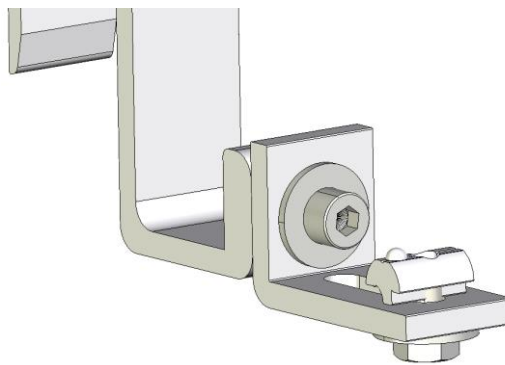


Figure 11 - Bracket Assembly Step 3

Repeat Step 1 -3 to assemble each individual Bracket.

Step 4: Remove the roof tiles where the Brackets will be placed to expose the roofing battens. Hook the brackets onto the roofing battens and replace the tiles in their original place.

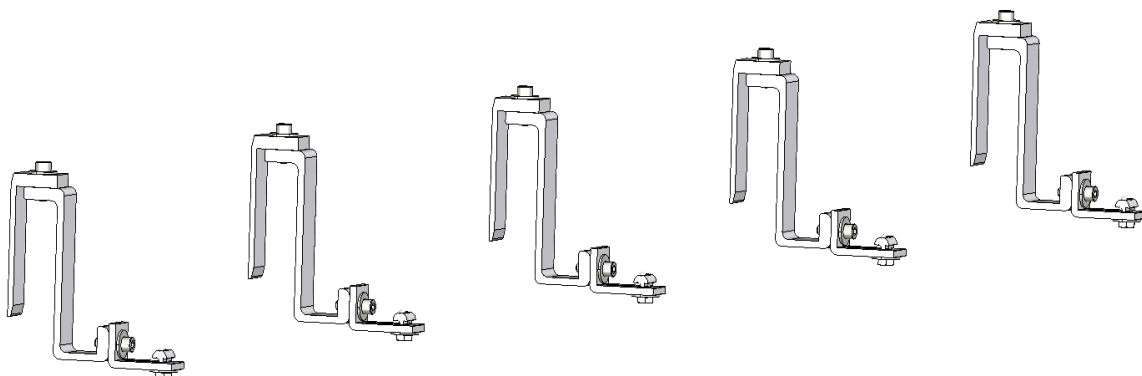


Figure 12 – One row of Brackets hooked onto battens.

5.2. Mounting Profile Assembly

The following steps describe how to connect the Mounting Profiles with the Brackets:

Step 1: Join the Extruded Profiles and the complete Bracket Assemblies by sliding the Sliding Nut of each Bracket through one of the slots of the Extruded Profiles. Once each Sliding Nut is in the slot, the Hex Bolt at each Sliding Nut can then be tightened, and this will secure the Extruded Profiles in place.

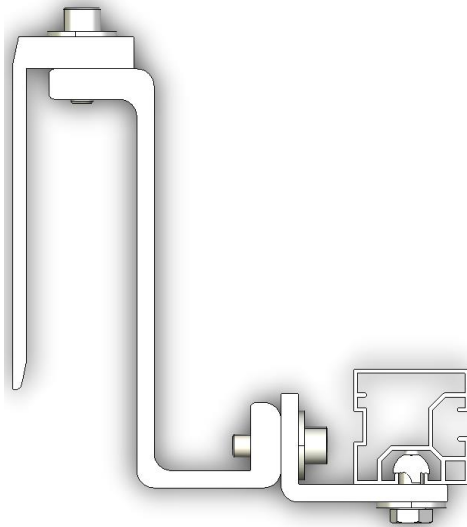


Figure 13 - Mounting Profile Assembly Step 1

(If preferred, it is also possible to skip Step 3 in 5.1 above and slide the Sliding Nuts into the Extruded Profile slots first. This combination assemblies can then be aligned with the Hook Connector of each bracket and connected via the Hex Bolt. Both methods are acceptable, and depends solely on personal preference)

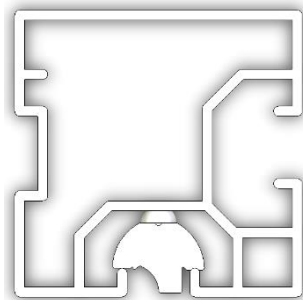


Figure 14 - Alternative Method 1

Step 2: Join the Mid Clamps or End Clamps with the Clamp Connectors by using a Socket Cap Bolt. **DO NOT** tighten the Socket Cap Bolts, only ensure that the Mid Clamps and End Clamps are lightly screwed onto the Clamp Connectors. This will allow the Clamp connectors to slide within the Extruded Profile slot freely and easily. The Socket Cap Bolts will be tightened after the solar panels are in place (see Section 5.3 below). Note that the Clamps can rotate on the Clamp connectors prior to tightening.

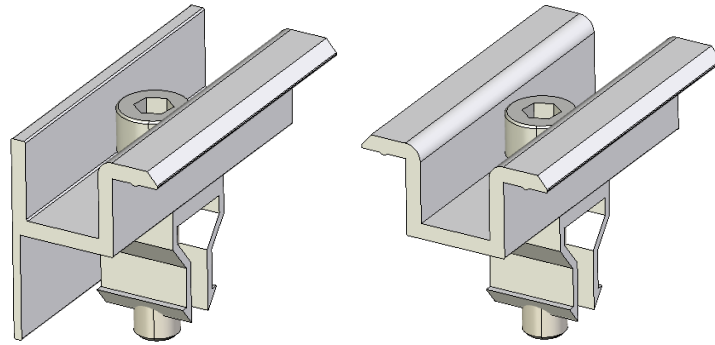


Figure 15 - Mounting Profile Assembly Step 2

Step 3: The Clamp Assembly in Step 2 above can now slide into the other Extruded Profile slot. The Socket Cap Bolts should still **NOT** be tightened until the solar panels are in place (see Section 5.3 below). They should be able to slide within the slot freely and easily.

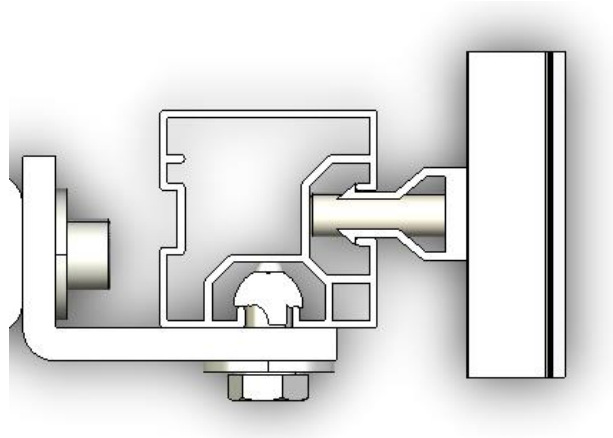


Figure 16 - Mounting Profile Assembly Step 3

Once completed, one row of this complete assembly will look like the Figure below. The number of rows will depend on the number of solar panels and the installation layout.

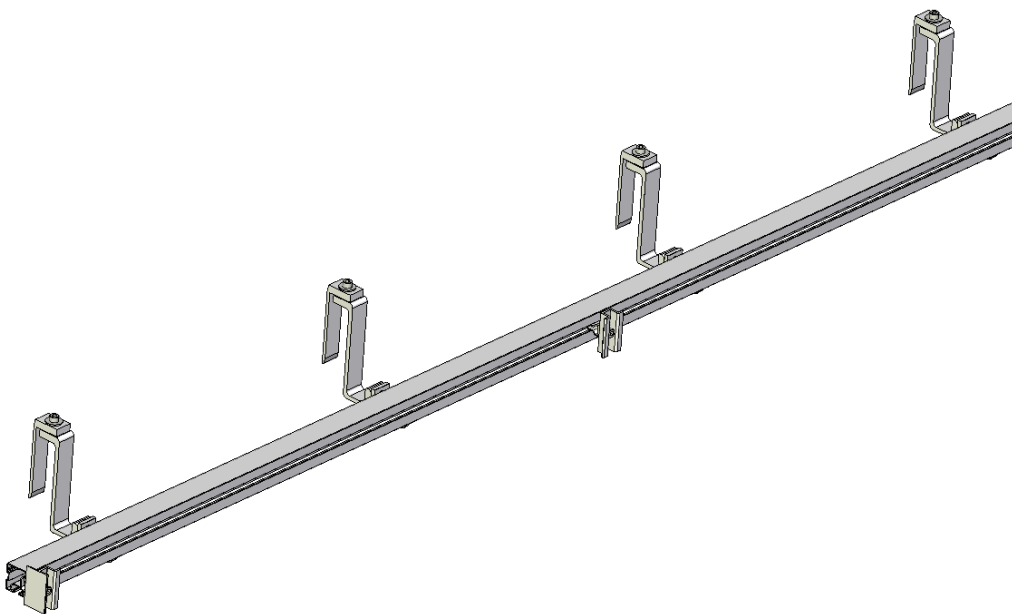


Figure 17 - One complete row of the complete Assembly

5.3. Solar panel Assembly

The following describes how to mount and secure the solar panels onto the Mounting System:

Once the above steps have been completed, one row of the mounting system will be in place. The steps must be repeated until the required number of rows for your desired configuration has been achieved. The Clamp Assemblies will be able to freely and easily slide within the Extruded Profile slots and can therefore easily be positioned and readjusted to allow the placement of the solar panels.

The first set of solar panels can then be placed onto the Extruded Profiles in their required position, and the Clamps can be positioned accordingly to keep them in place. Once this has been achieved, the Socket Cap Bolts can be tightened. This will secure the solar panels onto the mounting system.

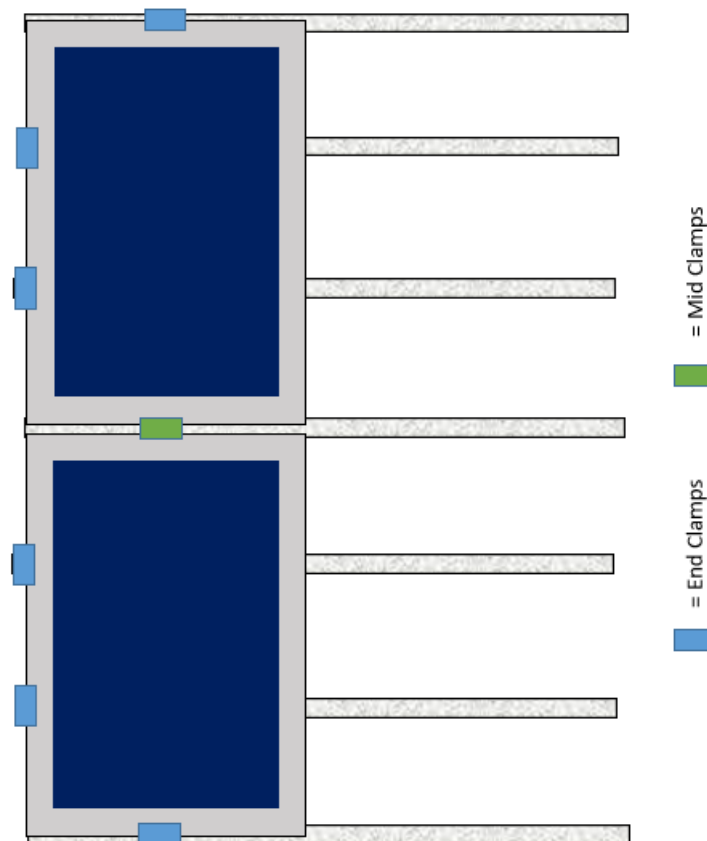


Figure 18 - First set of solar panels (Example)

Afterwards the process above can be repeated with the next set of solar panels, until all the panels are in position and have been secured onto the Extruded Profiles.

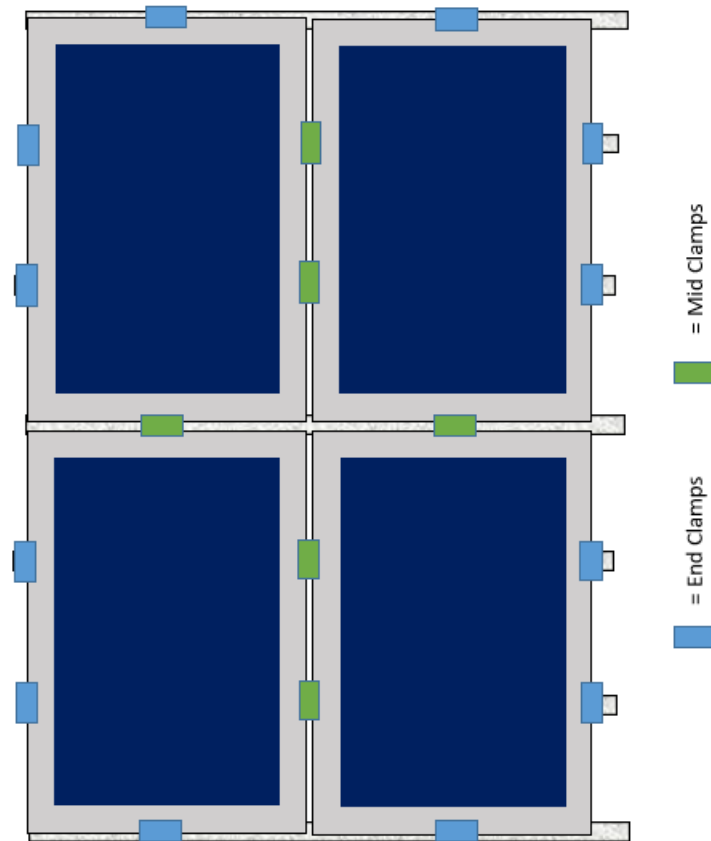
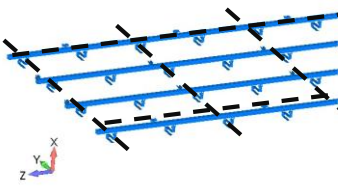
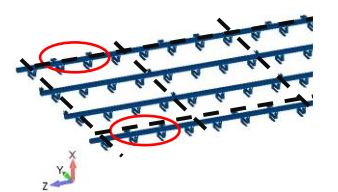


Figure 19 – Final solar panel installation (Example)

The final product will look similar to the figure above, with a combination of mid clamps between the solar panels and end clamps around the outside edges of the solar panels. Note that the above figure only serves as an illustration. Your configuration might differ due to the number of panels and installation layout.

APPENDIX A – Locations and Circumstances

	Variation 1	Variation 2																																																																																																																																																																																																																																																										
Design of frame (black line represents solar panel)																																																																																																																																																																																																																																																												
Hook distance (attachment to roof)	Every 60 cm	Every 30 cm																																																																																																																																																																																																																																																										
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Possible placement areas and possible placement height on the roof	<table border="1"> <thead> <tr> <th rowspan="2">Hoogte m</th> <th colspan="3">Gebied I</th> <th colspan="3">Gebied II</th> <th colspan="2">Gebied III</th> </tr> <tr> <th>Kust</th> <th>Onbebouwd</th> <th>Bebouwd</th> <th>Kust</th> <th>Onbebouwd</th> <th>Bebouwd</th> <th>Onbebouwd</th> <th>Bebouwd</th> </tr> </thead> <tbody> <tr><td>1</td><td>0,93</td><td>0,71</td><td>0,69</td><td>0,78</td><td>0,60</td><td>0,58</td><td>0,49</td><td>0,48</td></tr> <tr><td>2</td><td>1,11</td><td>0,71</td><td>0,69</td><td>0,93</td><td>0,60</td><td>0,58</td><td>0,49</td><td>0,48</td></tr> <tr><td>3</td><td>1,22</td><td>0,71</td><td>0,69</td><td>1,02</td><td>0,60</td><td>0,58</td><td>0,49</td><td>0,48</td></tr> <tr><td>4</td><td>1,30</td><td>0,71</td><td>0,69</td><td>1,09</td><td>0,60</td><td>0,58</td><td>0,49</td><td>0,48</td></tr> <tr><td>5</td><td>1,37</td><td>0,78</td><td>0,69</td><td>1,14</td><td>0,66</td><td>0,58</td><td>0,54</td><td>0,48</td></tr> <tr><td>6</td><td>1,42</td><td>0,84</td><td>0,69</td><td>1,19</td><td>0,71</td><td>0,58</td><td>0,58</td><td>0,48</td></tr> <tr><td>7</td><td>1,47</td><td>0,89</td><td>0,69</td><td>1,23</td><td>0,75</td><td>0,58</td><td>0,62</td><td>0,48</td></tr> <tr><td>8</td><td>1,51</td><td>0,94</td><td>0,73</td><td>1,26</td><td>0,79</td><td>0,62</td><td>0,65</td><td>0,51</td></tr> <tr><td>9</td><td>1,55</td><td>0,98</td><td>0,77</td><td>1,29</td><td>0,82</td><td>0,65</td><td>0,68</td><td>0,53</td></tr> <tr><td>10</td><td>1,58</td><td>1,02</td><td>0,81</td><td>1,32</td><td>0,85</td><td>0,68</td><td>0,70</td><td>0,56</td></tr> <tr><td>15</td><td>1,71</td><td>1,16</td><td>0,96</td><td>1,43</td><td>0,98</td><td>0,80</td><td>0,80</td><td>0,66</td></tr> <tr><td>20</td><td>1,80</td><td>1,27</td><td>1,07</td><td>1,51</td><td>1,07</td><td>0,90</td><td>0,88</td><td>0,74</td></tr> </tbody> </table>	Hoogte m	Gebied I			Gebied II			Gebied III		Kust	Onbebouwd	Bebouwd	Kust	Onbebouwd	Bebouwd	Onbebouwd	Bebouwd	1	0,93	0,71	0,69	0,78	0,60	0,58	0,49	0,48	2	1,11	0,71	0,69	0,93	0,60	0,58	0,49	0,48	3	1,22	0,71	0,69	1,02	0,60	0,58	0,49	0,48	4	1,30	0,71	0,69	1,09	0,60	0,58	0,49	0,48	5	1,37	0,78	0,69	1,14	0,66	0,58	0,54	0,48	6	1,42	0,84	0,69	1,19	0,71	0,58	0,58	0,48	7	1,47	0,89	0,69	1,23	0,75	0,58	0,62	0,48	8	1,51	0,94	0,73	1,26	0,79	0,62	0,65	0,51	9	1,55	0,98	0,77	1,29	0,82	0,65	0,68	0,53	10	1,58	1,02	0,81	1,32	0,85	0,68	0,70	0,56	15	1,71	1,16	0,96	1,43	0,98	0,80	0,80	0,66	20	1,80	1,27	1,07	1,51	1,07	0,90	0,88	0,74	<table border="1"> <thead> <tr> <th rowspan="2">Hoogte m</th> <th colspan="3">Gebied I</th> <th colspan="3">Gebied II</th> <th colspan="2">Gebied III</th> </tr> <tr> <th>Kust</th> <th>Onbebouwd</th> <th>Bebouwd</th> <th>Kust</th> <th>Onbebouwd</th> <th>Bebouwd</th> <th>Onbebouwd</th> <th>Bebouwd</th> </tr> </thead> <tbody> <tr><td>1</td><td>0,93</td><td>0,71</td><td>0,69</td><td>0,78</td><td>0,60</td><td>0,58</td><td>0,49</td><td>0,48</td></tr> <tr><td>2</td><td>1,11</td><td>0,71</td><td>0,69</td><td>0,93</td><td>0,60</td><td>0,58</td><td>0,49</td><td>0,48</td></tr> <tr><td>3</td><td>1,22</td><td>0,71</td><td>0,69</td><td>1,02</td><td>0,60</td><td>0,58</td><td>0,49</td><td>0,48</td></tr> <tr><td>4</td><td>1,30</td><td>0,71</td><td>0,69</td><td>1,09</td><td>0,60</td><td>0,58</td><td>0,49</td><td>0,48</td></tr> <tr><td>5</td><td>1,37</td><td>0,78</td><td>0,69</td><td>1,14</td><td>0,66</td><td>0,58</td><td>0,54</td><td>0,48</td></tr> <tr><td>6</td><td>1,42</td><td>0,84</td><td>0,69</td><td>1,19</td><td>0,71</td><td>0,58</td><td>0,58</td><td>0,48</td></tr> <tr><td>7</td><td>1,47</td><td>0,89</td><td>0,69</td><td>1,23</td><td>0,75</td><td>0,58</td><td>0,62</td><td>0,48</td></tr> <tr><td>8</td><td>1,51</td><td>0,94</td><td>0,73</td><td>1,26</td><td>0,79</td><td>0,62</td><td>0,65</td><td>0,51</td></tr> <tr><td>9</td><td>1,55</td><td>0,98</td><td>0,77</td><td>1,29</td><td>0,82</td><td>0,65</td><td>0,68</td><td>0,53</td></tr> <tr><td>10</td><td>1,58</td><td>1,02</td><td>0,81</td><td>1,32</td><td>0,85</td><td>0,68</td><td>0,70</td><td>0,56</td></tr> <tr><td>15</td><td>1,71</td><td>1,16</td><td>0,96</td><td>1,43</td><td>0,98</td><td>0,80</td><td>0,80</td><td>0,66</td></tr> <tr><td>20</td><td>1,80</td><td>1,27</td><td>1,07</td><td>1,51</td><td>1,07</td><td>0,90</td><td>0,88</td><td>0,74</td></tr> </tbody> </table>	Hoogte m	Gebied I			Gebied II			Gebied III		Kust	Onbebouwd	Bebouwd	Kust	Onbebouwd	Bebouwd	Onbebouwd	Bebouwd	1	0,93	0,71	0,69	0,78	0,60	0,58	0,49	0,48	2	1,11	0,71	0,69	0,93	0,60	0,58	0,49	0,48	3	1,22	0,71	0,69	1,02	0,60	0,58	0,49	0,48	4	1,30	0,71	0,69	1,09	0,60	0,58	0,49	0,48	5	1,37	0,78	0,69	1,14	0,66	0,58	0,54	0,48	6	1,42	0,84	0,69	1,19	0,71	0,58	0,58	0,48	7	1,47	0,89	0,69	1,23	0,75	0,58	0,62	0,48	8	1,51	0,94	0,73	1,26	0,79	0,62	0,65	0,51	9	1,55	0,98	0,77	1,29	0,82	0,65	0,68	0,53	10	1,58	1,02	0,81	1,32	0,85	0,68	0,70	0,56	15	1,71	1,16	0,96	1,43	0,98	0,80	0,80	0,66	20	1,80	1,27	1,07	1,51	1,07	0,90	0,88	0,74
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