Mounting Profile for Photovoltaic Modules

The present invention relates to an improvement on mounting structure for photovoltaic modules. This mounting profile allows for various method of installation of photovoltaic modules.

Description

Photovoltaic modules are used as an alternate energy source to grid power. They operate by converting the sun's light energy into electrical energy. As such photovoltaic modules are installed in places that are high or open to maximize their exposure to the sun. Also, depending on the location, the modules have to be tilted to a certain angle and facing a certain direction to capture the sun's ray. Either way, mounting on rooftops or open area, there needs to have some kind of structure to hold the photovoltaic modules.

Conventionally, structures are custom made to the situation and thus expensive. One of the main tasks is to get the mounting holes in the right position. For stand alone structure, it is much simpler as access to the bottom side of the modules is possible. For roof mounted structure, it is more challenging as access to the bottom of the modules are restricted. Conventional mounting profiles are dedicated to certain types of installation conditions and hence multiple types of profiles have to be used for different situations.

This invention, the mounting profile, seeks to improve the installation time and also offers various ways of mounting depending on the situation using the same mounting system. The only customization is to tailor the length to the situation.

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Summary of Invention

The present invention is a mounting profile with multiple features for holding photovoltaic modules in many ways to reduce installation time and effort. The multiple features of the profile further allow the profiles to be secured to other structures in multiple ways. The present invention further provides recesses to accept wires running within the mounting profile.

This mounting profile is designed for top mounting and thus reduces the need for accessibility of the photovoltaic from the bottom, which in some cases are difficult. The 2 ways of mounting the photovoltaic modules are i) rest-on method and ii) seat-in method. With 4 slot-for-bolts features and 2 surface-for-general-screw features, there are great flexibilities in how the photovoltaic modules can be mounted. These same features also help overcome the difficulty of mounting the photovoltaic modules on the different structures like roof tops, stand alone racks, steel structure and the like.

The top mounting design also allows for ease of maintenance and should any photovoltaic module be faulty and requires replacement, it can be easily done by just replacing the faulty modules without removing the rest of the modules. Together with a few other accessories, the photovoltaic modules can be mounted in almost any situation.

Drawing Description

Figure 1 Section View of the Mounting Profile.

Figure 2 Mounting using Slot-for-Bolt feature 1b of Mounting Profile.

Figure 3 Mounting using Slot-for-Bolt feature 1c of Mounting Profile.

Figure 4 Mounting using Slot-for-Bolt feature 1d of Mounting Profile.

Figure 5 Mounting using Slot-for-Bolt feature 1e of Mounting Profile.

Figure 6 Mounting using Surface-for-General-Screw feature 1a of Mounting Profile.

Figure 7 Mounting using Surface-for-General-Screw feature 1f of Mounting Profile.

Figure 8 Mounting using Slot-for-Bolt feature 1e of Mounting Profile with nut inside Slot.

Figure 9 Section View of Photovoltaic Module mounted on Mounting Profile in a Seat-in method.

Figure 10 Section View of Photovoltaic Module mounted on Mounting Profile in a Rest-on method.

Figure 11 Sketch of Photovoltaic Modules mounted on Mounting Profile with Accessories in a Rest-on method.

Figure 12 Sketch of Exploded View of Photovoltaic Modules mounted on Mounting Profile with Accessories in a Rest-on method.

Figure 13 Sketch of Enlarged View of Photovoltaic Modules mounted on Mounting Profile with Accessories in a Rest-on method.

Figure 14 Sketch of Enlarged Exploded View of Photovoltaic Modules mounted on Mounting Profile with Accessories in a Rest-on method showing End Grip Plate.

Figure 15 Sketch of Enlarged Exploded View of Photovoltaic Modules mounted on Mounting Profile with Accessories in a Rest-on method showing Grip Plate.

Figure 16 Sketch of Photovoltaic Modules mounted on Mounting Profile with Accessories in a Seat-in method.

Figure 17 Sketch of Enlarged View of Photovoltaic Modules mounted on Mounting Profile with Accessories in a Seat-in method showing End Grip Plate.

Figure 18 Sketch of Enlarged Exploded of Photovoltaic Modules mounted on Mounting Profile with Accessories in a Seat-in method showing End Grip Plate.

Preferred Embodiment

Figure 1 shows the mounting profile 1, which consists of four slot-for-bolts features 1b, 1c, 1d and 1e and two surface-for-general-screw feature, flange 1a and recess 1f. The slot-for-bolts feature 1b, 1c, 1d, 1e are designed to fit industry standard hexagonal head screws and nuts such as M6 hexagonal head screw 6 and M6 nut. The surface-for-general-screw feature 1a and 1f allows for i) drilling of holes for mounting with nuts and screws on to any fixed surface or ii) drilling directly through using #12 hexagonal head self taping screw on to any fixed surface.

The profile will have an overall dimension of around 50mm to 75mm width by 50mm to 75mm height such that when the photovoltaic module 4 is installed on the rest-on method, it will not be too high above the mounting surface. The dimension of the module-seating recess 1g is around 40mm to 50mm to accommodate most framed photovoltaic module 4 available in the market. Overall wall thickness on the profile 1 will be around 2.5~4mm for strength, with at least 4mm on the vertical wall that consists of 3 slot-for-bolt features and 1 surface-for-general-screw feature.

The L-shape of the profile provides for strength in both up/down and left/right direction to reduce sagging when mounted on cross beams with large span. Surface 1i and 1j are perpendicular surfaces and are the main surfaces coming in contact with the fixed mounting structure. The fillets at all corners reduce the danger of getting cut by the profile during handling. Fillets also help to reduce stress concentration areas especially on recess 1g.

Slot-for-bolts features 1b, 1c, 1d and 1e are designed to accommodate industry standard hexagonal head screw and/or nut. The width of the larger surface of the slot is slightly bigger than the Across-Flat (AF) dimension of a standard hexagonal head screw 6 and nut 5. The depth of the narrower surface of the slot is to be 10~12mm deep such that there is allowance for longer screw should the method of tying is as shown in Figure 8. Standard screws 6 and/or nuts 5 can be placed in the slot by either i) sliding them in from both ends of the profile or ii) drilling a dia.12mm hole through the slots anywhere along the length of the profile 1.

Profile 1 can be mounted on to a fixed surface using the slot-for-bolt feature. First, holes of dia6.5mm to dia8mm need to be drilled on the fixed surface. Then, slot the screws into any

slots on the profile 1, place the profile 1 on the fixed surface with the screws 6 through the holes on the fixed surface and fasten the profile 1 on to the surface using corresponding washers, spring washers and nuts 5 on the screws. Figure 2, 3, 4, 5 and 8 shows examples of how profile 1 can be fastened on to fixed surface using the slots-for- bolt feature.

Profile 1 can also be mounted onto a fixed surface using the surface-for-general-screw flange 1a and recess 1f. To mount profile using flange 1a, place the profile on the desired position, using the v-notch on the flange as guides, drive self-taping screws #12 through the profile 1 directly on to the fixed surface. Similarly, mounting of profile using recess 1f can be done in the same manner as mounting using flange 1a. If the surface to be mounted is made of tough material, a smaller pilot hole may be drilled prior to driving in the self-taping screw. Figure 6 and 7 shows examples of how profile 1 can be fastened on to fixed surface using the surface-for-general-screw feature.

On the other hand, profile 1 also caters to a number of ways where photovoltaic modules 4 can be mounted. Photovoltaic modules 4 (framed) usually come with an all round encompassing frame with height varying from 30mm to 50mm and such frame usually includes at least 4 pre-cut mounting holes/slots of size between 6mm to 9mm. A row of modules are mounted on 2 profiles 1 which in turn are mounted on a fixed surface. The profile 1 allows for the photovoltaic modules 4 to be mounted in the rest-on method and the seat-in method.

For the rest-on method, photovoltaic modules 4 are placed on the profile with any one of the slot-for-bolt feature facing the modules. The photovoltaic modules 4 can either be fastened using i) grip plate 3 and end grip plate 2 held in place by hexagonal screw 6 with washer, spring washer and nut 5; or ii) hexagonal screw 6 with washer, spring washer and nuts 5 through the photovoltaic modules holes/slots on the frame.

To fasten the photovoltaic modules 4 using rest-on method i), screws 6 of adequate length (depending on the height of the frame) are to be slotted into the profile's 1 prior to the placing of the photovoltaic modules 4. The first photovoltaic module 4 is placed onto the desired position by clamping it down using the end grip plates 2 to rest on the profile 1 with screws 6, washer, spring washer and nuts 5. Place in the next module 4, align the module next to the first module using grip plates 3 making sure that there is a set of screws 6 already inserted the

slot-for-bolts in between the 2 modules 4. Place the grip plates 3, through the screws 6, on both the modules' 4 frame and fasten them down using washer, spring washer and nuts 5. Proceed using the same procedure till the last module of the row where it will be fastened using end grip plates 2 with screws, washer, spring washer and nuts 5. Examples of this method of mounting are shown in Figure 11, 12, 13, 14 and 15

To fasten the photovoltaic modules 4 using rest-on method, screws 6 of adequate length (approximately 20mm) are to be slotted into the profile's 1 prior to the placing of the photovoltaic modules 4. Place the module on the profile 1 and align all the screws 6 to the holes/slots on the frame. Using washer, spring washer and nuts, fasten the modules on to the profile 1. Proceed with the rest of modules 4 in similar manner. One important thing to note is that this mounting method requires the 2 profiles 1 to be installed apart at a distance equal to the distance of pre-cut mounting holes/slots present on the frame of the module 4. Also, access to the bottom side of the modules 4 must be available if this method of installation is to be adopted, for example, stand alone structure.

For seat-in method, the 2 profiles 1 are oriented to have the recess 1g facing one another and mounted apart on a fixed surface with the distance between the vertical face of recess 1g equal to the overall length or width of the photovoltaic modules depending on the way the modules 4 are to be mounted. The photovoltaic modules 4 are then placed in to the profile 1 seating on recess 1g. After all the modules 4 are placed in, they are fastened in place by a flat grip plate 7, with holes drilled at equal interval along the length, with screws 5 (of adequate length and already slotted into slot 1e), washer, spring washer and nuts. At both ends, end grip plates 2 are fitted on to the profile 1 using screws, washer, spring washer and nuts 5 to prevent the modules from sliding along the profile 1. Should modules 4 have frames height lower than the depth of recess 1g, an elastomer (for example rubber) of adequate thickness can be pasted on to the horizontal surface of recess 1g to compensate for the shortness of frame before resting the photovoltaic modules 4 on and fastening the modules 4 with flat grip plate 7, screws 6, washer, spring washer and nuts 5. If modules 4 have frame height higher than the depth of recess 1g, an elastomer of adequate thickness and width equal to the width of external surface of slot 1e can be pasted on the flat grip plate 7 (holes on elastomer cut according to flat grip plate 7) before fastening on to the profile 1 with screws 6, washer, spring washer and nuts 5 to fasten the photovoltaic modules 4. Examples of this method of installation are shown in Figure 9, 16, 17 and 18.

In general, a typical installation using the profile 1 will be to first identify the fixed structure. Follow by installing the profile 1 in the manner shown in Figure 6 on to the fixed structure using self-taping screw #12. Thereafter, mounting the photovoltaic modules 4 on to the profile 1 using either the rest-on method shown in Figure 10 or using the seat-in method shown in Figure 9.

Mounting Profile for Photovoltaic Modules

Claims

1. This invention is related to a mounting profile for securing photovoltaic modules on to different mounting surfaces and structures wherein the said mounting profile consists of six main mounting features, in which four of them are slot-for-bolts; and the other two are surfaces-for-general-screw, provides the versatility for fastening either onto fixed mounting structure or photovoltaic modules, of which there are two main configurations namely rest-on method; and seat-in method.

2. The mounting profile as claimed in claim 1, wherein the photovoltaic modules are mounted onto the profiles in a rest-on method such that the photovoltaic modules rest on the face of the said profile with at least one accessible slot-for-bolts feature.

3. The mounting profile as claimed in claim 1 wherein the photovoltaic modules are mounted onto the mounting profiles in a seat-in method such that the said profile is positioned with the module-seating recess facing up.

4. The mounting profile as claimed in 1 is fabricated by aluminum extrusion.

5. The mounting profile as claimed in claim 4 wherein the slot-for-bolts feature fit industrial standard screws and nuts.

6. The mounting profile as claimed in claim 5 wherein the surface-for-general-screw is designed to fit industrial standard self taping screw.

7. The mounting profile as claimed in claim 6 wherein the module-seating recess has a depth between 40mm to 50mm to accommodate a wide range of commercially available photovoltaic modules.