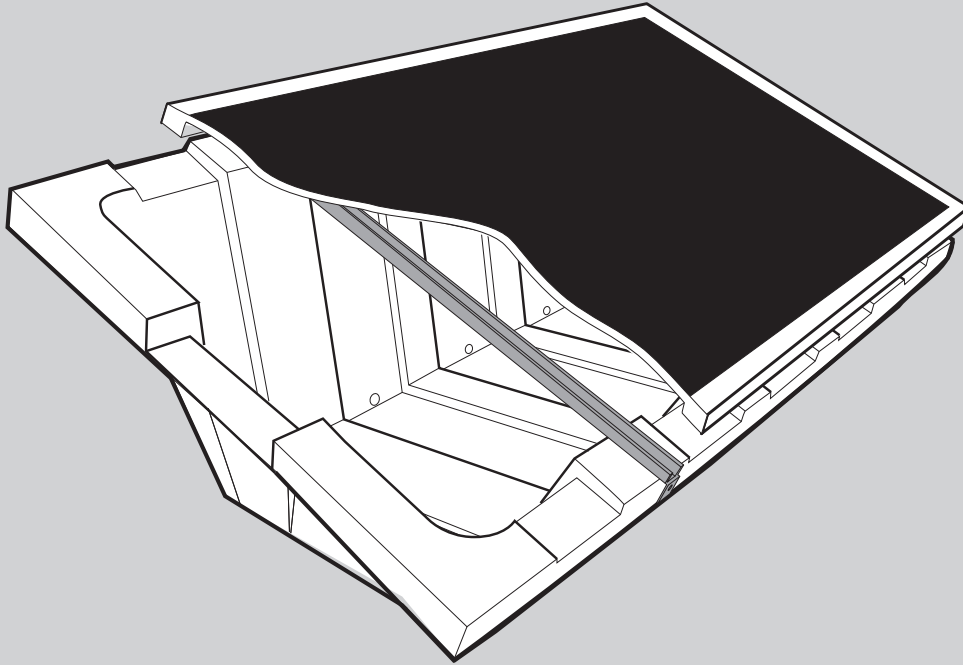




ubbink
S O L A R

Installation Guide

ConSole



The ConSole is the ideal solution for mounting solar panels on flat roofs. Most common solar panels in the 70 to 260 range can be mounted on the ConSole.



The ConSole is filled with ballast (gravel, flagstones, etc.), in order to provide greater resistance to wind loading. The amount of ballast is determined according to the height of the building, its location and the nature of the installation surface. Please refer to the table on page 3 for reference values with regard to the amount of ballast.

The ConSole is made of 100 % recycled, chlorine-free high-density polyethylene (HDPE). The raw materials of the ConSole are fire resistant and comply with fire protection standards in accordance with DIN 4102 Class B2. The energy payback time for the ConSole is less than one year.

The ConSole weighs between 3-6 kg, is stackable (40 ConSoles per pallet) and has a continuous mounting border.

The non-slip ConSole Light is also optionally available. This ConSole has an EPDM film bonded onto its bottom side, which generates a higher friction coefficient. This ConSole is particularly suitable for slippery roofing materials.

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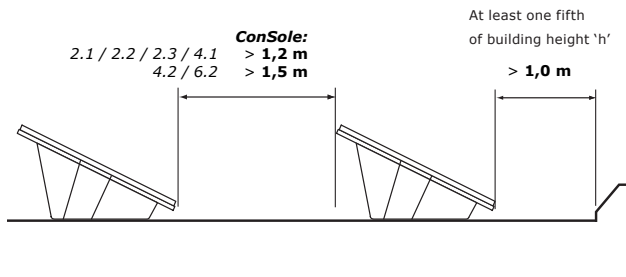
Please check for any updated versions of the installation guide on www.ubbinksolar.com

The Ubbink Solar Team.

Installation Preparations

Scope of Supply

- 1 ConSole
- 2 Aluminium U-Profile
- 8 M6 x 20mm Stainless Steel Hexagonal Bolts
- 8 M6 Stainless Steel Self-Locking Nuts
- 8 18 mm Stainless Steel U-Washers



Required Tools

- Electric Screwdriver with a Hexagonal Bit for a 10 mm Bolt
- 7 mm Drill
- 10 mm Open-End or Ring Spanner

Make sure the installation surface is even, clean and not too smooth / slippery. In the case of slippery surfaces (e.g. PVC roofing membranes or similar), a non-slip mat should also be used.

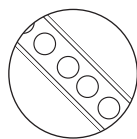
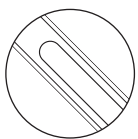
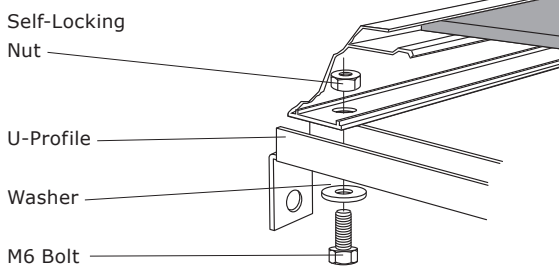
Please check whether the installation surface (e.g. the roof) has been designed to sustain the required additional permanent ballast loading.

Position the ConSole with the flat side facing in a southward direction. Maintain a distance from the edge of the roof of at least one fifth of the building height 'h'. (e.g. at a building height 10 meter keep a distance of 2 meter). The distance between the parallel rows of ConSoles is illustrated in the diagram on the left.

Add the corresponding amount of ballast that is required (please refer to the table on page 3 for the reference values).

Installation

1



Mount solar panel onto the U-profile (please refer to the diagram above). Please make sure that the slotted hole is positioned on the higher side of the ConSole and that the small round holes are on the lower side. Please use the supplied mounting materials. Screw the bolts tight.

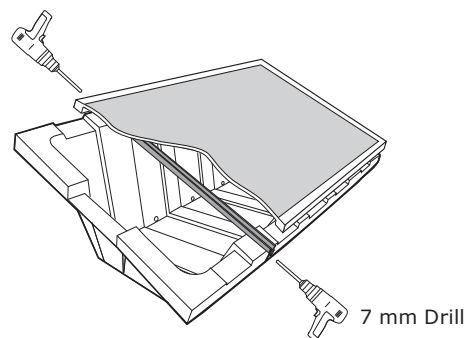
2

Connect the cables.

3

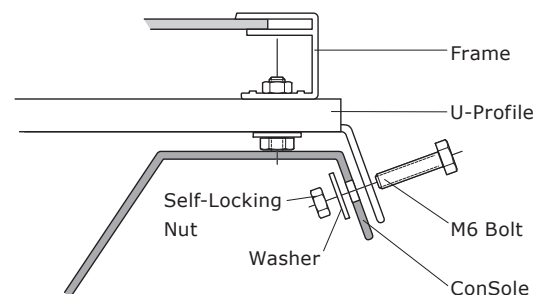
Position the solar panel symmetrically onto the ConSole. If positioned correctly, the U-profile strips should prevent the solar panel from sliding away.

4



Use the profiles as a jig to drill four (4) holes (7 mm) in the vertical edges of the ConSole.

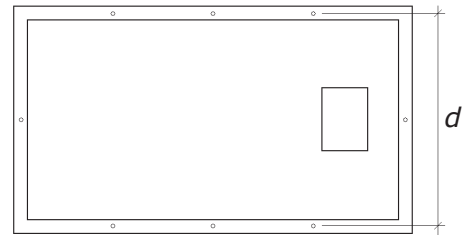
5



Mount the profiles onto the ConSole with the supplied mounting materials (please refer to the diagram above). Please make sure that the u-washer is placed between the nut and the ConSole.

Finding the Right ConSole for Your Solar Panel

- 1** First measure the distance **d** for the mounting drill holes on the back of the solar panel.

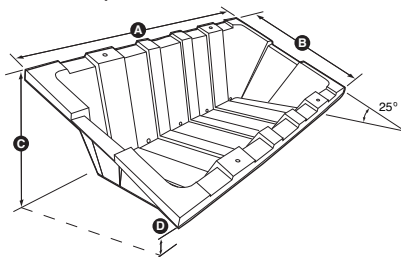


- 2** Determine the required ConSole for the **width** of your solar panel using the table on the right. Any extension rails that may be required should be listed as a separate position on the order.

Distance d	ConSole 2.1	ConSole 2.2	ConSole 2.3	ConSole 4.1	ConSole 4.2	ConSole 6.2
531 - 591 mm		●				
591 - 651 mm	●	●				
651 - 661 mm	●	○				
661 - 711 mm	●	○		●		
711 - 721 mm	○	○		●		
721 - 781 mm	○		●	●		
781 - 841 mm			●	○		
841 - 851 mm			○	○		
851 - 895 mm			○			
895 - 911 mm			○		●	●
911 - 1015 mm					●	●
1015 - 1085 mm					○	○

(○ = only with extension rail)

- 3** If there are multiple possibilities, then select the ConSole, which fits the **length** of your solar panel best. The dimension **A** of the ConSole should correspond approximately to the length of the module. Extended solar panels require larger amounts of ballast due to the larger contact surface that is exposed to the wind. Please always select the ConSole, where the surface area of the solar panel extends over the edges as little as possible (maximum 12 cm on either side).



	A	B	C	D
ConSole 2.1	135	73	44	10
ConSole 2.2	144	67	39	10
ConSole 2.3	125	86	48	9
ConSole 4.1	160	80	45	8,5
ConSole 4.2	120	105	55	8
ConSole 6.2	168	105	55	8

All dimensions are in cm

Determining the Amount of Ballast Required for ConSole

In order for the ConSole to withstand wind loads, it is necessary to fill the ConSole with ballast. Suitable ballast are gravel, stones, slabs or similar. Please refer to the table on the right for indicative ballast values. These values correspond to the inland wind conditions in Germany at reference wind speeds of 22,5 m/s. These have been calculated according to DIN1055-4 (2005-03) and Eurocode, and have been confirmed by long-standing experience for wind loads of up to 130 km/h. The outer rows of Consoles (on the edge of the module field) have to be ballasted with higher loads according to the table. The stated values ensure that the ConSoles do not lift off or tip over. In order to make sure that they do not slide away, one should ensure that the friction coefficient between the roof surface and the ConSole is higher than 0.6. This value can easily be determined using a

Ballast (kg) in the Console according to DIN1055-4:2005-03 and a reference windspeed of 22,5 m/s, For German inland wind conditions: wind zone I, and the suburban terrain category III.

Building height	up to 8 metres		12 metres		16 metres	
Position in	middle edge		middle edge		middle edge	
module field:	middle	edge	middle	edge	middle	edge
ConSole 2.1	50	78	59	91	66	101
ConSole 2.2	46	73	55	86	61	95
ConSole 2.3	51	82	60	96	68	106
ConSole 4.1	62	99	73	115	82	128
ConSole 4.2	58	94	68	110	77	122
ConSole 6.2	83	134	98	156	110	173

Please be aware that for higher reference wind speeds more ballast should be added.

For example for a reference wind speed of 26 m/s, an extra 50% of ballast should be added.



spring balance. The ConSole Light with the non-slip base generates a higher friction coefficient, especially useful on slippery roofing material. To comply with the local circumstances and locally applicable norms we advise to consult an approved construction engineer. We inform you that in order to prevent accidents, it is necessary to work in accordance with the statutory industrial safety regulations. Please implement the corresponding safety measures. Consult our website for latest information.

Frequently Asked Questions

What is the maximum roof angle allowed for the ConSoles?

The ConSole has been designed only for flat roofs. An angle of up to 5° is acceptable.

Is it necessary to place roof protection between the roof and the ConSoles?

The ConSoles have no sharp edges, they spread the weight out over a large area of the roof and are made of relatively soft material. Based on these reasons, as well as our widespread experience, no roof protection is required, provided that the roof surface is flat and clean.

Is earthing required?

The ConSole is made of HPDE, a non-conductive material. Therefore it is not necessary to earth the ConSole itself. However, if due to statutory regulations, the frame of the solar panel itself must be earthed, then these should be connected to each other so that they conduct electricity.

Is it possible to connect the ConSoles to each other?

Normally the ConSoles are not connected to each other, as the ballast suffices to keep the ConSole in place. However in some cases, such as in extremely windy regions or when the surface is very slippery or for aesthetic reasons (alignment), it may be necessary to connect the ConSoles. If this is the case, it is for example possible to use the holes for fixing the modules or extra holes can be drilled (not included in delivery).

How much time is needed for the installation of the ConSole?

If the recommended installation method is applied (fasten the U-profile strips to the solar module, position the module onto the ConSole, tighten with self-locking nuts) then, in our experience, two minutes suffices per solar panel.

Can modules be placed in portrait orientation?

The ConSole is designed for installation in landscape orientation. Portrait orientation is not recommended.

How many modules fit on one ConSole?

The ConSole is designed to carry one module. In some exceptional cases, two smaller modules may fit on one large ConSole.

Which material can be used as ballast?

We recommend the use of gravel or flagstone. However, in principle, any material that has a high density and can be stored in the open air for many years without being or causing any damage may be used.

What is the operating temperature range for the ConSole?

The ConSole can be used or stored at temperatures ranging between - 40 °C and 85 °C.

Is the material UV-resistant?

The ConSole is made of blackened, recycled HDPE (high-density polyethylene). This material has excellent UV-resistance characteristics. In addition extra UV-stabilisation agents have been added to the raw material. The UV-resistance characteristics have been tested according to ISO 4892.

How long is the warranty period?

The warranty period is 10 years. The expected lifetime of a ConSole is 30 years.

How many ConSoles have been installed to date?

By January 2006 more than 350,000 ConSoles had been installed. This is equivalent to an installed power of approximately 50 MWp.

Where and when was the first ConSole installed?

The first ConSole was installed in 1996 in The Netherlands.

What is the angle of the ConSole?

The irradiation angle is 25°. By reducing the angle slightly (in relation to the optimal irradiation angle for PV systems) the ConSole becomes lower, is thus exposed to less wind and therefore requires less ballast. In addition the distance between rows can be reduced. The loss of energy production is minimal.

What is the maximum temperature increase inside the ConSole?

Tests in The Netherlands, Italy and Portugal have shown that the temperature of a module placed on a ConSole is less than 3 °C higher than on a free support. This difference is even smaller at lower temperatures, so that the effect on the net yearly energy production is minimal. The temperature increase mainly has an effect on the maximum power.

An objective comparative value cannot be determined, as there are no standardized testing methods for this. Thus for example, the reflections on the roof and any possible obstacles may influence the results for installation on a free support, but would be practically insignificant for the ConSole. Therefore any comparison of the two systems may only occur on an individual basis.

How is the module ventilated?

There are unsparing ventilation slots along all sides of the ConSole, enabling free circulation of air. The temperature increase inside the ConSole is limited by the chimney-effect, which ensures the ventilation of the entire surface of the module by natural convection. This ventilation is even further improved by the extra air space of 1.5 cm provided by mounting the modules on the U-profiles.

How are ConSoles manufactured?

The ConSole is a thermo-vacuum formed product manufactured using HPDE sheets with a thickness of approximately 3.5 to 4.5 mm.

Which fire protection class is applicable for the ConSole?

The material (HDPE) of the ConSole complies with fire protection standards in accordance with DIN 4102 Class B2.

Does the ConSole contain chemical substance that might react with the roof?

The ConSole is made using 100% recycled, chlorine-free high-density polyethylene (HDPE). To date no damaging reactions with the roof have been reported.

What is the function of the holes at the base of the ConSole?

These are drainage holes.

What materials are the U-profiles made of and what are they for?

The U-profiles are made of aluminium. They enable customers a very simple and easy installation and provide mechanical stability for the module frame.

Is it possible to equip existing installations with the U-profile?

Generally the U-profiles are supposed to simplify the overall installation. The equipping of existing installations with the U-profiles is always possible, however not required.

