Heckert Solar

Installation instruction solarmodules

www.heckert-solar.com

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Installation and operating manual for the ZEUS 1.0 and ZEUS 1.1 solar modules

This operating manual is addressed to suppliers, installers and operators of PV systems with monocrystalline high-performance solar modules manufactured by Heckert Solar GmbH. It aims to ensure that the installed PV systems produce optimum yields through the entire running time. Non-compliance may render the warranty invalid. Please read the following instruction manual thoroughly.

Solar modules may only be installed by qualified specialist companies. Please observe the relevant standards and regulations for the installation and operation of photovoltaic systems, such as VDE regulations, DIN standards, VDEW guidelines, the TAB of the responsible grid operator and the rules of the employers' liability insurance associations for accident prevention, in particular IEC 62446 for commissioning and maintenance. Non-compliance may result in considerable personal injuries and material damage. The standards and laws applicable in Germany form the basis of the information contained in this installation and operating manual.

This installation manual should form part of the plant documentation, and should be available to the plant operator at any given time.

Heckert Solar reserves the right to amend the present document at any time without prior notice. Please use the most current copy, which can be found on our homepage at

https://www.heckertsolar.com/service/

This installation and operating manual is in accordance with IEC 61730-1:2016.

Overview

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1. Risks & safety precautions

Solar modules generate electricity as soon as they are exposed to light. It is hazardous to touch a module with a voltage of 30 volts or more. Each serial or parallel connection of modules increases the voltage or current. By connecting more than two solar modules in series, hazardous voltages may occur!

Danger of death due to electric shock!

Although touch protection is provided in the form of the fully insulated plug contacts, please ensure that when handling the solar modules

- no electrically conductive parts are inserted into the plugs or sockets!
- solar modules and cables are not installed with wet male and female connectors!
- all work on the cables are undertaken with extreme caution!
- high contact voltages may still be present inside the inverter even when the unit is switched off!
- as a rule, caution is to be exercised when performing any work on the inverter and cables!

The solar modules comply with protection class II.

Risk of death by electric arc!

A deadly electric arc can result when opening a closed section (e.g. when separating the DC cable from the inverter under load):

- Never separate the solar generator from the invertor if the latter is connected to the grid!

Working on the roof
Please observe the applicable accident prevention regulations. Do not carry out installation work when there are strong winds. Secure yourself and other persons from falling from height. Prevent objects from potentially falling down. Secure the work area so that no other persons can be injured.

2. General information on PV plants

Orientation
The solar module achieves the highest yield when oriented to the south (towards the north when in the southern hemisphere). The optimum angle of inclination outside the tropics can be estimated using the following equation:

Angle of inclination = latitude of the installation site minus 20.

Deviations from the optimum orientation and inclination of the modules lead to a reduction in yield.

Angle of inclination >75° may lead to regional restrictions.

Location
The area planned for the installation should be as free as possible from shade of any kind (houses, trees, branches, chimneys, dormers, antennas, satellite dishes, cables, etc.), because shade can significantly reduce the efficiency of the solar modules. Even partial shading will lead to a significant reduction in yield. A module is considered "shade-free" when the entire surface is shade-free all year round and, even on the most unfavourable days of the year when the sun is low, receives unobstructed sunlight for several hours.

Rear ventilation
The output of solar modules decreases considerably as the modules heat up. Rear ventilation avoids yield-impairing heat accumulation. The so-called "chimney effect" (draught behind the modules) should not be impeded if possible (e.g. roof windows, collectors).

The minimum distance between the underside of the module and the roof cladding is 10 cm to facilitate the ventilation and heat dissipation of the module.

Maintenance / Cleaning
As a rule, solar modules are low-maintenance. To ensure safe and smooth operation, we recommend a regular visual inspection. Please note that there may be optical differences at different viewing angles due to the anti-reflective coating of the lenses.

Check the modules every six months for glass breakage, delamination, coarse soiling and other visual changes.

Check the plug connections and cables as well as the tight fit of the module fastenings.

With a sufficient inclination of the modules (>15°), there is a self-cleaning effect with rain and snow. Cleaning the modules is generally unnecessary.

However, the soiling of the modules is strongly dependent on the surrounding environment and should be checked once a year. In case of heavy soiling, it is recommended that the modules be cleaned after cooling down (e.g. in the morning) using plenty of warm, de-mineralised water and a gentle cleaning device, as sharp-edged items might lead to scratches on the surface or to destruction of the anti-reflective (AR) coating. Clean, lint-free cotton, microfibre cloths or paper towels should be used for cleaning. Greasy or oily residues can be removed using alcohol or alcohol/water mixtures. You should also refrain from using strong acids, alkalis, benzine-based cleaning agents or hot cleaning agents, as well as cleaning agents containing silicone oil, fluorides or wax, polishes, alkaline cleaning agents and cleaning agents with

abrasive chemical products or high-pressure cleaners. Any methods, means or conditions which can exchange Na ions from the glass surface are unsuitable for cleaning glass. Any abrasive cleaning agents and utensils are also unsuitable. Please note that too great differences in temperature can lead to tension in the glass, which may destroy the module.

Please make sure that the earthing is not interrupted or destroyed when carrying out cleaning and maintenance work!

3. Delivery & handling of the modules

The goods must be checked immediately upon delivery to ensure completeness and integrity. Only damage that is noted on the driver's delivery receipt and are immediately communicated in written form to Heckert Solar can be recognised as transport damages.

Take care when unpacking, transporting and storing the modules. We recommend keeping the modules in their packaging until ready for installation. Always place the pallets on level and firm ground.

In general, the solar modules are packed upright on the long side on a disposable pallet of 36 modules (standard packaging). Never stack more than 2 pallets of standard packaging on top of each other.

Up to 22 modules are packed in one picking package. These pallets must **not** be stacked.

	Standard Packaging	**Picking packaging**
Number of modules/ pallets	23 to 36 (+1…4)	1 to 22
External dimensions (WxLxH)	1.80m x 1.14m x 1.25m	1.20m x 1.17m x 1.90m
Weight of full pallet	912 kg (1010 kg)	39 kg – 554 kg
Quantity per truck	28 pallets 1008 units	

Exercise caution when working with the modules!

Two people are always required to unpack the modules!

Secure the modules against falling over, especially when the tensioning straps are loosened!

The packaging is partially not covered with foil and is therefore not rainproof!

Instructions for unpacking the standard package with 36 modules

- First remove the foil and all tensioning straps.
- Open the cover and remove the outer packaging.
- Loosen the inner tensioning straps. Attention, the modules must be secured by a **second** person!
- The modules are secured with additional adhesive tape. Do not remove it from the first module until you are sure that it is well stuck to the following module.
- Carefully remove and secure the modules one by one (e.g. on another pallet)

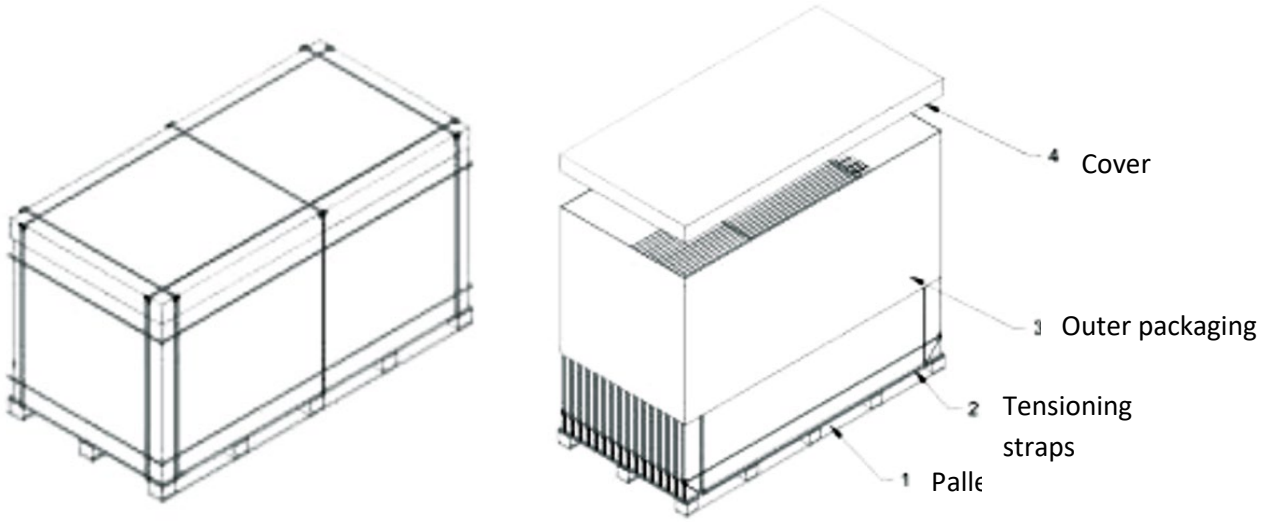


Figure 1: Standard packaging: Pallet with 36 modules

Instructions for unpacking the picking packaging with up to 22 modules

- Remove the straps and the outer packaging.
- Remove the upper spacers.
- Carefully remove and secure the modules evenly.

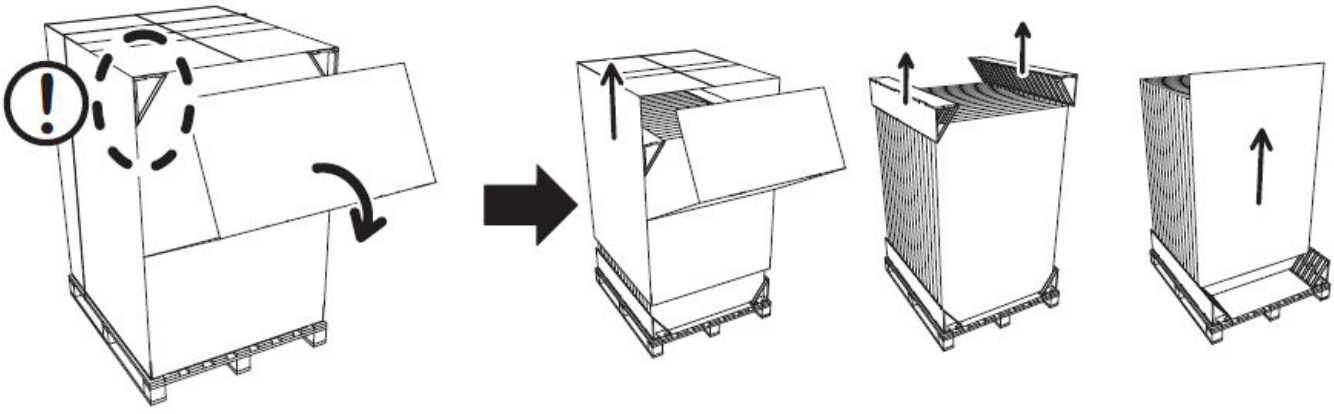


Figure 2: Picking packaging: Pallet with 22 modules or fewer

- Carry the modules with both hands. Do not use the connection sockets or cables(s) as a handle. During the transport and installation, take care that no pressure or tension is exerted on connection sockets and cables.
- Do not expose the modules to any hard shocks! Do not set the modules down roughly on hard ground. Do not set down the modules on their corners. Do not place the modules on top of each other unprotected. Do not

place any objects on the modules. **Never stand on the modules!** Do not allow the modules to fall or use hard or pointed objects on them.
- Special care must be taken to connect the modules in accordance with the instructions and should not be forced. Keep all electrical contacts clean and dry.
- A dry, well-ventilated room should be used to store the modules if necessary.
- For the system documentation, it is advisable to make a note of the serial number and address of the place of installation on the installation plan.
- Do not install any damaged modules.
- No modifications may be made to the modules or the type plates removed, otherwise the warranty may be void.

Please observe the specific instructions for handling solar modules with AR glass.

Compared with non-coated glass, the surface of AR glass has a similar resistance to mechanical or chemical influences and should be handled with a similar level of care. However, due to its special reflective properties, light soiling is more visible than on non-coated glass. In particular, fats and oils are already visible in small quantities and may influence transmission. In order to avoid hand prints, the modules should only be touched with clean gloves.

4. Information on the module

Certification, performance data
For performance data and information on the certificates of the solar modules, please refer to the data sheets of the respective series.

Use
Please note the following points in particular when using our solar modules:

- Installation or operation of the solar modules is permissible up to an altitude of max. 2000 m above sea level.
- The function of the modules is tested at an ambient temperature of -40 to +40°C. This range should be adhered to.
- The solar module is not saltwater-resistant (recommended distance from the sea: 500 m). Despite passing the salt mist test, corrosion can occur on the module frame.
- The module must not be subjected to unusual chemical loads (e.g. emissions from manufacturing plants).
- Do not immerse the solar module in liquid.
- Do not use any lenses or mirrors to concentrate light (risk of overheating).
- Avoid damage to the module from using carbide or diamonds.
- Protect solar modules from overvoltage, e.g. voltage peaks from battery-charging devices, alternator generators etc. (Please ask your specialist retailer in case of any doubt).
- If solar modules are connected to energy-storage devices, the safety instructions of the respective manufacturer must be followed.
- Keep children away from solar modules.

In southern regions, a PV module can supply greater power and/or a higher voltage than stated for the standardised test conditions. To determine the voltage ratings of components, current ratings of conductors, sizes of fuses connected to the output of PV modules, the values of $_{sc}$ and U_{oc} indicated on the module should therefore be multiplied by a factor of 1.25. The highest rated value for overcurrent protection (reverse current resistance) is 35 A.

5. Module installation

General instructions on module installation
All modules can be fitted both horizontally and vertically independently of the connector sockets.

The modules must not be subject to stress during installation. The modules cannot be used as a rigid linking or fixing element.

Please be advised that the holes in the frame and in the corners must remain free in order to allow condensation water to flow out.

Load on the modules
The load capacity of standard solar modules is independent of the installation situation and the system used. Please observe the installation situations in the following table and the resulting maximum load capacity of the modules.

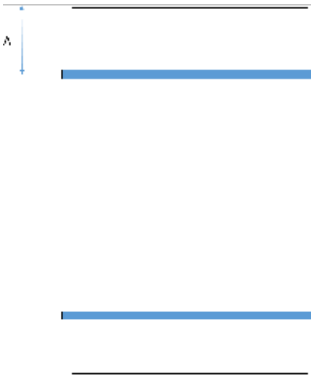
The stated values (figure 3) correspond to the design load in accordance with IEC 61215: 2016. The cyclical load test is carried out according to the standard of a 1.5 times higher test load.

Default situation for continuous mounting rails
Please note that the module can bend under high loads and can strike the mounting rails. Ensure that the mounting rail displays a sufficient stability and the fixing points are set with sufficient frequency to prevent the mounting rail from bending. (Tested with Heckert Solar rails and a support spacing of max. 1m)

Ensure that the maximum mechanical load is not exceeded, in particular while also taking into account the site-dependent loads, e.g. wind and snow (DIN 1055-4/5).

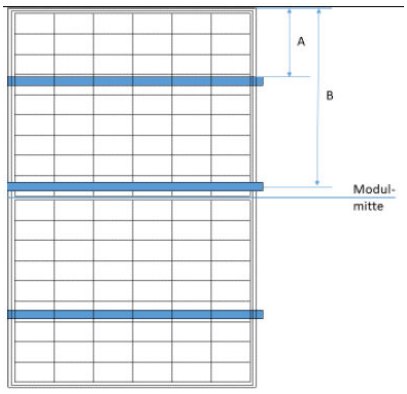
Do not use any attachment material that might damage the module e.g. due to pointed, sharp or uneven structures. Please note that the module bends under load and can strike the supporting surface/ mounting rails. Ensure that the connector sockets and cables, when necessary, are not damaged or exert pressure on the cells.

The total snow load on the ground sk in kN/m² results from the respective snow load zone, the building location and the location's elevation above sea level. The total wind load for the project site must be determined from the wind zone map, which takes into account the site situation as well as wind zones. For buildings up to a height of 25 m, the total wind load may be determined through a simplified procedure. Dependent on building heights, the wind load is specified as velocity pressure q in kN/m^2.



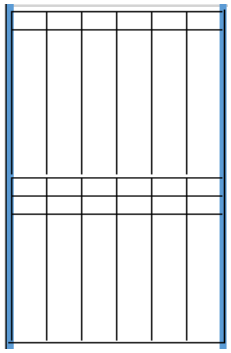
2 continuous rails, 4 fixing points

Module type clamping area	Load	Pressure [Pa]	Suction [Pa]
ZEUS 1.0	Test	5400	2400
A: 440 ± 50	Design	3600	1600
ZEUS 1.1	Test	5400	2400
A: 440 ± 50	Design	3600	1600



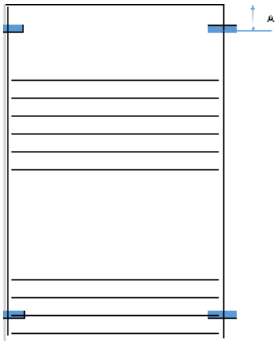
3 continuous rails, 6 fixing points

Module type clamping area	Load	Pressure [Pa]	Suction [Pa]
ZEUS 1.0	Test	8100	2400
A: 294 ± 50	Design	5400	1600
B: 490			
ZEUS 1.1	Not tested		



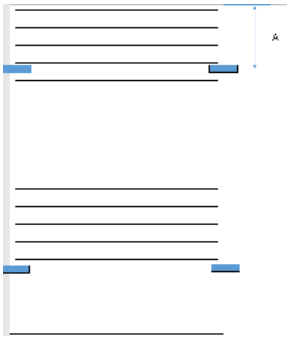
Positioned linearly on the long side

Module type	Load	Pressure [Pa]	Suction [Pa]
ZEUS 1.0	Test	2400	2400
	Design	1600	1600
ZEUS 1.1	Test	2400	2400
	Design	1600	1600



4 fixing points in the corners (long and short side)

Module type clamping area	Load	Pressure [Pa]	Suction [Pa]
ZEUS 1.0	Test	1600	1600
A: 0 to 200	Design	1067	1067
ZEUS 1.1	Test	1200	1200
	Design	800	800



4 fixing points at the long side

Module type clamping area	Load	Pressure [Pa]	Suction [Pa]
ZEUS 1.0	Test	2600	2200
A: 440 ± 50	Design	1733	1466
ZEUS 1.1	Not tested		

Figure 3: Load capacity depending on the installation situation

The maximum load capacity of the modules can only be achieved by clamping the specified area and complying with all conditions!

Please note that the planning and execution of the project is the sole responsibility of the installation company, and in some cases, it is necessary to prepare building structural calculations!

Load restraints

To prevent the modules from slipping on sloped surfaces during installation and to facilitate installation, our module frames are fitted with holes for load restraints. Hexagon socket head cap screws are fixed in these holes in the module frame. The screws are fastened with a washer and nut or using a self-locking nut. An M5x10 VA screw and the corresponding toothed washer and nut are recommended for the load restraints.

6. Connecting the modules

The solar modules from Heckert Solar are equipped with Original MC4 EVO 2A connectors (Stäubli – MultiContact).

Only connectors in accordance with DIN EN 62852 (VDE 0126-300) may be used. In addition, only plug connectors from the original MC4 plug family may be connected with one another.

Please note that only the proper tool may be used for the crimping of connectors.

Defective crimped connections may cause significant damage to the modules and could even cause the system to catch fire.

The modules are connected in series to form strings. This adds the voltage of the modules to the string. Please note that the permissible system voltage of 1500V may not be exceeded, even at very low temperatures.

The correction value Voc can be calculated using the following formula:

$$Cvoc=1-\beta voc \times (25-T)$$

T is the expected lowest temperature at the installation location.

Bvoc is the temperature coefficient [5/°K]. You can find this in the corresponding data sheet

Please note that it is imperative to avoid tensile force on the connection cables.

Please note that only the manufacturer's connectors may be connected. Even "compatible" connectors can loosen the connection and cause an electric arc. This is especially important to consider when using power optimizers!

Any change in the connector socket can lead to the warranty being rendered null and void, and therefore may only be carried out by trained and skilled personnel.

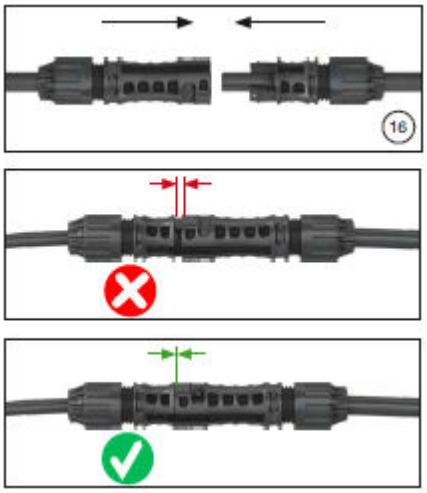
No damaged modules may be installed!

The two outer connection boxes are each equipped with a cable (length 1200 mm) and Stäubli MC4-EVO2A connectors. The connectors are each designed in such a way as not to create confusion.

Figure 4: Arrangement of connection boxes using the example of ZEUS 1.0

The individual solar modules in a string can be interconnected effortlessly in this way.

Please ensure the correct connection of the plugs and sockets!



It is essential to follow the manufacturer's instructions (PV_MA298):

Connect the cable couplings until there is an audible "click". Check correct engagement by pulling on the cable coupling (max.20Nm)

Incompletely engaged cable couplings are not permitted. This can lead to a permanent deformation of the latching lugs and thus to loss of the locking function

Figure 5: Connecting EVO2A modules

The string cables are connected to the EVO2A connectors on the first or last module in the string.

The plug compatibility within the original MC4* connector family from Stäubli is given, i.e. MC4 can be plugged with MC4, but also with MC4-Evo 2/A (1,500V variant) and vice versa. It must, however, be ensured that the max. system

voltage (Vdc) of the "weaker" components prevails, i.e., for MC4 and EVO2/A the maximum permissible system voltage is 1,000 V.

The connectors comply with IEC 62852.

Please be sure to observe the requirements set out in DIN VDE 0298-3 for cable routing, in particular the smallest permissible bending radii (Figure 6; R>5 x cable Ø) and the guidelines for cable fastening and routing.

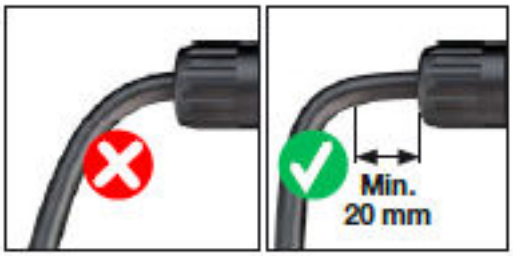


Figure 6: Bending radii

- The connection box and the connectors (after connecting the plugs) have protection class IP68. Both components are permanently protected against environmental influences.

- Pleasure be sure to observe the instructions and installation instructions of the respective manufacturer. See annex. You can also find the Stäubli-MultiContact instructions on our homepage under (https://www.heckertsolar.com/de/downloads/partner-download-center/montage.html).

Cable routing

Per string, 2 cables are required that connect the solar generator to the inverter. Please use solar cables that comply with the standard EN 50618 class 5 and the respective requirements. The minimum cross-section is 4mm². Cable losses should be < 1%. At greater distances, the cable cross-section must be adjusted accordingly. Be sure to observe the requirements for cable laying and fire protection specified in DIN VDE 0298-3.

The strings (+ and - cables) are fed into the inverter and connected to the DC inputs. The module connectors are marked. To avoid conductor loops, the strings (+ and -) should be laid together.

When connecting the strings to the inverter, ensure that its polarity is correct. The + and - cables may not be interchanged. Using a multimeter/voltmeter, the polarity and voltage of the individual strings should be verified before connecting them to the inverter.

Only certified, suitable connectors are approved for the connection of the solar cables to the inverter. The installation or connection of the inverters should be carried out in accordance with the manufacturer's instructions.

The inverter manufacturer's instructions are binding.

Please ensure that there is no tension when routing the cables and that the plug and crimp are properly connected!

Depending on the module performance and inverter type, different length strings are possible. Make absolutely sure that the permissible system voltage cannot be achieved at full-load (V_{OC}) and at low temperatures.

Parallel connection of PV modules

When connecting the solar modules, it is important to note that string fuses (16 A fuse) must be used when connecting more than 2 strings in parallel.

The maximum reverse current load capacity is 30 A. Where more than two strings are connected in parallel, this may be exceeded in the event of a fault.

Electrical installation
Connection of the inverter to the public electricity network must be carried out by an authorised specialised company.

Even at low solar radiation, there is high DC voltage. Never touch unprotected + and - cables that are in operation!

Equipotential bonding
The requirements for the lightning and surge protection are dependent on the local conditions. Where there is already an external lightning protection system in place or planned for the building, the PV system must be integrated in the protection system against a direct lightning strike.

When using transformer-less inverters, due to the galvanic isolation, equipotential bonding may be required for reasons of personal safety. Country-specific laws shall apply.

The responsibility for a professional equipotential bonding of the module frame lies with the installing company. Country-specific standards must be adhered to.

A hole is drilled in the middle of the short sides of the module frame for equipotential bonding, and is marked with the corresponding symbol (Figure 8). An M4 screw is required for equipotential bonding. The fixing must be carried out using a spring washer or toothed washer to ensure that the anodised layer is penetrated.

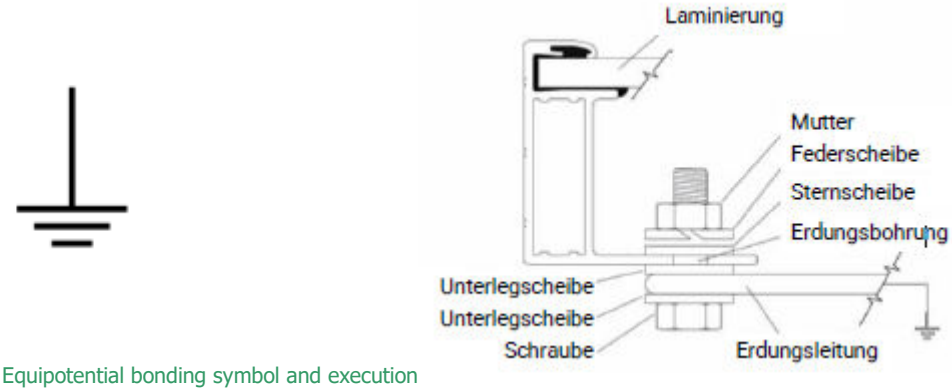


Figure 7: Equipotential bonding symbol and execution

Alternative grounding devices may be used provided they are certified and approved for the frame thickness. Additional holes may not be drilled into the frame.

Fire safety
The installation of on-roof systems can affect the fire safety of a building; improper installations can result in a hazard in case of fire. Please observe LBO Building Law requirements. In the case of on-roof systems, the solar modules must be installed above a fire-resistant substrate ("hard roofing" according to DIN 4102-4). The module is "non-explosion-proof operating equipment". It may not be installed near highly-flammable gasses and vapours (e.g. petrol stations, gas containers or spraying systems). The module may not be installed near an open flame or flammable materials.

The solar modules were tested for their fire behaviour according to IEC 61730-1:2004 and ISO 11525-2:2014. They are considered non-flammable (fire resistance class A). Heckert Solar does not accept any warranty claims for inadequate supporting surfaces, in particular roof covering. A clear labelling of the PV system and installation diagram, on the domestic junction box and the main building distribution board, are normative.

7. Returns & recycling

Returns & recycling of solar modules are governed by the WEEE ElektroG2 Directive. Please observe country-specific regulations. Where applicable, notification may be required in the respective country.

EAR registration number DE42676826

8. Product and service warranty

Information and terms for our product and service warranties can be found on our homepage under www.heckert-solar.com.

9. Disclaimer

This installation and operating manual applies to standard installations. All information is supplied without guarantee. Heckert Solar GmbH shall assume no liability for the usability and functionality of the system if there are deviations from the instructions contained in this user information. Given that neither compliance with this user information, nor the conditions, use and methods of installation, nor system operation, nor maintenance of the modules can be checked or monitored by Heckert Solar GmbH, the latter shall assume no liability for damage resulting from unintended use, incorrect installation, operation, use or maintenance.

Moreover, liability for patent infringements or infringements of other third-party rights resulting from the use of the modules is excluded unless liability is mandatory by law.

Our application technology team is happy to answer any other technical questions on +49(0)371/458568-0.

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