DASOLAR

LIGHTWEIGHT CORRUGATED ASSEMBLY USER MANUAL

DAS-LOJP
DAS-LH132PA

Applicable Product List

Product type	Product model
Lightweight high density module	**DAS-LOJP**
Lightweight half cell	**DAS-LH132PA**

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1. Introduction To User Manual

First of all, thank you for choosing our products! This manual contains relevant information and data in connection with the installation mode and safety operation of the photovoltaic module (hereinafter referred to as "Module") manufactured by DAS Solar Co., Ltd. DAS Solar Co., Ltd. is hereinafter referred to as "DAS Solar". Any violation of this manual may lead to casualties or property loss.
Before Module installation, installation personnel shall go through and understand this manual. Should you have any concerns, please contact the service department of DAS Solar or our local representative for further information. Installation personnel shall comply with all safety precautions set out in this manual, local requirements, and regulations of the law and authorized institutions. Prior to installation the solar photovoltaic system, installation personnel shall clearly understand its mechanical and electrical requirements. The operation of the photovoltaic system requires relevant expertise, and therefore the system installation and maintenance shall be performed by qualified personnel with professional skills and knowledge. Please keep this manual in a secure place, and adopt it as the basis for maintenance and servicing, or use it upon resale or disposal of the Module. DAS Solar Module passes the tests of global detection and certification institutions, and can be used safely provided that the requirements set out in the provisions of this manual are observed. Any Module installation operator shall notify the above requirements to the end users (or consumers).

1.1 Disclaimer

*DAS Solar reserves the right to revise this manual without prior notice. If the customer fails to comply with the requirements set out in this manual during the installation process of the Module, the limited product warranty offered to the customer will be invalidated. This manual is of no significance to the warranty, whether explicit or implied. This manual doesn't contain any information in relation to any compensation plans for any losses, module damage or other costs arising from or in relation to the installation, operation, use and maintenance of the Module. DAS Solar disclaims any liability for any infringement on any patent rights or third-party rights arising from the operation or use of the Module.

1.2 Scope of liability

DAS Solar disclaims any liability for any following kinds of injuries and losses, including but not limited to any physical injuries or property losses resulted from module misoperation, system installation failure, and violation of any instructions set out in this manual.

Mandatory

Otherwise the product may be damaged or the user's personal safety may be endangered.

Prohibited

Otherwise the product may be damaged or the user's personal safety may be endangered.

2. Precautionary Safety Measures

2.1 Warning

Please read and understand all safety rules prior to installation, wiring, operation or maintenance of the Module. The Module may generate power energy when directly exposed to light sources, and a photovoltaic array comprised of multiple modules may create critical electric shock and/or burning, and thus any person without authorization and receiving related training shall not contact the Module and its wiring terminals, etc.

2.2 General safety

Before Module installation, please keep the Module in its original packing case, and properly protect the packing case from any damage. Please transport and unpack the Module according to the corresponding recommended methods and procedures. In order to prevent damage to the Module, please do neither scrape nor impact the Module. Do not put any direct pressure on the Module during transportation. Improper transportation or installation may damage the Module and invalidate the warranty. Do not tread or stand on the Module's packing case or directly on the Module.
For hoisting, lift the Module's packing case upright with its top side facing upwards, to the node of the supporting beam on the roof. Then, unpack the packing case, arrange the in an opposite way, and put them (vertical to the supporting corrugated boards) in the installation area or on standby trays (do not let the connector terminals against the ground). For unpacked modules, do not keeping them on the roof for a long time.
Conduct all operations in a dry environment, and ensure all modules and electrical contacts are clean and dry before installation. If it is unavoidable to keep any uninstalled modules outdoors for a certain period of time before installation, cover them at all times, put them downwards on flexible surfaces, and hang connectors in the air, so as to prevent damage due to internal moisture accumulation of the modules, and inductive arcs caused by the connectors' conduction to the ground.
Unpacking should be done by at least 2 or more operators together. It is prohibited to lift the Module by holding its junction box or cables. It should be handled by two operators together in an upright manner, and not more than two pcs can be stacked together. Do neither place the Module in environments without reliable support or fixation, nor put any heavy or sharp objects on the Module.

2.3 Conventional safety

DAS Solar Lightweight Module conforms to the Application Class II. Modules of this category can be used for systems (DC 50V or 240W or above) accessible to the public.
When the Module is installed on rooftops, the overall fire resistance grade and maintenance of the structure should be taken into account. Any rooftop to be installed with photovoltaic systems must be evaluated by construction experts or engineers with formal analysis results produced for the overall structure to certify that the structure can bear the stress of additional system brackets, including the weight of the Module.
For the sake of your safety, please do not work on the rooftop without proper safety protection, which includes, but is not limited to, protection against falling, ladders or stairs, and personal protective articles. Do not install or handle the Module in a dangerous environment, including but not limited to climates with strong wind or gust, humid or sandy rooftop.

2.4 Electrical performance safety

- Installation personnel shall comply with all safety precautions set out in this manual, local requirements, and regulations of the law and authorized institutions. The operation of the photovoltaic system requires relevant expertise, and therefore the system installation and maintenance shall be performed by qualified personnel with professional skills and knowledge. Any person, if not duly authorized or trained, shall not access the Module and approach the installation area or storage area of it.
- Do not use or repair any damaged Modules. Touching the surface of the Module may lead to electric shocks. Do not disassembly the Module or remove any component of it. Do not focus sunshine on the Module through human efforts.
- Do not connect the anode of any cable to the anode end of a single PV Module. Please ensure that the polarity of any Module or Module series is not reverse to that of any other Module or Module series. Please ensure that there is no gap between the insulating washers of connectors. Otherwise, it may cause fire and/or electric shocks.
- As stipulated by the national electrical code, the maximum system voltage shall not be greater than the certified value of the Module that is used.
- Do not install or handle the Module if its installation area is damp or the weather is windy. The Module is installed by backing adhesive, and thus the paste surface should be kept dry and clean.
- Any damaged junction box and connector may potentially expose electrical hazards and scratch risks. Do neither use any damaged Module, nor disassembly it.

2.5 Operating safety

- In order to prevent damage to the Module, please do neither scrape nor impact the Module, and do not use any paint or glue on its front and back sides. To prevent degradation of the Module's insulation performance, do not scrape or cut the cables and connectors or expose them to the sun for a long time. Take measures to prevent the Module from dropping or any objects from dropping on the Module. Do not put any heavy or sharp objects on the Module.
- If any fire accident occurs, first cut off the power supply and extinguish the fire according to fire protection requirements.
- Please only work in a dry environment and only use dry tools. Do not work in a humid environment without any protective equipment. Do not touch the junction box, connectors, cables and other conductors of the Module without protective measures when the Module is exposed to the sun in spite of the connection condition of the Module with the system.
- Do not directly climb, tread, stand, walk or jump on the packing case or the Module.
- Do not place the front side of the Module onto any platform for dragging.

2.6 Fire safety

Before installation of the Module, please consult local laws and regulations to ensure compliance with relevant fire resistance requirements for buildings. The fire resistance grade of DAS Solar lightweight Module is UL Class C according to the applicable certification standards. The rooftop structure and different installation methods may affect the fire resistance and fire safety performance of buildings. Please use appropriate Module accessories according to local regulations, such as fuse, circuit breaker, and grounding connector. In case of any flammable gas nearby, do not use the Module.

3. Precautions For Handling, Storage And Transport

3.1 Turnover precautions

- Please use a forklift to unload the Module from the truck (two trays of modules at most each time), and place the Module on the level ground.
- Do not stack modules in the project site to prevent collision and damage.
- Please use rainproof fabrics to cover the Module when it is pending for turnover for a long period so as to prevent dampness, and do not unwrap the packing.
- Packaged Modules can be transported by land, sea or air, and make sure the module package will not roll during transportation.
- Turnover. In terms of general transport trucks, at most two modules can be stacked together for transportation.
- When handling or installing the Module, do not support the Module through its back plate, do not carry it on the operator's back, and do not use rope to carry it.
- Do not use tricycle to transport the Module. As for transport in the project site, stacking is disallowed.

3.2 Storage precautions

- Do not expose the Module to rain or dampness. If it is unavoidable to keep any uninstalled Module outdoors for a certain period of time before installation, cover them at all times, make the lightweight Module's cells face downwards and on flexible surfaces, hang connectors in the air, so as to prevent internal moisture accumulation of the Module, and any damage to connectors.
- If long-distance transportation or long-time storage is required, do not remove the original packing of the Module, but use waterproof and shading rain cloth to cover and protect it.
- During installation, keep an eye on any weather condition in the project site, and make possible arrangements to avoid exposure of the Module with packing cases to direct rain and sunlight, and take measures in a timely manner to protect them from rain and sun exposure.
- Warehousing storage (humidity:<70%; temperature: -20°C - +50°C). The static stacking limit of the lightweight modules series is 2 trays.

3.3 Unloading mode and precautions

When unloading the Module from the truck, please use suitable hoisting and handling tools, and handle at most 2 trays of modules each time. Before hoisting, check whether the trays and cartons are damaged or titled, and whether the ropes for hosting are firm and strong. When the hoisted module is landing on the ground, two operators shall hold the carton in the opposite direction at both sides to gently locate and place the carton onto the flat ground. Alternatively, forklift can be used to unload it from the truck on the flat ground.

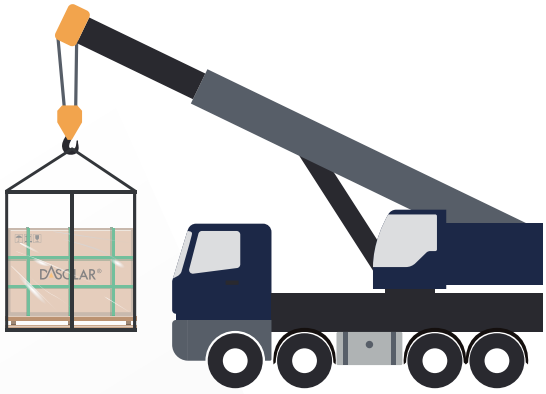
For temporary storage of the Modules in the project site, keep it in a dry and ventilated place, and do not stack several modules in the project site. Instead, use rain cloth to cover them and reinforce them with cloth curtains or mesh belts to prevent them from dampness and rain.

The packing instructions are as follows:

Do Not Discard Recycle Right 	**Do Not Expose To Water** 	**No Stepping On Surface** 
Handle With Care 	**When In Transit Keep Upright** 	**Max Stack** 

Hoisting and handling:

When unloading with hoist, please use specialized tooling, and adopt hoisting tools with sufficient tension according to the weight and size of the Module. During hoisting, please timely adjust the sling and keep the Module's gravity center steady. Please use a wooden board (its width shall be the same with the wooden board) on the top of the packing case or other fastening devices to prevent the sling from crushing the packing case and damaging the Module. Please operate the hoist in a steady rate, and when the hoist is approaching the ground, please hold the case and gently secure it to a relatively level position.

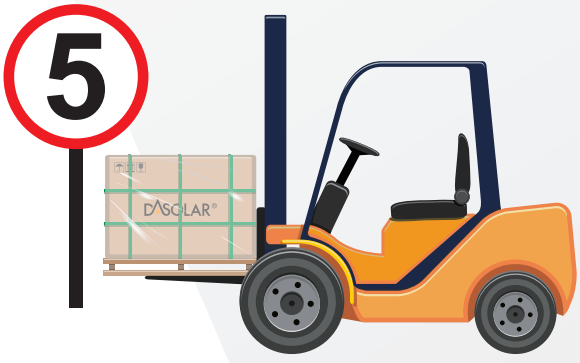


Please do not hoist the Module in any adverse weather conditions, such as strong wind greater than scale 6 (Beaufort scale), heavy snow or heavy rain. At most 2 trays of modules can be hoisted together if they are in horizontal packing.

Handling by forklift:

The height of the handling platform shall be on the same level with the carriage to the greatest extent, and the driving speed of the forklift shall be controlled within 5km/h upon straight running, and 3km/h upon steering. Emergency stop and start shall be avoided.

If the packing case shields the view of the forklift driver, the driver is advised to reversely run the forklift during the handling process, and a specialized person shall be assigned to monitor and provide guidance, so as to prevent collision with any persons or articles and avoid injury accidents or damage of the Module due to drop of the packing case. After transporting the packing case the installation site, please place it on the level and hardened ground.

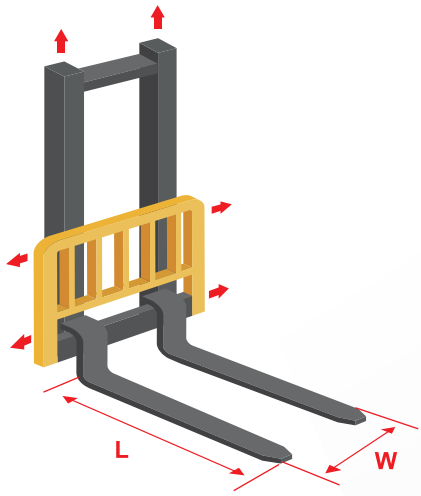


General warehousing forklift:

Please use a forklift with appropriate lifting capacity according to the weight of the Module. The depth of the fork sticking into the tray shall not be less than three fourths of the tray length (length of the fork not less than LN3/4 of the tray length). It is advised to extend the height or width of the forklift load-backrest to prevent direct collision of the forklift with Module glass.

In order to ensure better stability of forklift operation, please make sure that the fork spacing shall be adjusted to the largest extent possible while avoiding collision with the two corners of the tray.

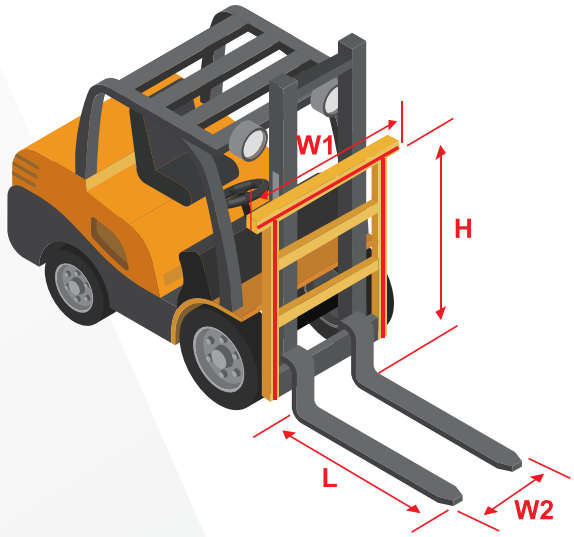
Please slowly operate the forklift, and do not crush the carton or tray. Please provide protective buffering materials beforehand (for the section highlighted in yellow in the figure, silicone, rubber or EPE is recommended) to prevent damage of the Module inside the packing case due to external force.

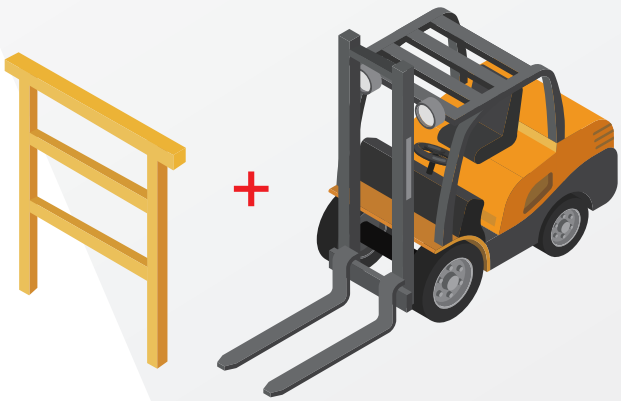


3.4 Project site transport

Project site transport refers to loading and transport of the tray-based Modules from the storage site to the project site after the Modules arrive at the storage site.

Forklift specification requirement: Please uniformly use forklifts with the rated lifting capacity of N3.5t for loading and transfer of the Module, and avoid direct contact of the fork protrusion with the cartons or the Module so as to prevent damage of the Module due to collision.





The fork length (L) shall be N1.0m, and fork interval (W2) shall be adjusted to approach the two corners of the tray to the greatest extent.

The gantry height (H) shall be N1.5m or gantry width (W1) shall be N2.5m.

The gantry shall be vertical to the fork, and the gantry structure shall be sturdy (able to bear the load of N1.5t). When the entire tray of modules is leaned on the gantry, the gantry shall not become deformed due to stress.

The injunction part of the top beam of the gantry and the Module packing shall be protected with buffering materials (silicone, rubber, or EPE recommended), to avoid damage of the Module and profiles by the forklift.

The specification and operating specification of the forklift include but are not limited to the foregoing:

The driver shall operate the fork to slowly stick into the space baseplate and the panel from the long edge side of the tray, avoid colliding with the Module, and make sure that both sides of the fork gantry are approaching simultaneously. When transporting the Module with the forklift, lean its packing case onto the fork gantry, and make sure to fasten the Module with safety ropes featuring the tensile strength of N2000kgf. Upon loading with the forklift, first steadily place the packing case on the ground, and then remove the safety ropes when the tilting risk is negligible. Control the driving speed of the forklift during transport, and slowly withdraw the fork when unloading, so as to prevent tilting.

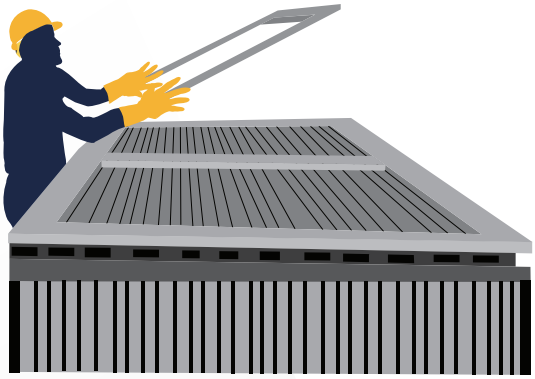
3.5 Secondary transport

- In case of secondary long-distance transportation or long-time storage of the Module, do not remove its original packing. Packaged modules can be transported by land, sea or air.
- During the transport, please securely fix the packing case onto the transport platform, and make sure it will not roll. In case of (for example) land transportation by truck, the stacking limit is 2 layers, and cut-off of the packing straps is prohibited.
- Upon consignment in the project site, please do not remove the original packing, and do not stack modules. During transportation, please fix the packing cases onto the transportation platform to prevent them from rolling.
- Do not use tricycles to transfer the Module, do not use ropes to bind and hold the Module, do not carry it on the back, and do not handle or drag it by its lead wire or junction box.
- When transported through small truck, horizontal packing shall not be stacked together, the four corners of the Module must be fixed onto the truck with safety ropes, and the contact part between the safety ropes and the case must be isolated with corrugated paper or other buffering material. During the transport, the driving speed must be controlled according to road conditions.
- When transporting the Module through a van truck or non-van truck, different trays must be close with each other to leave no space, and any empty space at the rear of the carriage must be stuffed and reinforced to prevent the Module's movement to the rear during transport. When transporting it through a non-van truck, each tray of modules must be fixed onto the truck with safety ropes.
- The tray must be placed within the loading area of the truck.

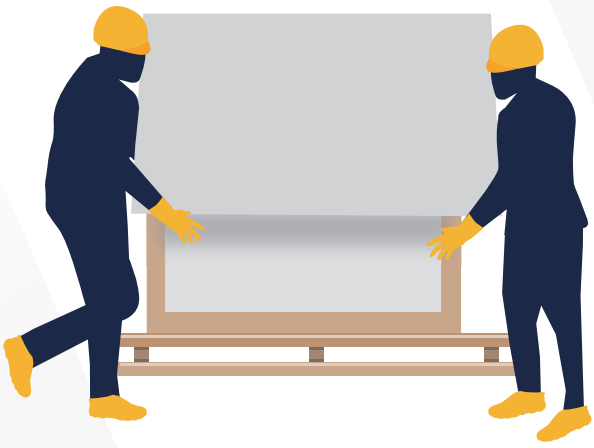
4. Unpacking mode

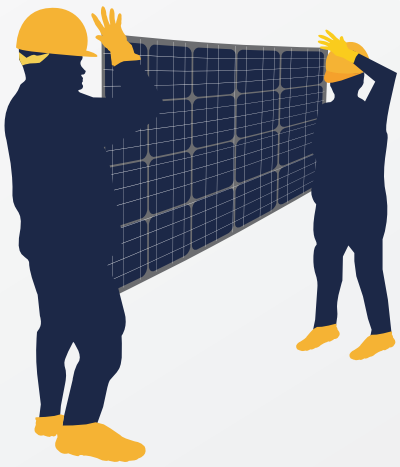
4.1 Precautions

- Before unpacking, please verify the product name and serial number on the A4 paper attached to the outer packing case, and do not use any unauthorized unpacking method.
- For unpacking, please use a knife or scissors to cut off all vertical packing straps (long packing straps first, and short ones second); remove the upper cover of the packing case, and take out two or three upper hoist supports.



- In order to take out the Module from the packing case, two operators shall stand at the opposite sides of the packing case to hold the Module simultaneously (with one hand holding one corner of the Module, and the other hand holding the short side of the Module), and then take out the Module.
- To unpack on flat ground, please take out the Module from one side of the packing case to the other side, and handle it upright by two operators. To unpacking on uneven ground, please use supporting withdrawal tools to prevent tilting of the Module.





- As the Module is taken out from the packing case, do not make it lean on the erection column or place it in an unsupported or unsecured environment.

4.2 Unpacking safety

- Do not handle any module and properly secure and fix any unpacked modules in windy days.
- Do not move the leaning posts during the unpacking process, so as to prevent tilting of the Module.
- Do not carry out outdoor unpacking operations in harsh weather conditions such as rain and snow.
- Take proper protective measures to prevent titling of the whole unit of modules before removing the inner packing straps.
- Unpack it in a place where the packing case is horizontally and steadily placed and tilting can be prevented.
- Do not lean the Module against the installation post. Do not use wooden strips or other items to directly contact and support the rear side of the Module.
- Do not handle the Module by one operator to prevent scratches, deformation or micro-cracks of the Module due to sliding and collision of the Module with other modules. When lifting the Module, do not pull the junction box or cables to take it out.
- Unpack it in strict accordance with the requirements of unpacking instructions. When removing the packing straps of horizontal packing, please provide protective measures to avoid scratching your face or eyes, and avoid standing on the tray during unpacking, but handle the Module from the two sides of the tray.

5. Introduction To Installation Method

5.1 Safety requirements

- DAS Solar Lightweight Module is certified by IEC, and shall be properly disposed according to local laws and regulations upon the expiry of their service life.
- Do not remove the Module's packing, but keep it in the packing case before installation.
- Please only work in a dry environment and only use dry tools to install the Module. Do not work in a humid environment without any protective equipment. Do not install the Module under weather conditions of rain, snow or strong wind. Keep the connectors dry and clean to prevent the risk of electric shocks during the installation. If the terminals of the Module are damp, do not carry out any operation to avoid electric shocks. Please install the Module immediately after unpacking.
- During installation and wiring, do not place the connector terminals against the ground, but keep them hanging in the air, and fully cover the Module with nontransparent materials to prevent electrical loss. Do not disconnect the electrical connections or unplug the connectors if the circuit bears loads. Do not touch the Module if unnecessary after installation. The surface of the Module may become hot, which will result in burn injury or electric shocks.
- Do not install the Module individually, but in a team of 2 or more operators.
- Secure or tie up the cables together after installation to avoid direct sun exposure and thus prevent cable deterioration. Low-hanging cables may cause a variety of risks, such as power leakage at places of impoundment, and fire accident.
- The application class of DAS Solar Lightweight Module is A.

5.2 General requirements

- Lightweight modules should be bond to dry, clean and unweathered color steel tile rooftops, which shall comply with the supporting requirements and binding requirements of certain scenarios. The installation tilting angle should be within 0°-90°, and each module should be installed southwards.
- The rooftop to install lightweight modules shall be flat, smooth, and fold-free. Lightweight modules shall not be installed in any irregular areas and pits of the rooftop, which may deform the surface of the modules when they are bound to the rooftop.
- Before binding a module to the rooftop, use cleaning reagent to clean the mounting baseplate, and use a piece of clean cloth or paper tissue without fiber scraps to wipe the baseplate clean, and make the rooftop completely dry. Ensure that there is no scrap, rubble, dust, oil stain, ice, snow, moisture and other sundries on the rooftop, as they would reduce the binding effect and shorten the service life of the adhesive material.
- In case of any rust on the mounting face, use a steel brush or sandpaper to remove it, and then coat it with industrial anti-rust paint and air dry it before installation.
- The following installation methods of DAS Solar Lightweight Module have passed 2,400Pa load tests.
- In the system design of DAS Solar lightweight Module, the reserved spacing for the junction box terminal is not less than 300mm, the spacing between the Modules' long sides in the array is not less than 10mm, and the distance from the O&M channel or cable trough to the Module array is not less than 500mm.

5.3 Mechanical installation

Neutral silicone structural adhesive is adopted for DAS Solar Lightweight Module, and double-sided tape is sued for auxiliary positioning. It is ideal for the installation on color steel tile rooftops.

5.3.1 Color steel tile installation

A Check the material, size and appearance features of color steel tiles.

Materials: galvanized steel plate, aluminized steel plate, tinned steel plates, or cold-rolled steel plate coated with color PE.

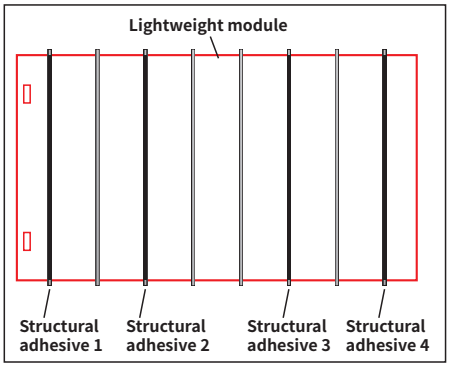
Size and appearance features: trapezoidal color steel tile, angle color steel tile, upright overlock color steel tile.

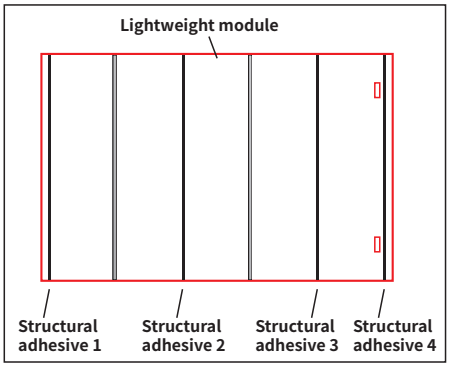
Types of color steel tiles	Trapezoidal color steel tile	Angle color steel tile	Upright overlock color steel tile
Corrugation width (mm)	⩾15	⩾3	⩾3
Corrugation spacing (support interval: mm)	⩽250	⩽430	⩽488

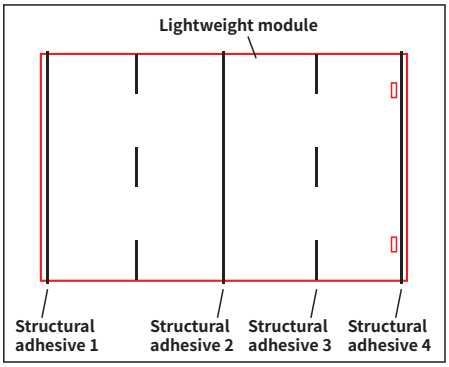
B Prepare the corresponding adhesive material.

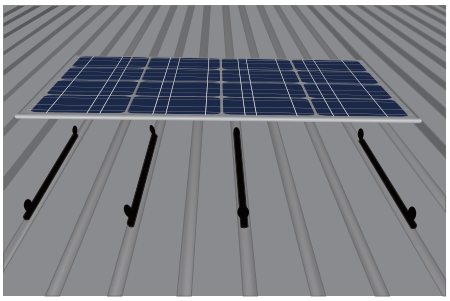
C Upon installation of the lightweight module, equally distribute it from both sides on the corrugation. Please refer to the table below for the binding schematic and construction method selection.

No.	Module model	Specification (mm)	Installation mode	Adhesive application length (mm)	Number of adhesive strips (nr.)	Unit consumption (ML)	Loss rate %	Loss (ML/PCS)
1	DAS-LOJP	1985*1165*9	Double-layer adhesive application 20mm to both ends, and singly-layer adhesive application in the middle Adhesive strip specification: 10*10mm	1165	4	271.0311	5	284.5827
2	DAS-LH132PA	2148*1134*9		1134	4	263.8191	5	277.0100

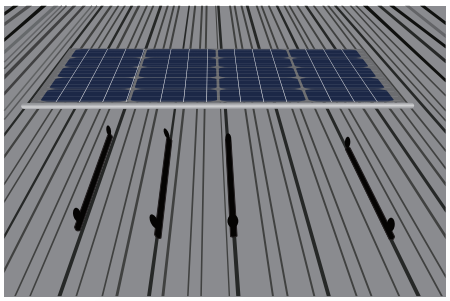




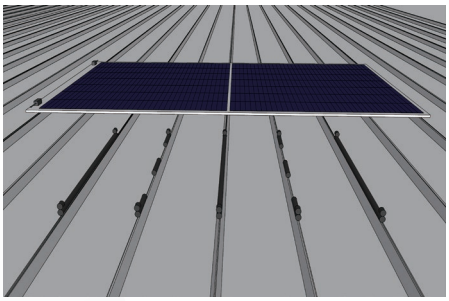




Trapezoidal color steel tile installation schematic



Angle color steel tile installation schematic



Upright overlock color steel tile installation schematic

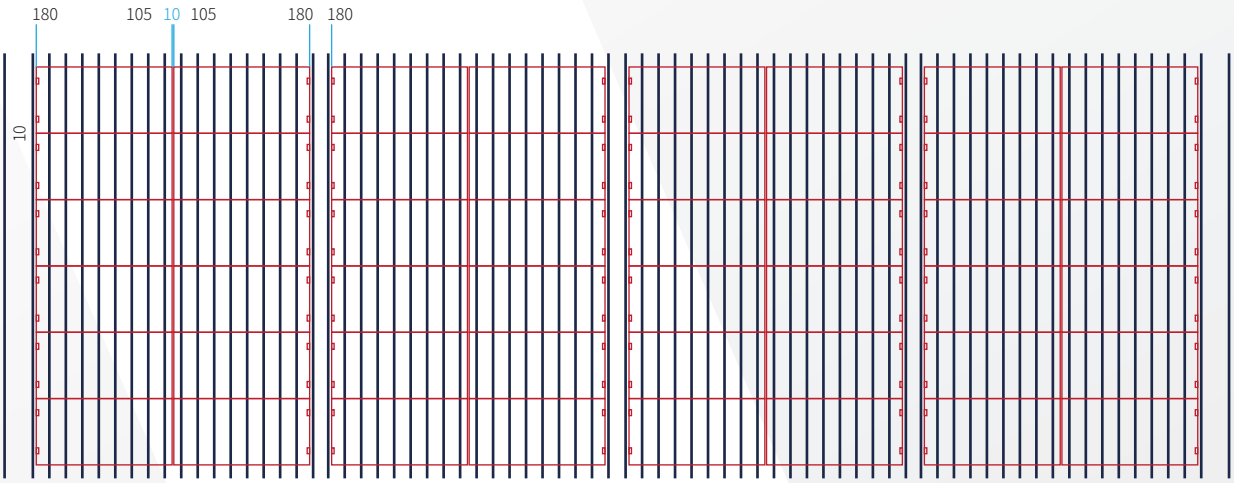
1. Spacing between adjacent supports: ⩽680mm. When the support spacing is greater than 680mm, additional bracing rails are required to meet the installation requirements.

2. The installation operation shall be performed according to the construction temperature requirements and the reference table of construction method selection.

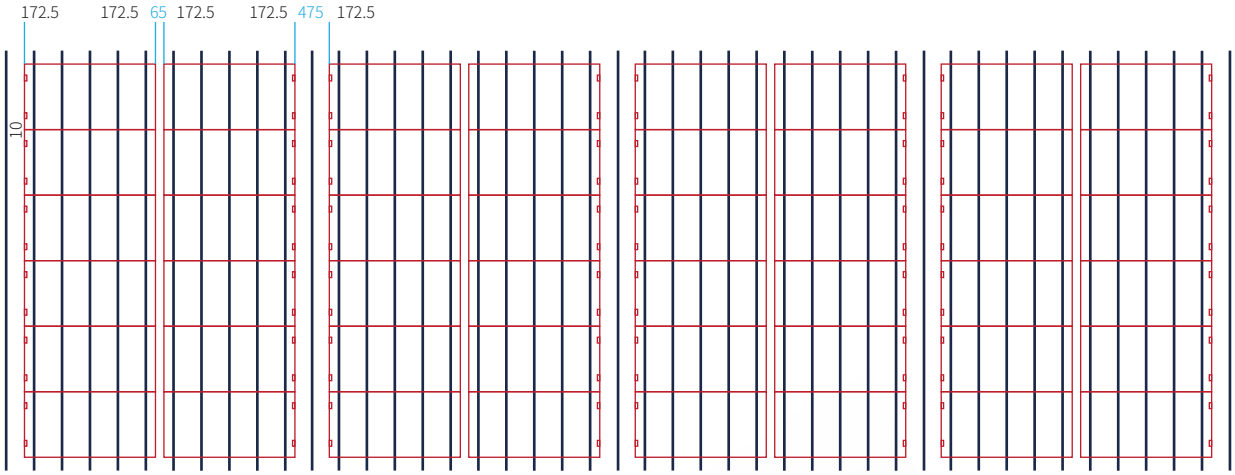
3. Lightweight modules shall be placed in the installation area in an opposite way and be parallel to the supporting corrugation (connector terminals are prohibited from being placed against the ground), and it is recommended to prepare a proper number for installation within 24H.

4. The above binding method is applicable to DAS Solar Lightweight Modules DAS-LOJP and DAS-LH132PA.

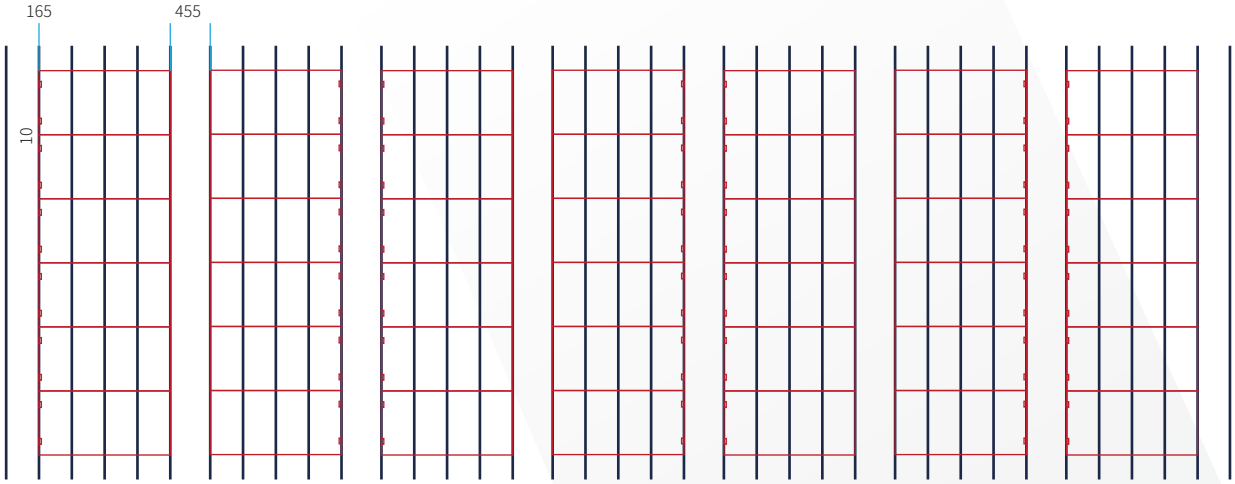
D Lightweight module - horizontal layout.



YX-25-210-840 trapezoidal color steel tile - layout schematic



YX51-410-820 angle color steel tile - layout schematic



RS488 upright overlock color steel tile - layout schematic

1. The Module's long side shall be perpendicular to the peak and valley corrugation of the color steel tile for installation purpose, and the spacing between different module sides shall not be less than 10mm to prevent dust accumulation between modules.

2. For good layout, the Module shall be evenly distributed across the corrugation, with 15-200mm overhead clearance, not less than 300m reserved for junction box terminals, and not less than 500mm for O&M channel or wire trough channel for convenience of system O&M and overhaul.

3. Make sure that cables do not cover any cell area on the front side of the Module, and do not directly place any connector terminal against the ground.

4. Make sure that the Module as a whole is not shaded; otherwise, provide reserve space according to the actual length of the shadow.

5.3.2 Rooftop installation of glass plane/flexible waterproof material

A Check the rooftop, size and appearance features of glass plane/flexible waterproof materials.

B Prepare the corresponding adhesive material.

C Adhesive binding of the Module.

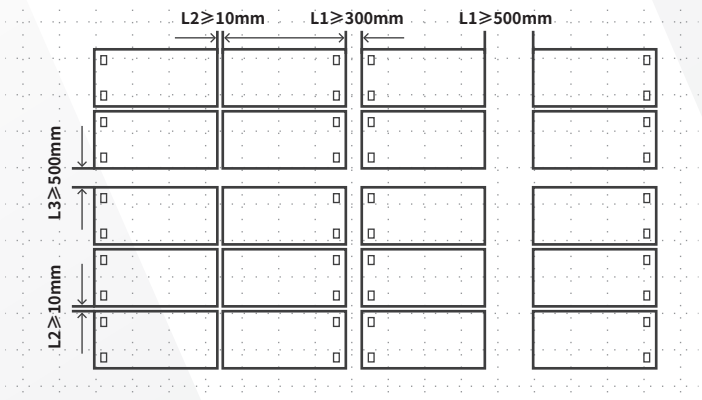
Installation mode: Arrange along the water flow direction on the rooftop, and glue the bracing parts with structural adhesive.

No.	Module model	Spacing between bracing parts' short sides: L1mm	Spacing between bracing parts: L2mm	Adhesive application at the bottom	Adhesive application at the top	Structural adhesive consumption (Ml/pcs)
1	DAS-LOJP	50	615	Adhesive specification: 300*10*10mm Evenly distributed in three segments	Adhesive strip *4, adhesive specification 1,165*10*10mm	504.4313
2	DAS-LH132PA	50	669		Adhesive strip *4, adhesive specification 1,134*10*10mm	496.8592

Structural adhesive:
Apply the adhesive evenly on the upper surface of the aluminum tube, with the adhesive strip's the same long with the short side of the Module. Apply a single layer of adhesive in the middle part and two layers 20mm to both ends in the dimensions of 10*10mm.

Apply the adhesive on the lower surface of the aluminum tube in three segments, with the adhesive strip 300mm long and the specification being 10*10mm.

D Lightweight module - horizontal layout



1. Spacing with the junction box terminal on the top: 300mm.

2. Layout spacing at the rear and inside the array: ⩾10mm.

3. Adjust according to the actual mounting face.

5.3.3 Cement flat rooftop EPS installation

A Check the cement flat rooftop, size and appearance features.

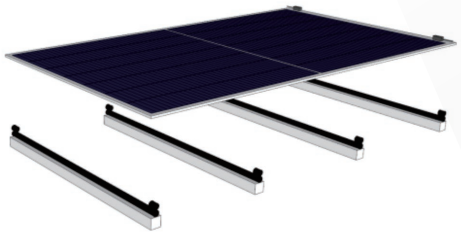
B EPS installation method

No.	Module model	Spacing between the bracing parts and the short side (mm)	Spacing between bracing parts (mm)	Adhesive application at the top	Structural adhesive consumption (Ml/pcs)
1	DAS-LOJP	50	615	Adhesive strip*4 Adhesive specification: 1,165*10*10mm	504.4313
2	DAS-LH132PA	50	669	Adhesive strip*4 Adhesive specification: 1,134*10*10mm	496.8592

C Module installation

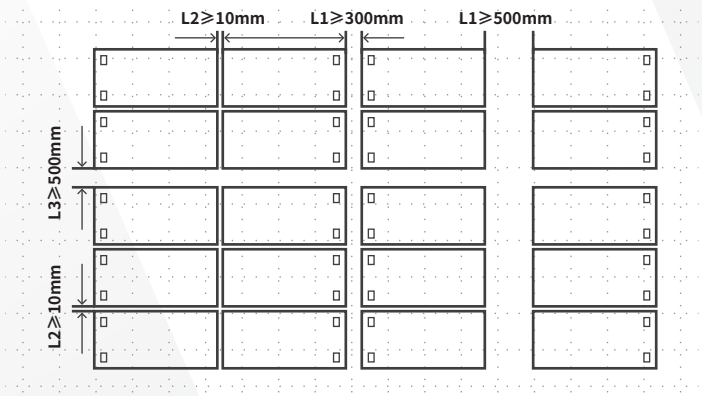
Steps: Mounting face cleaning, positioning and marking, adhesive mixing, adhesive coating, EPS module installation, positioning and adhesive application, Module installation

Horizontal installation: Arrange along the water flow direction on the rooftop, and glue the bracing parts with structural adhesive



Structural adhesive:
Apply the adhesive four times in the middle of EPS, with the adhesive strip's the same long with the short side of the Module. Apply a single layer of adhesive in the middle part and two layers 20mm to both ends in the dimensions of 10*10mm.

D Lightweight module - horizontal layout



1. Spacing with the junction box terminal on the top: 300mm.

2. Layout spacing at the rear and inside the array: ⩾10mm.

3. Adjust according to the actual mounting face.

5.3.4 Lightweight installation

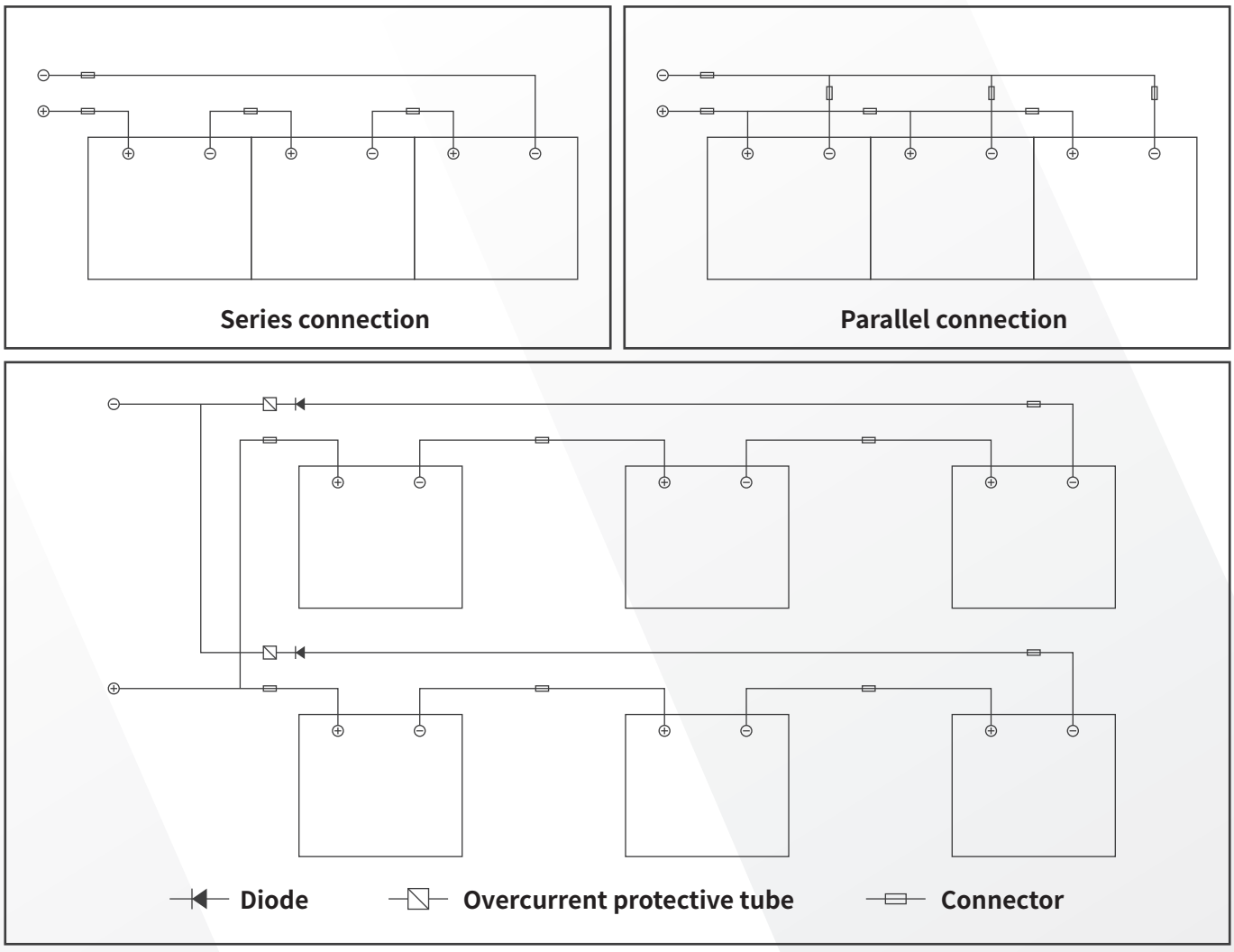
If the materials and types of building rooftops are verified as above, the lightweight modules can be installed with the corresponding adhesive materials. Otherwise, please contact the product development department for evaluation.

6. Electrical Installation

6.1 Electrical performance

There is a deviation of ±3% for the nominal values of the electrical performance parameters of the Module from the standard test conditions (STC), such as Isc, Voc and Pmax, according to the standard test conditions. For the STC of the Module, the irradiance shall be 1,000W/m², cell temperature 25°C, and air mass AM1.5.

When several modules are connected in series, the final voltage is the sum of the voltage of all these modules; when they are connected in parallel, the final current is the sum of the current of all of them. Modules of different electrical performance models shall not be connected in series.



Circuit Diagram of Series Connection and Parallel Connection

For a single series connection of modules, the maximum number of them to be connected in series shall be calculated according to the requirements of relevant regulations, and the open circuit voltage under the expected local minimum air temperature shall not exceed the specified maximum system voltage specified (the maximum system voltage of DAS Solar Lightweight Module is DC1,500V - the actual system voltage is subject to the design of the selected module model and inverter) and the limit values of other DC electrical parts.

The correction factor of the open circuit voltage can be calculated as per the following formula: CVoc=1-βVoc×(25-T). T is the minimum ambient temperature expected in the place of system installation, and β(% /°C) is the temperature coefficient of the selected Module's Voc (refer to the parameters table of the corresponding module).

If the reverse current which may exceed the maximum fuse current of the Module is introduced to the Module, an overcurrent protection device of equivalent specification shall be used to protect the Module. If there are 2 or more parallel connections, one overcurrent protection device must be provided for each parallel connection, as shown in Figure 1.

6.2 Cable and wiring

Modules shall be connected through junction boxes of IP68 protection grade, with safety protection provided for the lead wires and the corresponding connections, and contactable protection shall be provided for non-insulation live parts. The junction box consists of the connected cables and the connectors of IP68 protection grade, making it convenient for series connection of modules. Each single module has two lead wires connecting to the junction box, one for anode and the other for cathode. Two modules can be connected in series by connecting the anode terminal of one module's lead wire to the cathode port of the adjacent module's lead wire.

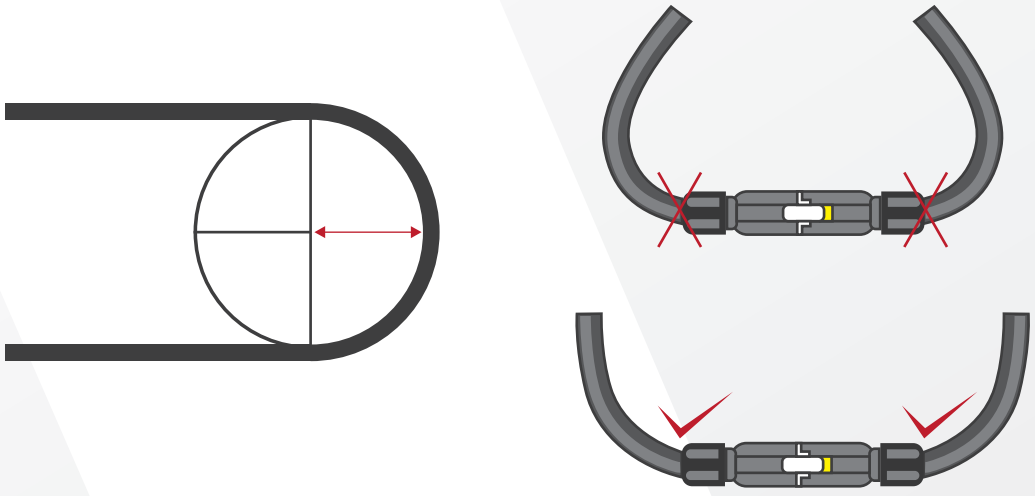
According to local fire protection, architectural and electrical specifications, special solar cables and compatible connectors (electric wires shall be enclosed with anti-aging conduits, and if exposed in the air, they shall be aging-resistant) shall be used, and the cables should have good electrical and mechanical performance.

Only single-wire solar cables (2.5-16mm2 (5-14 AWG), 90°C) can be used, which shall also have good insulation performance to withstand the potential maximum open circuit voltage of the system (as approved in EN50618). Lead wire of appropriate specifications shall be used to reduce the voltage drop.

DAS Solar specifies that all wiring and electrical connections shall comply with the corresponding requirements of the National Electrical Code, and it is prohibited that cable connectors are directly placed against the ground or block any cells.

When the cables are fixed onto the bracket, measures against mechanical damage to the cables or the Module shall be taken. It is prohibited to press the cables with force. Cables shall be fixed on the bracket by special anti-aging binding wires and clips. Though the cables are anti-aging and waterproof, they shall still be prevented from direct sun exposure and rain soaking.

The minimum bending radius of the cables shall be 41.5mm.



6.3 Connector

Keep the connectors dry and clean, and check whether the screw caps of the connectors are tightened before connection. Do not connect the connectors if they are damp, filthy or under any other unfavorable conditions. If the connectors are not coupled, they will not be waterproof. After the Module installation is completed, connect promptly or take appropriate measures to prevent penetration of moisture or dust. Measures shall be taken to prevent the connectors from direct sun exposure and rain soaking, and also from dropping on the ground or rooftop.

Wrong connection may cause electric arcs or electric shocks. Ensure that all electrical connections are secure and that all locking connectors are connected in place.

Connectors of different models are not recommended for use together (please consult DAS Solar if necessary).

6.4 Bypass diode

The cell strings in DAS Solar Lightweight Module are protected by bypass diodes through parallel connection and are encapsulated in the junction box. When there is any local hot spot on the Module, the diodes will start up to detain the main current from going through the cells with hot spot, thereby limiting the Module's heating and performance loss. It should be noted that the bypass diodes are not overcurrent protection devices.

When the diodes really or actually malfunctions, please consult the installation service provider or the system operator and DAS Solar for support. Do not attempt to open the junction box of the Module without authorization.

7. Grounding

7.1 Module grounding

DAS Solar lightweight PV modules are not equipped with metal frames, and thus do not need to be grounded.

7.2 Grounding of other modules

For the propose of grounding, the rooftop lightweight module's bridge frame or inverter bracket will be supported by the building's existing lightning protection and grounding system, with the grounding resistance less than 4Ω, and on-site measurement is required to verify the actual grounding resistance. If the actual grounding resistance doesn't conform to the requirement, artificial grounding poles shall be additionally constructed outside the building.

To create such holes, 2.5m long #5 angle steel shall be erected with certain spacing as vertical grounding poles, and 25*4 hot-dip galvanized flat steel shall be used to reliably interconnect the angle steel. Surrounding the array, a circle of 25*4 hot-dip galvanized flat steel shall be arranged as the lightning protection and grounding grid. Actual measurement shall be conducted during construction, and if the measurement results show non-compliance, additional grounding poles shall be constructed until the requirement is met.

8. Operation and maintenance

8.1 Cleaning

- The power generated by the Module is proportional to the solar radiation received. Modules generate less power if certain cells are shaded, and thus keeping them clean is quite important.
- Clean the Module when the irradiance is lower than 200W/m^2, and use heated water with its temperature close to the air temperature to prevent cell cracking. In case of hard water, it shall be softened for cleaning, and any residual water on the Module surface shall be wiped clean.
- Do not clean the Module in case of scale-4 or stronger wind, major storm or heavy rain.
- When using pressurized water to clean the Module's surface, the water pressure shall not exceed 70kPa, and additional external force to the Module is prohibited.
- Do not tread on the Module and splash water to the rear side and cables of the Module when cleaning it, but keep the connectors dry and clean at all times to prevent electric shocks and fire accidents; do not use any steam cleaners; instead, use a piece of soft cloth or lightweight roller brush to clean the Module with clean water, but do not directly immerse it in water. Take measures to prevent any severe thermal impact which may damage the Module during cleaning.
- If any oil stains and other foreign matters on the Module surface is resistant to cleaning, use neutral non-frictional liquid cleaning reagent instead of organic solutions containing acids or alkali. Do not use corrosive solvent or hard object to wipe the Module.
- If it is not sure as to whether to clean the array or sectional area, start cleaning from a particularly filthy array. If the improvement ratio is lower than 5%, then cleaning is generally not required. The above verification shall be done in a day with a constant sunshine condition (clear day, strong sunshine, without clouds).
- The rear side of the Module dot not need to be cleaned generally. If necessary, take measures to prevent seepage of the cleaning reagent into the substrate of the material.
- Trim the vegetation regularly to avoid the Module from being shaded.
- Water quality requirements:
  - ☑ PH : 5~7
  - ☑ Turbidity : 0~30 NTU
  - ☑ Total dissolved solids : ⩽1000 mg/L
  - ☑ Water hardness : 0~40 mg/L
  - ☑ Chloride or salinity content : 0~3,000 mg/L
  - ☑ Electrical conductivity : 1500~3000 μs/cm
  - ☑ Make sure to use non-alkaline water. Softened water is ideal if possible.

8.2 Module appearance inspection

- Regularly check whether any module in the PV array is damaged, such as functional failure and safety-impacted failures due to factors such as module fracture, cable damage, junction box damage, and if so, replace it with a new one of the same model.
- A well-designed solar generation system rarely requires maintenance, but certain steps can be taken to improve its performance and reliability.
- Well-trained personnel shall carry out maintenance of the system at least every half year. The maintenance personnel shall wear rubber gloves and insulating boots at all times during the maintenance, and remove any coverings which may adversely affect the performance of the Module.
- Check whether the installed hardware is fastened securely.

- Check whether all array fuse wires to each non-grounding pole function well.
- If any module is damaged, replace it with a new one of the same type. Do not touch any live parts of the cables and connectors during the replacement. Use appropriate safety protection articles (insulating tools, insulating gloves, insulating boots, etc.) when handling the Module.
- To replace any module, remove it first from the position without structural adhesive, use cleaning reagent to remove the adhesive, and then install and wire the new one according to the foregoing installation method.
- Use non-transparent materials to cover the front surface of the Module to repair it. The Module generates high voltage when exposed to the sun, which is extremely dangerous.
- Bypass diodes are provided in the DAS Solar Module's junction box, which can minimize the Module's heating and current consumption.

8.3 Connector and cable inspection

Check all cables to verify whether their connection is firm and secure. It is recommended that all cables should be arranged in appropriate conduits, and located away from areas prone to impoundment.

It is recommended to check electrical, grounding and mechanical connection parts every 6 months to ensure that they are clean, secure, and damage- and rust-free; check whether the installed parts and components are properly fastened; and check all cables and ensure their connectors are secure.

9. Release and execution

This document is under the centralized management of, and will be implemented and interpreted by the product development department of DAS Solar.

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