

INSTALLATION MANUAL

for

VSF01M-01x01 to VSF01M-6x12

VSG01M-01x01 to VSG01M-6x18

Verdisol-5 to Verdisol-420

VERSION 2.3

October 2022

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DISCLAIMER

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Verditek Solar Italy shall not be held responsible for damages of any kind including, and without limitation, bodily harm, injury, or damage to property as a result of receiving, unpacking, storing of Verditek Solar PV modules, the installation of modules or PV system, or correct or incorrect adherence to the instructions described in this manual.

Please read these instructions thoroughly before unpacking, storing, installing, connecting, or operating the Verditek Solar Italy modules. All PV modules should be assumed to be electrically active when exposed to any light source and the terminals therefore charged with direct current. Any contact with the terminals could result in injury, death, or damage to property.

1. Introduction

Verditek Solar Italy is extremely grateful for your confidence in purchasing our products. At our manufacturing site in Lainate , Milan, Italy we endeavour to produce the highest quality PV module possible. The instructions and guidance contained in this document are meant to ensure that you proceed safely and professionally with the installation and maintenance of the product.

This manual applies to Solar Photovoltaic Flexible Modules (Hereafter referred to as “Modules”) manufactured by Verditek Solar Italy (Hereafter referred to as “VSI”).

The VSI Modules are intended to be adhered/Laminated to a substrate using a suitable adhesion method

You must carefully read and be familiar with this manual before handling, installing, wire, operate and maintaining. This manual contains important information such as safety, installation, maintenance of modules and other relevant information.

This manual is not in any form or represents or shall be any types of warranty document, expressed or implied. It does not stipulate compensation scheme for any loss, damage or other expenses caused by or generated during installation, operation, or maintenance. VSI assumes no responsibility for any infringement of patents or other rights of third parties, which may result from using VSI Modules. VSI reserves the right to make changes to its products or this manual without prior notice's .VSI is not responsible for any damages caused by inappropriate installation, use or maintenance of VSI Modules including without limitation damages, losses and expenses caused by non-observance of instructions of this manual or caused by or in connection with products of other manufacturers.

Failure to comply with the requirements listed in this manual will invalidate the Limited Warranty for Modules as provided by VSI at the time of sale to the direct customer. Please provide a copy of this manual to the system owner for their reference so to inform them of all relevant aspects of safety, operation, and maintenance.

2. Regulations & Warnings

Under all circumstances, only authorized and qualified personnel should be involved with any aspect of unpacking, storing, installing, connecting, or operating the PV modules or any part of the BBIPV system.

The mechanical and electrical installation of PV systems should be performed in accordance with applicable regional national or international codes where applicable including electrical codes, building codes and electric utility interconnect requirements. Such requirements may vary for adhesion, lamination, and mounting locations. Requirements may also vary with system voltage and or for DC or AC applications. Contact local electrical district network operator/authorities for detailed governing regulations, acquire confirmation and relevant permissions. The following precautions are recommended;

- All personnel should always wear appropriate personal protective equipment (PPE) when on site, typically comprising rubber gloves and boots with maximum working voltage not lower than 1000V DC.
- The site should be prepared to HSE standards meeting local regulations and, in all cases, to address electrical hazards. This should typically include fire extinguishers rated for electrical fires, defibrillator, and first aid kit.
- PV Modules produce electricity whenever exposed to sunlight sources, always treat as live.
- Modules connected in series, voltage is cumulative. When modules are connected in parallel, current is cumulative. As a result, a large scale PV system can produce high voltage and current and shall result in an greatly increased hazard to life.
- Every precaution should be taken to avoid damaging or scratching the front or backside surfaces of a module. In the event of damage, modules cannot be repaired at site and contact with any broken surface could lead to electrical shock.
- The module, junction box and terminals should be protected from soiling or exposure to solvents during handling and installation. Terminal connection should only be made as advised in the electrical installation section of this manual.
- The PV module is delivered complete and ready for installation and connection. Under no circumstances should the cables be altered, the junction box or module integrity opened or changed in any manner.



- It is possible that any PV module under normal operating conditions can produce more current and/or voltage than specified under standard test conditions. Subsequently, any rated values of current or voltage should be tested before connection to any system components, fuse capacity or control systems. Typically, any rated electrical properties should be within ± 10 percent of measured values at Standard Test Conditions of 1000 W/m^2 , 25°C cell temperature and AM 1.5 solar spectral irradiance.
- Fire classification of PV systems vary from country or region and in most cases are required to match the minimum fire classification of the roof, membrane or building on which it is mounted. Verditek PV modules will normally be used as components of PV systems and, although PV modules can receive a fire rating (for example in accordance with UL 1703), the entire system must be consistent to support any warranted fire classification. The VSI module fire rating will be specified in the order form to comply with the applicable quoted standard for the system in which the modules are to be installed.

3. MODULE INFORMATION

3.1 – Nameplate

The nameplate describes the product type, peak power, the maximum power current, the maximum power voltage, open circuit voltage, short circuit current, the maximum system voltage and certification marks.

All the above are measured under standard test conditions (STC).

4. General Safety

Verditek Solar panels comprise silicon wafers embedded in and enclosed in a polymeric laminate. The silicon cells are prepared using silver wiring and connected in series in the panel. The wiring terminates in a junction box with a positive and negative terminal which can be placed on the top or back side of the module depending upon application. The entire module is water resistant and has been tested to work reliably between -40C and +85C. The module efficiency measured at standard irradiance shall be a minimum of 85%.

VSI modules are designed to meet with the requirements of IEC 61215 and IEC 61730. The application class is A. VSI modules also meet the requirement of IEC61730-1 and ICE 61730-2 and qualified for Safety Class II.

Transportation & storage safety: Do not open the original package during transportation and storage until they are ready to be installed. Protect it against damage during transportation. Secure the pallets from falling over. Do not exceed the maximum stack height limit when stacking as indicated by the symbols outside the package. The package shall be stored in a cool and dry location until the modules are ready to be unpackaged. The modules shall be handled at the edge. Never use the junction box or cables as a grip. Do not exert mechanical stress on the cables. Never step on modules or drop or place heavy objects on them. Be cautious when setting the modules down onto a surface, especially on the corner of the modules.

4.1 Operating safety:

When unpacking the modules from the original package, first remove the pallet lid (after removing securing straps, if provided). Remove one module at a time. You may need to secure the remaining modules in the original packaging and prevent them from falling over. Check modules for damage due to transportation before they are installed. Do not install damaged modules. Contact VSI if you need to make claim of the defective products. Do not attempt to remove any part from the modules; do not apply paint to or stick labels on the module surface; do not scratch on module back sheet to avoid any damage. Do not drill holes on the edge. This may compromise the module strength and cause corrosion of the cells; do not attempt to disassemble or modify the modules for your safety. This may have

negative effect on the module quality and safety, even irreversible damage. Additionally, all the warranty will be not available.

The recommended ambient temperature should be within – 40°C to 50°C. Do not apply mirrored, magnifiers or other concentrate light onto the modules.

Before proceeding with an installation, ensure that all local regulatory inspections and approvals are in order and posted at the site. All HSE requirements should be in place to ensure safe working conditions and all personnel appropriately trained and aware of the instructions in this manual. The building structure and roof should have been inspected and local codes consulted to ensure that the structure can tolerate any additional load bearing capacity of the total PV system and loads brought to bear upon the structure during installation.

4.2 Electrical Safety:

In the case that no load or external circuit being connected, photovoltaic modules can produce DC electricity when exposed to light and therefore can produce an electric shock or burn. DC voltage of 30 Volts or higher is potentially lethal. Please use insulated tools and rubber gloves when working with modules in sunlight. Modules have no on/off switch. Modules can be rendered inoperative only by removing them from sunlight area, or by fully covering their front surface with cloth, cardboard, or other completely opaque material, or flipping Modules, and placing the front side of Modules onto a smooth, flat surface. In order to avoid arcs and electric shock, please do not disconnect electrical connections under load. Faulty connections can also result in arcs and electrical shock. So please keep connectors dry and clean and ensure that they are in proper working condition. Never insert any other metal objects into the connector or modify them in any way in order to secure an electrical connection. Do not touch or handle modules with broken cells or damaged back sheet unless the modules are disconnected in advance, and you are wearing proper PPE. Avoid handling modules when they are wet unless cleaning the modules as directed in this manual. Never touch electrical connections that are wet, without PPE or insulated gloves. Reflection from snow or water can increase sunlight and therefore increase current and power. In addition, low environmental temperature can also substantially increase voltage and power.

4.3 Fire Safety:

Consult your local authority for laws and codes; Follow requirements for building or structural fire safety. VSI modules have been listed as Class C according to IEC 61730-2 standard. For BIPV installations VSI shall require modules to be adhered/laminated a minimum 250mm from all edge's to including verge, ridge and eaves of a building. In the event of fire, modules may continue to produce a dangerous DC voltage, even if they have been disconnected from the inverter, have been partly or entirely destroyed, or the system wiring has been compromised or destroyed. In the event of fire, inform the fire crew about the hazards from the PV system, and stay away from the PV system during and after a fire until the necessary steps have been taken to make the PV system safe.



5. Module Attachment

5.1 General

VSI modules must be mounted on buildings or other structures with a suitable substrate for the adhesive solution being applied or via clamp system, this procedure deals with the adhesive mounting method.

The modules are intended to be adhered to the substrate using an adhesive or adhesive tape.. While bonding to the substrate ensure that it shall be clean, free of debris, and dry

Partial or complete shading of a module or modules can significantly reduce system performance. VSI recommends installing modules in the place without shade throughout the year to increase the amount of energy produced by the modules.

VSI recommends installing the modules with a tilt angle of at least 5 degrees, making it easier for dust to be washed off by rain and reduce the time of cleaning; In addition, this will help to drain the water out directly from the surface, avoid watermarks from trapping water on the module surface and affect the appearance and performance of modules

In the northern hemisphere, modules should typically face south, and in the southern hemisphere, modules should typically face north; For detailed information on the best installation angle, please refer to standard solar photovoltaic installation guides or consult a reputable solar installer or systems integrator.

5.2 Bonding of Modules

The roof substrate should be cleaned with a suitable alcohol based cleaning agent, a maximum of 10-20 minutes prior to module bonding, to ensure that the substrate is clean and free of dust and dirt.

An approved list of substrates and applicable glues are show in Appendix 1

Ensure that atmospheric conditions are within the limits set by the adhesive manufacturer



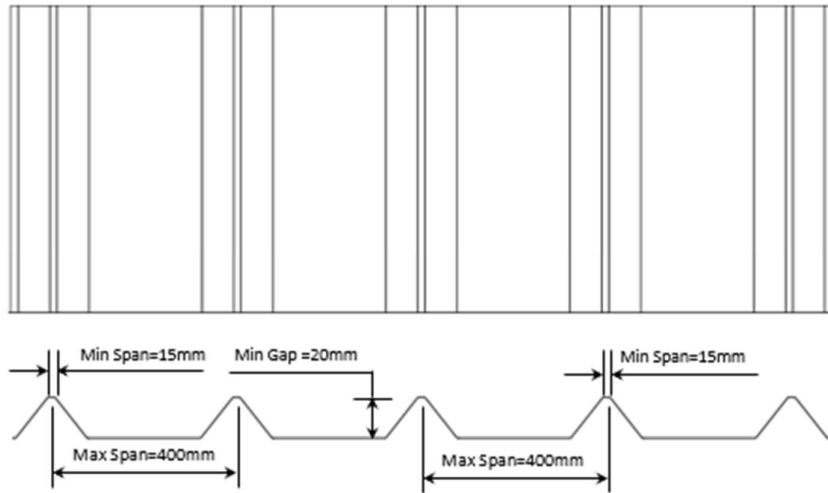


Fig. 1

Ensure that the substrate complies with Fig. 1 and there is a sufficient bonding area between the substrate and the panel.

If the span between the substrate ridges is less than 400mm then there is only the requirement to ensure that the adhesive is applied at least every 400mm.

Prior to applying the adhesive, the surface should be cleaned with the appropriate pre-agent as specified by the adhesive manufacturer and listed in Appendix 1. The surface must be clean and dry prior to the application of the silicon adhesive.

Apply the adhesive in a uniform bead along the designated contact points on the substrate and position the panel in place.

Once complete apply light pressure with a soft polyethylene roller, or similar, to ensure a complete bond.

To maintain the fire rating of the modules do not install 250mm of the roof edge

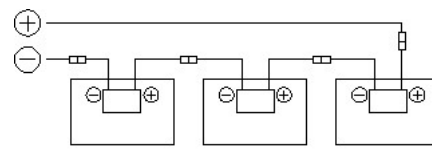
6. Electrical Installation

The deviations always exist between the nominal value and test value in standard test condition of Rated electrical characteristics of module such as I_{sc} , V_{oc} and P_{max} , Standard test Conditions: 1000 W/m^2 Irradiance, 25°C Cell Temperature and 1.5 Air Mass, normally, the value of current and voltage generated from Modules will be probably higher than values under standard test condition. When determining module voltage ratings, conductor current ratings, fuse sizes, and size of controls connected to the PV output, on the basis of highest local temperature, combine with temperature coefficient of current in manual, I_{sc} can be calculated by multiplying by the coefficient of 1.25; On the basis of lowest local temperature, combine with temperature coefficient of voltage in manual, V_{oc} can be calculated. When modules are in series, voltage to be added up; when modules are in parallel, current to be added up.

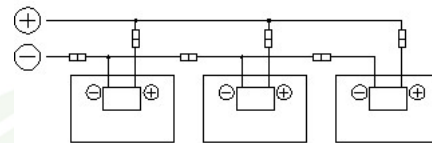
PV modules with different electrical properties can't be connected in series, different electrical components of modules may cause mismatch of electrical connection, make sure to install them in accordance with manual provided by manufacturer.

6.1 Connection type

The maximum number of modules that can be connected in a series string must be calculated in according with applicable regulations in such a way that the specified maximum system voltage (According to IEC61730 tests and appraisal, the maximum system voltage is 1000Vdc or 1500Vdc depending on the series and model.) of the modules and all other electrical DC components will not be exceeded in open circuit operation at the lowest temperature expected at the PV system location. Correction factor for the open-circuit voltage can be calculated based on the following formula: $V_{oc} = 1 - \beta V_{oc} (25 - T)$. T is the lowest expected ambient temperature at the system location. $\beta (\%/^\circ\text{C})$ is the temperature coefficient of the selected module V_{oc} (Refer to corresponding datasheet).



Series wiring



Parallel wiring

An appropriately rated over-current protection device must be used when the reverse current could exceed the value of the maximum fuse rating of the modules. An over-current protection device is required for each series string if more than two series strings are connected in parallel.

The junction boxes have been designed to be easily interconnected in series for a good, connected cable and the connector with IP67 protection grade. Each module has two single conductor wires, one positive and one negative, which are pre-wired inside the junction box. The MC4 connectors at the opposite end of these wires allow easy series connection of VSI modules by firmly inserting the positive connector of a module into the negative connector of an adjacent VSI module.

6.2 Cables

Use approved DC cabling with suitable cross-sectional areas that are approved for use at the maximum short-circuit current of the module. VSI recommends installers use UV resistant and LSOH cables qualified for direct current (DC) wiring in PV systems. Cables should be fixed to the mounting structure or within cable containment in such a way that mechanical damage of the cable and/or the modules is avoided; Do not apply stress to the cables. For fixing, use appropriate means, such as UV resistant cable ties and/or wire management clips specifically designed to attach to the modules. While the cables are sunlight resistant and waterproof, where possible, avoid direct sunlight exposure and water immersion of the cables.

6.3 Connectors

Keep connectors/MC4's dry and clean and ensure that connector caps are hand tight before connecting the modules. Do not attempt to make an electrical connection with wet, soiled, or otherwise faulty connectors. Avoid sunlight exposure and water immersion of the connectors. Faulty connections can result in arcs and electrical shock. Check that all electrical connections are securely fastened. Make sure that all locking connectors are fully engaged and locked.

6.4 Bypass diodes

The junction boxes used with VSI modules contain bypass diodes wired in parallel with the PV cell strings. In the case of partial hot spot, the diodes bypass the current generated by the cells with hot spot, thereby limiting modules heating and performance losses. Bypass diodes are not over-current protection devices. In the event of a known or suspected diode failure, installers, or maintenance providers

6.5 Electrical Characteristics

The electrical characteristics for your panel are detailed on the label on the back of the panel

7. Maintenance and repair

VSI recommends that PV systems shall be periodically inspected by the installer or qualified person.

7.1 Maintenance

The modules are designed for long life and require very little maintenance. If the angle of the Module's or a BBIPV system is installed at 5 degrees or more, normal rainfall is sufficient to keep the surface clean in most weather conditions. If dirt, sand, moss, or bird mess becomes excessive then clean the top surface and BBIPV roofing system as a whole.

Do not clean the module surface with aggressive chemicals, harsh/ scour pads.

In order to ensure the correct operation of the system, the condition of MC4 connectors and wiring should be inspected periodically.

7.2 Repair

VSI Modules do not contain any user serviceable parts. If malfunction occurs or is suspected, then contact your appointed contractor or your local VSI Agent.

8. Contact Details

Europe Verditek Solar Italy Via Pogliano 26 20020 Lainate Milan Italy Email – Enquiries@verditek.com	UK Verditek PLC 29 Farm Street London W1J 5RL Telephone: +44 (0) 7129 1110 Email: Enquiries@verditek.com
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9. Appendix 1 – List of Approved Adhesives and Substrates

Adhesive Type	Suitable Substrates	Pre-Agent
Sika Sikasil SG-20	Aluminium 6065-T5 BlueScope Colorbond steel (excluding matte finishes) Zincalume	Sika Aktivator-205
Tonsan 1527	Aluminium 6065-T5 BlueScope Colorbond steel (Surfmist, Shale Grey, Windspray, Woodland Grey, Monument, Pale Eucalypt, Ironstone, Dune. Excluding matte finishes), Zincalume	Isopropyl alcohol
Sika Sikaflex-292i	Yachts	
Sika Lastomer 18		

Other substrates / adhesives can be approved upon request