



ACTIVESOL

USER MANUAL

Semi-Flexible Solar Panels

NAVY-BLUE XTREME SERIES

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1.0	03.2019	User manual release
2.0	13.08.2026	Double-sided tape (3M VHB) established as primary mounting method; added Safety/OHS chapter; added Handling & Cell Protection chapter; adhesive bonding repositioned as fallback; added Maintenance, Failure Modes and Recycling chapters; expanded common-mistakes and hand-over checklist sections.

IMPORTANT

This manual covers the *Navy-Blue Xtreme* series only. For other panel series, check our website for the relevant manual.

It replaces all previous installation instructions for Activesol semi-flexible panels of this series. Always make sure you're working from the latest revision - available at [Activesol.energy](https://activesol.energy)

Following this manual is a warranty requirement - see Chapter 15.

Table of Contents

Document Control.....	2
Table of Contents	3
Quick Reference.....	5
1. Introduction and Scope	7
2. Safety and Occupational Health (OHS)	7
2.1 Personal Protective Equipment (PPE)	7
2.2 Chemical Safety	7
2.3 Electrical Safety	8
2.4 Working at Height and on Deck	8
2.5 Environmental Working Conditions	8
3. Handling and Protecting the Panel	9
3.1 Unpacking.....	9
3.2 General Handling Rules	12
3.3 Walk-On Installations.....	13
3.4 Protective Film.....	14
4. Substrate Requirements.....	15
4.1 Substrates with Special Requirements	15
4.2 Substrate Types – Requirements	16
5. Mounting materials.....	18
6. Electrical Connection - Overview and Diagrams.....	20
6.1 Single Panel System.....	20
6.2 Series Connection	21
6.3 Parallel Connection	22
6.4 Individual MPPT per Panel.....	23
7. Ventilation and Water Drainage – Critical Rules.....	24
8. Most Common Installation Mistakes	26
8.1 Trapped air under the panels	26
8.2 Missing expansion joints.....	27
8.3 Tension on cables or fasteners left under the panel.....	28
8.4 Damage to panel cable insulation.....	28
8.5 Other frequent errors	29
9. Installation Method A - Double-Sided Tape (Recommended Method)	30
9.1 Key Installation Information	32

9.2 Installation Procedure	32
10. Installation Method B - Adhesive Bonding (Alternative Method)	35
10.1 Approved Adhesive Systems	35
10.2 Substrate Preparation	35
11. Strip Bonding.....	36
12. Pre-Hand-Over Checklist.....	37
13. Maintenance	38
13.1 Routine Cleaning	38
13.2 Periodic Inspection.....	38
13.3 Structural Check.....	38
14. Possible Failure Modes	39
14.1 Fractured Cells	39
14.2 Water Ingress into Junction Box or Connector	39
14.3 Hot-Spots	40
14.4 Reduced Output / Charge Controller Issues	41
15. Warranty Notice.....	42
16. Technical Support and Contact	43
17. Recycling and Disposal	44

Quick Reference



ACTIVESOL

NAVY-BLUE XTREME SERIES

THIS PAGE IS A SUMMARY ONLY - READ THE FULL MANUAL BEFORE STARTING WORK

This quick reference lists critical parameters only. It does not replace the full installation manual. Always read all chapters before starting any installation. Incorrect installation may cause panel damage, personal injury, and will void the product warranty.

PROHIBITED

Minimum bending radius	1 000 mm (1 m)
Cutting/drilling through panel	Never – damages the panel and voids the warranty
Sharp / heavy objects on panel	Never - fractures cells
Modifications to the panel	Never – voids the warranty
Bad weather installation	Do not install in rain, snow, strong wind, or when substrate temperature is below 10 °C.

HANDLING & INSTALLATION

Factory installed VHB Tape application temperature	10 °C - 38 °C
Glue application temperature	See chapter 10
Minimum crew for installation	2 persons
Substrate condition	Clean, dry, grease-free - no paint flakes, no moisture
Prohibited installation areas	- Spherical (multi-axial) or highly curved substrates - Permanently or significantly shaded areas - Low surface energy materials, thermally and mechanically unstable substrates - Areas exposed to excessive heat, chemicals, mechanical stress, impact, or vibration, such as locations near HVAC exhausts, stair edges, or engines.
Spacing panel to panel	Minimum 4 mm - mandatory

Spacing panel to object	Minimum 4 mm - mandatory
Handling	• Always use both hands when handling the panel • Hold the panel along the long edge and keep it vertical • Handle the panel slowly, avoid putting local tension with your fingers while holding • Try to avoid direct contact with solar cells • Never throw the panel • When putting panel on horizontal surface, avoid bending, local tension • Kneeling on the panel only acceptable when board is used to distribute bodyweight evenly For more details check Chapter 3
Protective film (if available)	Must be removed before first exposure to sunlight
Walking on	Only walk on panels barefoot or in soft-soled shoes.

IMPORTANT SAFETY INFORMATION

Series Connection	Increases voltage, 2+ panels can produce lethal voltage
Parallel Connection	Increases current – reverse current risk, blocking diodes or fuses mandatory when connecting 3 or more strings in parallel
Always live	No off switch - panels generate power in any light, cover to de-energise
Surface temperature	Can cause burns - disconnect if abnormal heat detected
Partial shading	Constant shading can create hotspots – risk of permanent cell damage
Electrical work	Qualified electrician with attention to local regulations and standards
Ropes and lines	Keep halyards, sheets, and other running rigging away from the panel surface. A heavy or whipping line can scratch the top layer or crack the cells beneath.

Always read the complete manual before starting installation - this summary does not replace any chapter.

1. Introduction and Scope

This manual covers everything you need to know about handling, installing, and maintaining Activesol *Navy-Blue Xtreme* semi-flexible solar panels. The series is designed primarily for marine use - yachts and sailing boats - but is equally suitable for campervans, vans, and other mobile platforms.

It is intended for qualified installers, boat builders, and anyone responsible for fitting solar panels to a hull, deck, roof, or similar structure.

The manual covers substrate assessment, surface preparation, tape and adhesive mounting methods, ventilation, common mistakes, maintenance, failure modes, and a pre-hand-over checklist.

Electrical design, cable sizing, charge controller selection, and battery integration are outside the scope of this manual. All electrical work must be carried out by a qualified electrician in accordance with applicable local standards.

2. Safety and Occupational Health (OHS)

Installation work involves chemical products, manual handling, electrical hazards, and - on yachts in particular - work at height, on unstable surfaces, or near water. The following rules apply to everyone involved in the installation.

2.1 Personal Protective Equipment (PPE)

- Nitrile or chemical-resistant gloves must be worn at all times when handling IPA, primers, activators, and adhesives.
- Safety glasses are required when cutting, sanding, or applying primers/activators that may splash.
- Use a respirator with organic vapour (A-type) filters when working in enclosed or poorly ventilated spaces (e.g. below deck, inside a van).
- Non-slip footwear must be worn when working on a yacht deck or curved/wet surfaces.

2.2 Chemical Safety

- IPA, primers, and activators are flammable. Keep away from open flames, sparks, and hot surfaces (engine compartments, exhaust systems).
- Always consult the Safety Data Sheet (SDS) of each product before first use.
- Work in well-ventilated areas. Vapours from activators and adhesives must not accumulate in enclosed spaces.
- Store chemicals upright, sealed, and away from direct sunlight and heat sources.
- Dispose of soaked rags, gloves, and empty cartridges according to local hazardous-waste regulations. Do not discard in general waste.

2.3 Electrical Safety

- A photovoltaic panel generates voltage as soon as it is exposed to light - even diffuse daylight. Treat all terminals and cables as live.
- Any mechanical damage to the panel may compromise the electrical insulation and create a shock or fire hazard. A damaged panel must be disconnected and removed from the system immediately. Do not attempt to repair a damaged panel. Damaged panels must never be installed.
- Disconnect and isolate all relevant electrical circuits (battery bank, charge controller, panel string) before drilling, cutting, or routing cables through the hull/roof.
- Never carry out electrical connection work in wet conditions or with wet hands.
- Verify that StealthLink connector holes are sealed against water ingress before powering up the system - see Chapter 9.
- Do not bypass, modify, or remove factory-fitted bypass diodes or connectors.

2.4 Working at Height and on Deck

- When working on a yacht deck, hull side, or camper roof, use appropriate fall-prevention measures (harness, guard rails, scaffolding) in line with local OHS regulations.
- Never work alone at height or over water - a minimum of two people is required for installation, both for quality and for safety reasons.
- Ensure the work surface is dry - tape liner offcuts and adhesive cartridges can be slippery underfoot.

2.5 Environmental Working Conditions

- Do not apply tape, primer, or adhesive outside the temperature ranges specified in Chapter 5 - outside these ranges, adhesion and curing will be compromised.
- Avoid installation in direct, intense sunlight on dark gelcoat/substrates exceeding 50 °C surface temperature, and in rain, fog, or high humidity unless the product datasheet explicitly allows it.
- Do not install in high wind conditions where panels or liners may be lifted or contaminated by airborne debris.

PROHIBITED

Smoking or using open flames near IPA, primers, or activators.

Working on energised electrical circuits.

Installing alone, without a second operator, at height or over water.

Using chemicals beyond their stated shelf life or outside their datasheet temperature range.

Removing or bypassing the panel's bypass diode or connector housing.

3. Handling and Protecting the Panel

Photovoltaic cells are fragile. The *Navy-Blue Xtreme* panel construction protects them provided certain precautions are observed at all stages - from unboxing through installation.

3.1 Unpacking

Before unpacking, inspect the outer packaging for any visible damage and report it to the carrier if found.

Open the packaging by cutting along the tape lines only.



With the box lying flat, slide the panel out horizontally. The cardboard insert beneath the panel supports it during extraction - do not remove the insert yet.



To move the panel before separating it from the insert, lift by gripping the cardboard insert - not the panel itself. The insert acts as a rigid carrier and prevents the panel from flexing during transport.



When setting the panel down, support it from underneath with one hand to keep it flat. Do not allow it to rest on its edge or bend under its own weight.



After cutting the tape that secures the panel to the insert. Again - support the panel from underneath with one hand before lifting. The panel will flex without support - even a brief unsupported bend can crack cells.



When removing the bubble wrap, keep one hand on the panel at all times.



Correct grip: hold the panel together with the cardboard insert. The insert can be used as a carrying platform throughout unpacking.



Correct: one hand supports the panel from underneath, preventing unwanted flex.



Correct grip on the panel alone: hold along the long edge, panel vertical.



Incorrect grip: holding only at one point causes localised bending. This can crack the cells directly beneath the flex point.



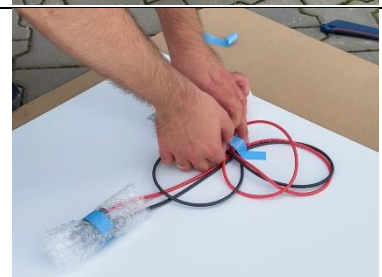
The panel may be placed face-down on the cardboard insert or clean packaging material.



Never place the panel face-down on an unprotected or abrasive surface.



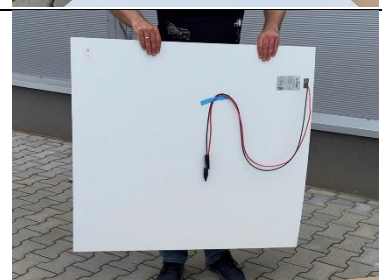
Carefully release the cables from the retaining tape. Do not pull - peel the tape back slowly.



Never pull the panel by its cables. Cables are not structural - any tension at the cable exit point can damage the internal connection.



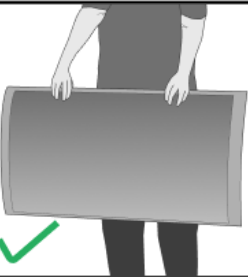
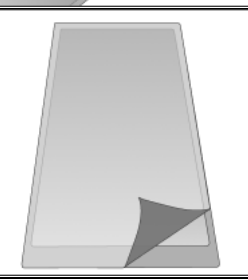
If the cables have been released and the panel needs to be moved again, re-secure the cables with tape before lifting.

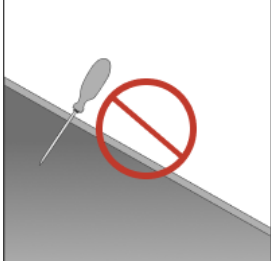
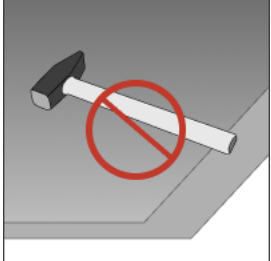
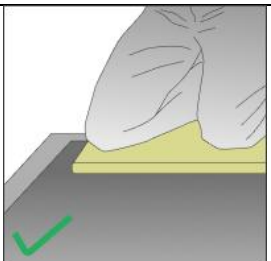
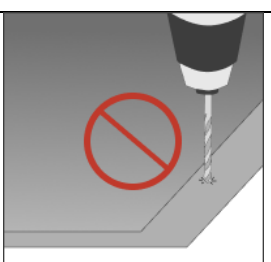
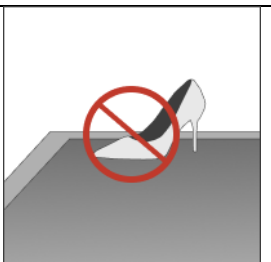


Never carry or reposition the panel with loose cables hanging free - they will drag on the ground and risk snagging or damaging the connector ends.



3.2 General Handling Rules

Activesol semi-flexible panels must not be rolled up or folded. The maximum permitted curvature is a radius of 1 m. Exceeding this limit will crack cells and voids the warranty.	
When lifting or carrying a panel, hold it along the long edge and keep it vertical. Do not grip the panel by the short edges only, as unsupported flexing can fracture cells. Avoid direct contact with the cells.	
When moving a panel, ensure cables are gathered and secured before lifting. Never allow cables to drag on the ground during transport or repositioning.	
Do not hold, carry, or support the panel by its cables or connectors. Cables are not structural components - mechanical stress on them may damage internal connections.	
Never walk or stand on an uninstalled panel. Walking is permitted only on panels from approved walk-on series that are fully bonded to a rigid substrate and completely cured.	
If a protective film is present on the panel surface, it must be removed before first exposure to sunlight.	

If sharp or heavy objects fall onto the panel during installation, inspect for cell fractures before proceeding (see Chapter 13 - Failure Modes).	
Do not apply point loads to the panel surface - avoid resting tools, fasteners, or other hardware directly on the face.	
If it is necessary to kneel on an installed panel during maintenance, use a wide, rigid board to distribute body weight evenly across the surface. Never kneel on an uninstalled panel.	
Any drilling, cutting or puncturing permanently damages the panel and voids the warranty.	
Only walk on panels barefoot or in soft-soled shoes. Hard soles or heels concentrate pressure and can crack the cells beneath.	

3.3 Walk-On Installations

Walking is permitted exclusively on installed **Navy-Blue Xtreme** panels that are fully bonded to a rigid substrate and completely cured. For other Activesol panel series, check the relevant product documentation before walking on them.

A panel may be walked on only when all of the following conditions are met:

- The panel is permanently bonded to a smooth, rigid substrate adhesive, with no gaps, voids, or irregularities underneath.
- The substrate surface must be solid and load-bearing.
- The panel does not flex when weight is applied - the bond between panel and substrate must be complete and fully cured.

When walking on an installed panel:

- Go barefoot or wear soft-soled shoes only. Hard soles, heels, or shoes with rigid inserts must not be used on panel surfaces.
- Avoid sudden impacts, jumps, or dragging equipment across the panel surface.
- Panels mounted on curved surfaces must not flex when walked on, even if the curve is within the 1 m radius limit.

NOTE

Walk-on capability applies to the panel's structural integrity only. It does not indicate that the panel surface provides adequate slip resistance in wet conditions - evaluate the specific anti-slip finish of your panel series before designating it as a walkway.

3.4 Protective Film

Some Activesol panel series are shipped with a transparent protective film applied to the front (sun-facing) surface. This film must be removed before the panel is put into service.

- Check whether your specific panel has a protective film before installation.
- Remove the film carefully by peeling from one corner - do not use blades or abrasive tools.

CRITICAL - REMOVE PROTECTIVE FILM BEFORE FIRST USE

Failure to remove the protective film before exposure to sunlight can cause the film to permanently bond to the panel surface, causing irreversible optical and power-output damage.

This type of damage is **NOT** covered under warranty.

It is recommended to remove the film after installation is complete and before commissioning, to protect the surface during the mounting process.

4. Substrate Requirements

Before starting any installation, the substrate must be assessed against the criteria below. Substrate type determines the mounting method, the materials required, and in some cases whether installation is permitted at all.

Substrate must be clean and dry at the time of bonding - any contamination, moisture, or residue will prevent proper adhesion

Allow sufficient time for the substrate to reach ambient temperature before installation. Cold surfaces brought into a warm environment, such as vehicle bodywork moved into a heated workshop will develop condensation that is not always visible.

SILICONE CONTAMINATION - INCOMPATIBLE SURFACE

Substrates that have previously been in contact with silicone-based products (sealants, lubricants, release agents) are not suitable for bonding with double-sided tape or any adhesive/sealant used in this instruction - this applies to hybrid STP adhesives (Sikaflex-522, Sikaflex-591). Silicone residue cannot be fully removed by cleaning and will prevent proper adhesion, regardless of the adhesive chemistry used.

4.1 Substrates with Special Requirements

The following substrate categories require special attention and may need additional preparation, alternative materials, or technical consultation before installation:

- Surfaces with low surface tension (e.g. PE).
- Substrates with a very low or very high linear thermal expansion coefficient (CTE).
- Highly curved surfaces (radius of curvature below 1 m) or surfaces curved in multiple directions (e.g. spherical).
- Substrates with a small effective contact area (e.g. finished with a deep anti-slip structure).
- Unstable substrates (e.g. fabrics).

Activesol *Navy-Blue Xtreme* series panels have a linear thermal expansion coefficient of CTE = 13×10^{-6} 1/K.

Detailed notes

- Substrates with low surface tension may require additional surface treatment or specialised adhesives to achieve reliable adhesion.
- Substrates with extreme CTE values may require thicker or more elastic bond lines / expansion joints.
- On substrates with low contact area (e.g. deep anti-slip texture), the bonding material only touches a limited portion of the surface, which increases the demands placed on the joint.

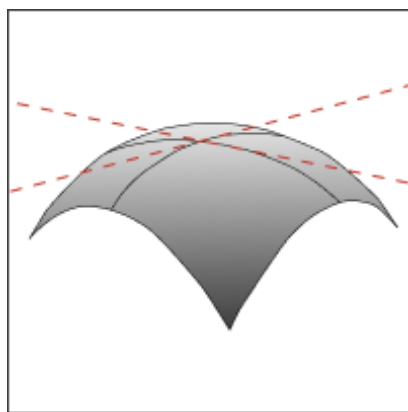


Fig. 1 – Multi-axial curvature Surface

DO NOT

Mounting on highly curved substrates ($R < 1\text{ m}$) or substrates with multi-axial curvature is not recommended. It risks damaging the cells and degrading the performance or safety of the system.

4.2 Substrate Types – Requirements

Substrate material	Substrate type	Remarks
GFRP with/without gelcoat	Smooth surface	3M VHB tape with primer applied along the bounding edges is required. Edge sealing for moisture protection is optional.
GFRP with/without gelcoat	Fine anti-slip structure	3M VHB tape with primer applied along the bounding edges is required. Edge sealing for moisture protection is optional.
GFRP with/without gelcoat	Deep anti-slip structure	Due to the reduced contact surface on deep anti-slip substrates 3M VHB tape with primer applied over the full bonding area is required. Edge sealing for moisture protection is required.
Fabrics	Unstable substrates (fabric)	Installation is only possible for <i>Navy-Blue Bimini</i> panels, fixed with Loxx fasteners. The fabric must be properly tensioned to avoid exceeding the panel's minimum bend radius. Do not install panels directly above bimini frame members, joints, or any rigid substructure. Localised pressure from underneath will crack the cells.
Other	Other	Non-standard substrates require contact with Activesol.



Fig. 2 - Fine anti-slip surface structure



Fig. 3 - Deep anti-slip surface structure

5. Mounting materials

Only the materials listed below may be used. Any substitution requires prior written approval from Activesol. 3M VHB tape is the recommended solution for the majority of applications - see Chapter 9.

NOTE

Adhesives and tapes require curing time before reaching full strength. Cure time depends on temperature and humidity. Always refer to the manufacturer's current technical datasheet for exact figures.

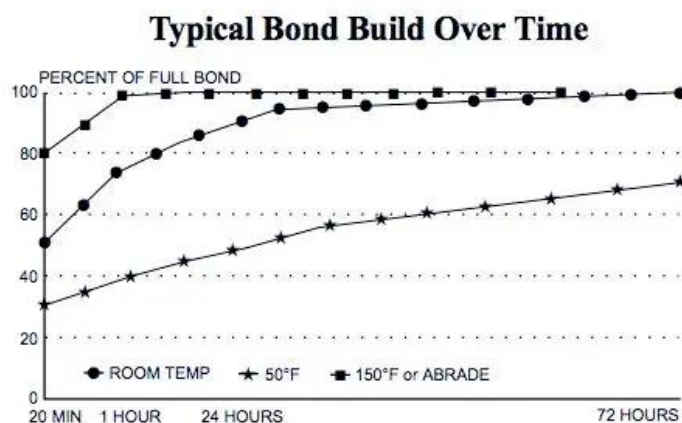


Fig. 4 - Typical bond strength build-up over time for 3M VHB tape (source: 3M)

Name	Type	Application temperature	Remarks
3M VHB GPH-110F	Adhesive tape	10 °C - 38 °C	Recommended factory-applied solution. Apply in accordance with Chapter 9
3M Primer 94	Primer	15 °C - 27 °C	Recommended to improve adhesion. Used with 3M VHB tape. Apply in accordance with Chapter 4.2
Sikaflex 522	Adhesive	5 °C - 40 °C	Apply in accordance with Chapter 10. One of the following approved combinations must be used: • Sika Primer 507 + Sikaflex 522 • Sika Primer 507 + Sikaflex 591 (<i>marine certified</i>) • Sika Aktivator-205 + Sikaflex 522 • Abrasive fleece + Sika Aktivator-205 + Sikaflex 591 (<i>marine certified</i>)
Sikaflex 591	Adhesive	5 °C - 40 °C	
Sika Aktivator-205	Primer / activator	5 °C - 40 °C	
Sika Primer-507	Primer	5 °C - 40 °C	

Factory-Applied Tape

Activesol panels are supplied with 3M VHB GPH-110F double-sided tape factory-applied to the panel backsheet, unless otherwise specified in the order. To improve adhesion on demanding substrates, 3M Primer 94 is recommended on the substrate surface, applied in accordance with Chapter 4.2.

Activesol takes full responsibility for the panel-to-tape interface on panels supplied with factory-applied tape. This responsibility applies exclusively to panels where the tape was applied at our production facility as part of the manufacturing process.

Activesol does not take responsibility for the tape to substrate interface. Proper substrate preparation and the quality of the tape to substrate bond remain the sole responsibility of the installer. For this reason, panels with integrated factory-applied tape are the recommended solution.

Adhesive Bonding

Activesol panels have been tested with Sikaflex 522 and Sikaflex 591. To ensure sufficient adhesion at the adhesive-to-panel backsheet interface, one of the approved combinations must be used.

Substrate preparation on the substrate side must follow the adhesive manufacturer's (Sika) documentation for the specific substrate material.

In both tape and adhesive installations, trapping air pockets beneath the panel is strictly prohibited. Any air bubble sealed under the panel will expand under heat and cause localised bulging and permanent deformation of the panel surface.

RESPONSIBILITY NOTE

The adhesives and tapes listed above have been tested and approved by Activesol for bonding to the Activesol panel backsheet only. Compatibility with the specific substrate (hull laminate, deck coating, GRP, aluminium, etc.) must be assessed and confirmed by the installer before use. Activesol accepts no liability for adhesion failures on the substrate side, for installation workmanship, or for any consequential damage arising from incorrect substrate assessment or preparation.

6. Electrical Connection - Overview and Diagrams

This chapter provides an overview of the main electrical connection configurations for Activesol photovoltaic panels. Electrical installation must be carried out by a qualified technician in accordance with local standards. This chapter does not replace a full electrical design - use it as a reference for system configuration selection. Always read the charge controller manufacturer's manual before installation. It will contain detailed wiring diagrams, configuration steps, and safety requirements specific to your controller.

GENERAL RULES

Use MPPT (Maximum Power Point Tracking) charge controllers for maximum energy harvest.

Cable cross-section must be sized for the maximum current and run length - consult a qualified electrician.

Always use UV-resistant, marine/automotive-grade cable rated for PV installations.

When sizing cables and selecting system components, always account for voltage at temperature extremes. Voc increases at low temperatures - this must be factored into the maximum system voltage calculation to avoid exceeding component ratings.

6.1 Single Panel System

One panel feeds a single MPPT controller, which charges the battery bank. The load is powered from the battery.

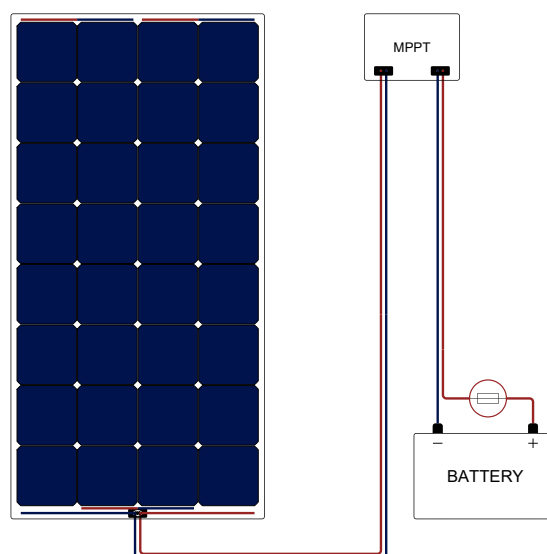


Fig. 5 - Single panel System

6.2 Series Connection

Two or more panels connected in series increase the system voltage while keeping current the same. The total voltage is the sum of individual panel voltages. Only panels with identical short-circuit current (I_{sc}) may be connected in series. Series strings are sensitive to partial shading - if any section of any panel in the string is shaded, the output of the entire string drops significantly.

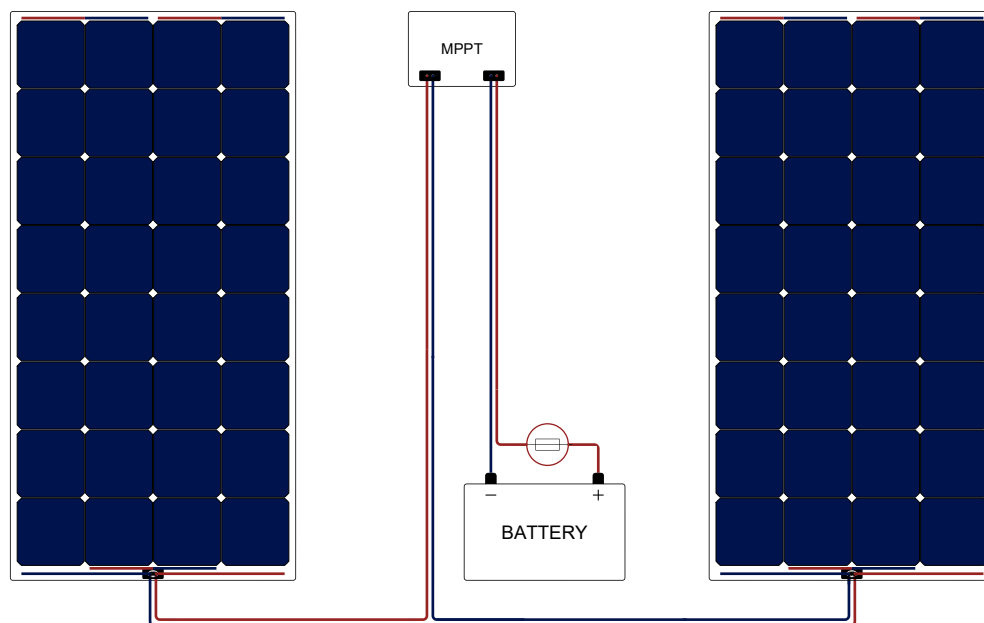


Fig. 6 - Series connection

SERIES WARNING

Only connect panels with identical I_{sc} (same cell type and model) in series.

Panels connected in series must face the same orientation and tilt angle. In the event of partial shading, the bypass diode activates to protect the affected panel.

6.3 Parallel Connection

Two or more panels connected in parallel increase the system current while keeping voltage the same. Parallel strings must have closely matched voltages, a reasonable tolerance is $\pm 5\%$ between strings. Cable length affects voltage drop, so panels located further from the controller will produce slightly lower voltage at the connection point - this must be accounted for during system design. Blocking diodes or fuses on each positive wire are required when connecting three or more strings in parallel. For two strings in parallel, such protection is not mandatory.

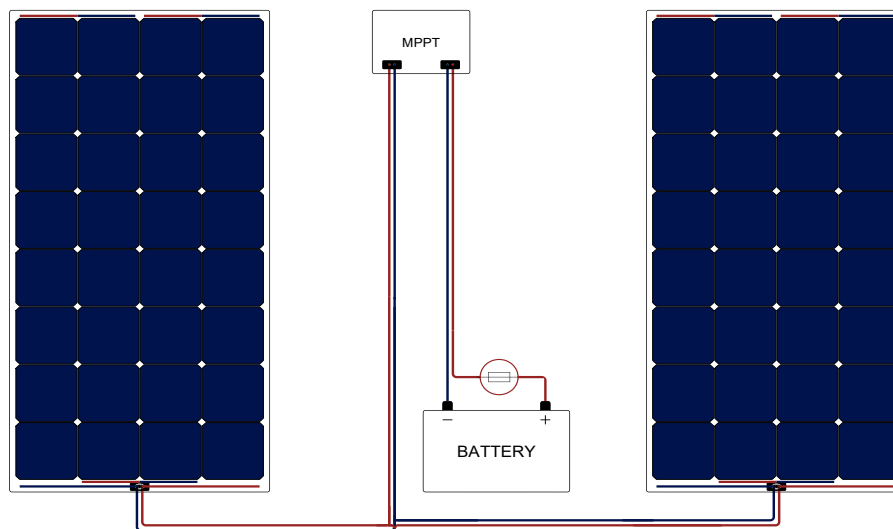


Fig. 7 - Two panels in Parallel connection

PARALLEL - BLOCKING DIODES / FUSES

When connecting three or more strings in parallel, each positive (+) wire must be protected by either a blocking diode or a fuse rated at $1.5 \times$ the string short-circuit current (I_{sc}).

Omitting overcurrent protection allows reverse current to flow through shaded or lower-output strings, causing overheating and potential fire risk.

Expect approximately 0.7 V voltage drop across each diode - account for this in system design.

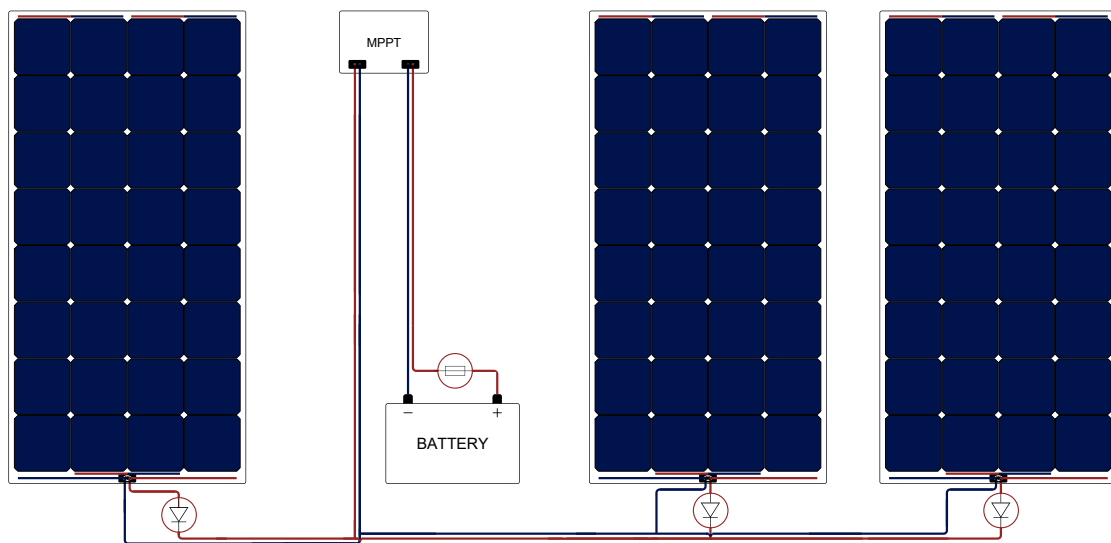


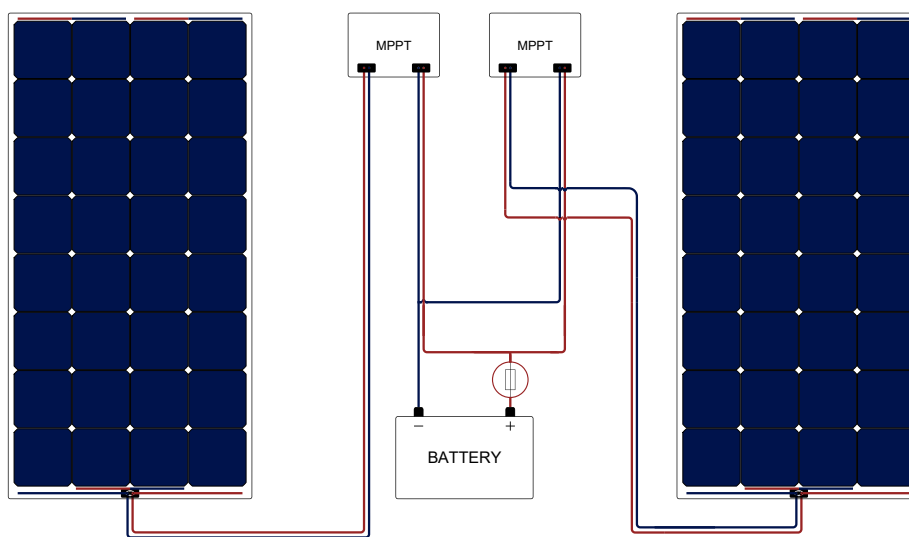
Fig. 8 - Three panels in Parallel connection

MC4 Connectors

Depending on the panel configuration, connectors may be factory-fitted or require field installation after mounting. In all cases, follow the current Stäubli MC4 connector installation instructions available on the manufacturer's website.

6.4 Individual MPPT per Panel

Each panel is connected to its own dedicated MPPT controller, with all controllers connected in parallel to the battery bank. This configuration eliminates shading losses between panels and simplifies fault diagnosis, as each panel operates independently.

*Fig. 9*

- one MPPT per panel, controllers in parallel to battery bus

NOTE

When controllers are connected in parallel to the battery, the total cable to the battery must be sized for the sum of all controller maximum currents.

The main fuse must be rated at $1.5 \times$ the sum of all controller I_{max} values.

This configuration allows panels of different orientations or models to be used within the same system, as each panel operates independently of the others.

7. Ventilation and Water Drainage – Critical Rules

CRITICAL - DO NOT SEAL THE FULL PERIMETER

Complete sealing of a panel's edges is prohibited for strip-bonded installations – see **chapter 11**. Heated air must be able to escape from beneath the panel - trapping it causes blistering, bond failure, and accelerated panel degradation.

- To create a permanent ventilation path, place a length of silicone cord under the panel during installation, then carefully remove it once the adhesive or grout has cured. The resulting channel allows continuous air exchange.
- Position ventilation channels at the lowest point of the installation to prevent rainwater or wash-down water from accumulating beneath the panel.
- Electrical outlet connector areas must be sealed against water ingress independently of the general ventilation strategy - these are point seals, not ventilation paths.
- We do not recommend StealthLink output for strip-bonded installations.

8. Most Common Installation Mistakes

The mistakes below account for the majority of warranty claims and premature panel failures observed in the field. Review this section with every installation team before work begins.

8.1 Trapped air under the panels



Fig. 10 - Trapped air causing visible deformation

During installation, air can become sealed beneath the panel due to:

- insufficient progressive pressure from the centre outwards
- inadequate surface preparation on either the panel backsheet or the substrate
- incorrect installation technique, or voids in the adhesive bead pattern where coverage is missing or insufficient.

Trapped air pockets expand significantly under direct sunlight as the panel surface temperature rises. The expanding air creates localised pressure domes (bubbles) that lift the panel away from the substrate, reducing bonding area and causing visible deformation of the panel face. In severe cases this can crack the underlying cells, leading to efficiency loss and hotspot formation - a potential burn and fire hazard.

Similarly, inadequate surface preparation - on either the panel backsheet or the substrate - can cause localised debonding after installation. As the panel heats up in sunlight, it expands like any other material. When bonding is uniform across the full surface, thermal expansion

forces are distributed evenly. Where adhesion is absent or weak in localised areas, those forces concentrate at the debonded zone, causing permanent deformation of the panel face.

There is currently no repair solution for either condition. A panel affected by trapped air bubbles or localised debonding has been permanently deformed and must be replaced.

To prevent this:

- Prepare both the panel backsheet and the substrate correctly before bonding - poor adhesion on either surface creates weak zones where bubble formation can initiate.
- Follow the installation procedure as described in Chapters 9 and 10 - correct technique directly determines long-term bond integrity.
- Always apply pressure progressively from the centre of the panel towards the edges using a roller. Never press down the edges first. When using adhesive bonding (Method B), ensure no voids are left in the adhesive bead pattern before pressing the panel down.
- For strip-bonded installations, always leave ventilation gaps at the lowest point of the panel - these equalise pressure beneath the panel as it heats up and prevent bubble formation over time.

8.2 Missing expansion joints



Fig. 11 - No expansion joint left between adjacent panels

Panels must always be installed with a minimum 4 mm expansion gap between panels and between panels and any fixed obstacle. Without it, thermal expansion can place panels under compressive stress, leading to lifting, cell damage, or substrate damage.

8.3 Tension on cables or fasteners left under the panel

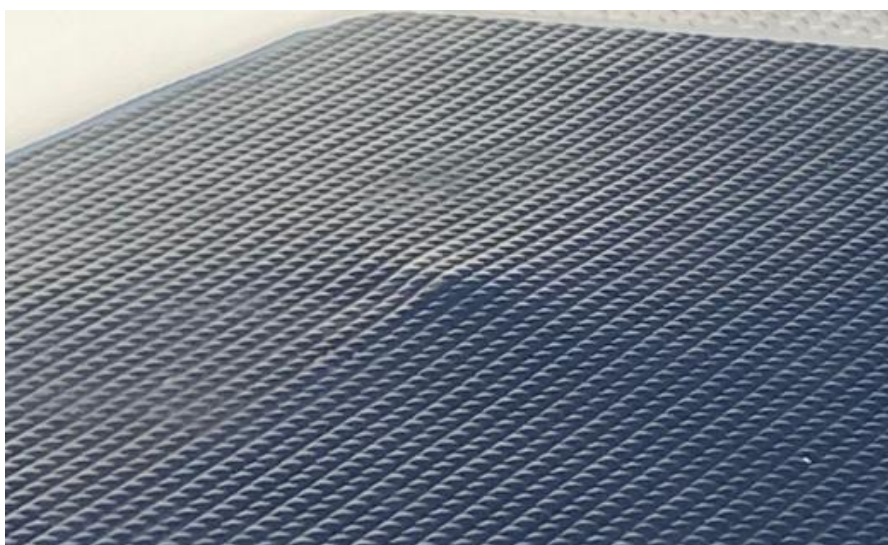


Fig. 12 - Tensioning elements left under the panel / tension on electrical outlets

Leaving clamps, spacers, or tensioning elements trapped beneath a bonded panel - or applying tension to the cable at the electrical outlet - creates localised stress points that can crack cells or pull connectors loose over time.

8.4 Damage to panel cable insulation



Fig. 13 - Insulation damage caused by sliding the panel over an unprotected rough surface

Sliding a panel across a rough or abrasive surface during positioning, without protecting the cable run, can abrade or cut the cable insulation, creating a short-circuit or water-ingress risk.

8.5 Other frequent errors

- Cutting, drilling, or penetrating the panel with any tool - no repair is possible and the panel must be replaced.
- Installing panels in permanently shaded locations, even partial or diffuse permanent shading increases the risk of hotspots, accelerates degradation of the cells and adhesive bond, and reduces long-term product life.
- Damaging the cable-to-panel connection by pulling, bending sharply, or putting mechanical stress on the cables at the point where they exit the panel.
- Using non-original or incorrectly crimped MC4 connectors. Poorly terminated or counterfeit MC4 connectors cause high contact resistance, localised overheating, and are a known fire hazard. Only use factory-fitted connectors or original MC4 connectors installed by a qualified electrician.
- Using materials not listed in Chapter 5 (unapproved tapes, adhesives, or primers) without prior written approval from Activesol.
- Fully sealing the panel perimeter when strip-bonding, blocking the ventilation path described in Chapter 7.
- Applying tape or adhesive outside the temperature / humidity range stated on the product datasheet.
- Insufficient bonding pressure during tape installation, resulting in trapped air pockets and reduced contact area.
- Placing the installation into mechanical or electrical service before the stated cure time has elapsed.
- Failing to remove the protective film before first exposure to sunlight - see Chapter 3.3.

9. Installation Method A - Double-Sided Tape (Recommended Method)

RECOMMENDED METHOD

Double-sided tape (3M VHB) is the factory-supported mounting method for Activesol semi-flexible panels. It provides consistent bond quality, faster installation, and is less sensitive to operator technique than wet adhesive bonding.

Activesol panels can be ordered with factory-applied double-sided tape. 3M VHB is a professional-grade solution designed for demanding applications - high-stress substrates, deep anti-slip surfaces, and environments with significant thermal cycling. Despite this, it is our recommended choice for every installation. The cost difference compared to adhesive bonding is minimal, while bond quality, long-term durability, and installation reliability are significantly better.



Fig. 14 - Activesol NAVY-BLUE panel with integrated 3M VHB GPH-110F tape

Before starting installation, complete the substrate preparation!

Required materials

Cotton gloves



Pressure roller or cloth



3M Primer 94 - applied along the bonding edges is required, when bonding to deep anti-slip surfaces primer applied over the full bonding area is required



Sealant/grout (e.g. Sikaflex 295UV, 522, or 591) - required around panels on deep anti-slip substrates to protect against moisture ingress, significantly improving bond durability



Optional: 4 mm tile spacers, to maintain consistent expansion joints between panels



Optional: finishing/grout tools (ball sticks)



9.1 Key Installation Information

Installation must be performed by at least two people. Once the liner is removed and the tape contacts the substrate, repositioning is generally not possible - the bond is essentially permanent on contact. Exceptional precision is required when placing the panel.

For panels fitted with StealthLink connectors, mark and prepare the cable pass-through hole before positioning the panel.

PRE-INSTALLATION PANEL CHECK

Before starting installation, test each panel individually with a DC voltmeter. Panels should produce measurable open-circuit voltage (Voc) even in overcast conditions. If a panel produces no voltage, do not install it - contact your supplier or Activesol.

RESPONSIBILITY NOTE

The installer is solely responsible for verifying that 3M VHB GPH-110F is compatible with the specific substrate surface prior to installation. Activesol's approval of this tape relates to its bond to the panel backsheet; substrate-side compatibility remains the installer's responsibility.

9.2 Installation Procedure

1. Mark the final panel position on the substrate. When marking panel positions, maintain a minimum 4 mm expansion gap between panels and between panels and any fixed obstacle. Use tile spacers to ensure consistent spacing during installation.
2. If StealthLink - cut cable pass-through hole and route cable before proceeding.



Fig. 15 - Holes for the StealthLink outputs

3. Clean the substrate surface thoroughly with acetone or isopropyl alcohol (IPA). Allow to evaporate completely before proceeding - do not rush this step.

4. If using 3M Primer 94 – apply with a clean cloth or applicator:
 - On smooth surfaces: apply along the bonding edges only.
 - On deep anti-slip or rough surfaces: apply over the entire bonding area for maximum adhesion



Fig. 16 - Primer applied on smooth surface

5. Place the exposed corner at the target position. The panel can be rotated slightly for alignment - the remaining liner prevents accidental full contact. (Pay attention to the StealthLink)



Fig. 17 - Placing panel in the desired location

6. Once the panel is positioned and cables routed through the pass-through hole, one operator must sit on the panel to hold it firmly in place. Without this, removing the liner will cause the panel to shift. Maintain this position throughout the following step.
7. Once alignment is confirmed, remove the liner along the shorter edge nearest the pressed corner and bond that edge with a roller.



Fig. 18 - One operator holds the panel in position by sitting on it while the second operator removes the liner along the shorter edge

8. Have a second operator progressively peel the remaining liner from the opposite side while you simultaneously press down with a cloth or a roller, working from the bonded edge outward to push out any trapped air.



Fig. 19 - Pressing down the panel with a cloth

9. Use a rubber roller to activate the tape. You can apply full body weight to the roller while doing that. Do it uniformly on the whole panel surface. It is recommended to make a final run around the edges. Apply approximately 1 kg/cm² of pressure across the panel.



Fig. 20 - Activating the tape

10. Record the panel's serial numbers, installation date, installer name, and materials used (tape batch, primer batch) before closing out the installation.

DO NOT

Do not load, flex, walk on, or apply additional cable tension to a freshly bonded panel before the cure period has elapsed.

10. Installation Method B - Adhesive Bonding (Alternative Method)

QUALIFIED APPLICATORS

This method is not the recommended mounting solution and should only be carried out by trained and experienced installers. Activesol approval of this method applies to qualified applicators only.

10.1 Approved Adhesive Systems

Activesol panels have been tested with the following adhesive combinations. One of the four approved systems must be used - no substitutions are permitted without written approval from Activesol.

Panel backsheet preparation	Adhesive
Sika Primer 507	Sikaflex 522
Sika Primer 507	Sikaflex 591 (<i>marine certified</i>)
Sika Aktivator-205	Sikaflex 522
Abrasive fleece + Sika Aktivator-205	Sikaflex 591 (<i>marine certified</i>)

RESPONSIBILITY NOTE

Sikaflex products are listed here as approved for bonding to the Activesol panel backsheet. Substrate-side compatibility, priming requirements, and installation workmanship are entirely the responsibility of the installer or applicator.

10.2 Substrate Preparation

The substrate (hull, deck, bodywork) must be prepared in accordance with the current Sika Pre-Treatment Chart for the specific substrate material and the chosen adhesive. Always consult the most recent Sika Product Data Sheet prior to use. All surfaces must be clean, dry, and free of grease, dust, silicone, and loose particles before applying any primer or adhesive. Use IPA or IPA/water 50/50 for degreasing.

11. Strip Bonding

Strip bonding is an alternative application layout where tape or adhesive is applied in parallel strips across the panel width rather than over the full surface. It reduces material consumption and speeds up installation, but comes with important limitations that must be understood before choosing this method.

CRITICAL RULES

Apply strips perpendicular to the long edge of the panel, spaced approximately 10–15 cm apart. On vertical surfaces, strips must run parallel to the direction of gravity. Always use primers or surface activation methods as specified by the tape or adhesive manufacturer - the reduced contact area makes surface preparation even more critical than in full-surface bonding. All underside outputs must be sealed with sealant. In strip-bonded installations this is critical - gaps between strips allow water to reach the output directly from beneath the panel.

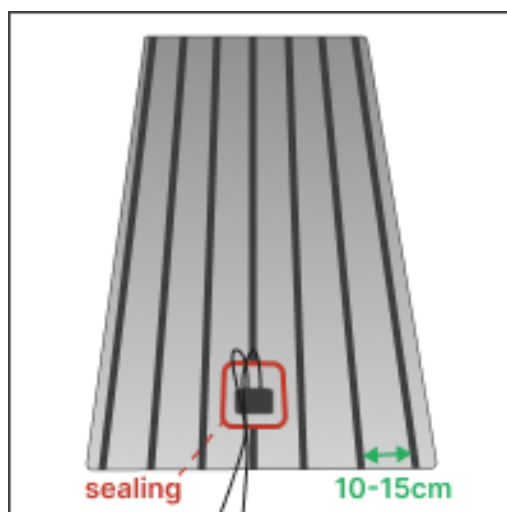


Fig. 21 – Strip bonding

Limitations:

- The panel is not approved for walk-on use in strip-bonded installations.
- Ventilation gaps at the lowest point are mandatory - see Chapter 7.
- Aesthetics are affected: adhesive strips may be visible through the panel Surface.
- Special care is required during installation to avoid cracking cells - the raised tape or adhesive bead creates a localised high point. Pressing unevenly across the panel can flex it over this point and fracture cells underneath.

NOTE

Strip bonding applies to both Method A (tape) and Method B (adhesive).

12. Pre-Hand-Over Checklist

Complete and retain this checklist (or an equivalent quality record) for every installation before handing the vessel/vehicle back to the owner.

- Substrate type identified and matched to an approved mounting method (see Chapter 4).
- Temperature and humidity within approved range for all products used during installation.
- Substrate cleaned, degreased, and prepared prior to bonding.
- Protective film removed from all panels (where applicable).
- Minimum 4 mm expansion gap maintained between panels and all fixed obstacles.
- Drainage gap left at the lowest point of each panel (strip-bonded installations only) - perimeter not fully sealed.
- Cable exit points (Stealth Link) sealed against water ingress.
- Cable routing checked for abrasion, sharp bends, and tension.
- MC4 connectors original, correctly crimped, and fully locked.
- Walk-on panels: substrate rigid, bond fully cured, no flex detected under load.
- Cure time completed before mechanical load or electrical commissioning.
- Installation date, installer name and panel serial numbers recorded.

13. Maintenance

The PV panels have no moving parts and require minimal routine maintenance. The following schedule and procedures will maximise performance and service life.

13.1 Routine Cleaning

Keep the panel surface clean and free of any material that could shade individual cells. Even partial shading of a single cell can cause a significant reduction in total output and, in extreme cases, local overheating.

- Wash with fresh water regularly, especially in salt-water environments - salt deposits accelerate surface degradation.
- Clean with neutral (pH-neutral) soap and water, wiping gently with a soft cloth. Do not use abrasive pads, scouring powders, or harsh solvents.
- IPA or a 50/50 IPA/water solution may be used to remove grease, fuel, or adhesive residue.

DO NOT

Do not use abrasive cleaning materials, high-pressure jet washers directed at panel edges, or solvent-based cleaners not listed here.

Do not apply paint, varnish, anti-fouling, or any coating to the panel.

13.2 Periodic Inspection

Inspect the installation at least once per season, or after any severe weather event:

- Check the bond line / tape perimeter for any signs of lifting, bubbling, or delamination.
- Inspect expansion joints and grout lines for cracking or shrinkage - reapply flexible sealant where necessary.
- Check all electrical connections and MC4 connectors for corrosion, mechanical damage, or moisture ingress.
- Verify that no objects or debris are resting on the panel surface and causing shading.
- Assess overall system output using the charge controller's monitoring display or logging function - a sustained drop in output may indicate cell fractures, shading, or a wiring issue.
- Inspect panels with a thermal imaging camera to detect any localised hotspots, which may indicate cell damage, partial shading, or delamination.

13.3 Structural Check

- Check that the cable routing remains correctly clamped and free of chafe, particularly at deck penetrations.
- Verify that the panel does not flex when loaded (walked on) - any flex indicates bond failure or substrate degradation and must be investigated immediately.

14. Possible Failure Modes

This chapter describes the most common failure conditions observed in field installations, their likely causes, and the recommended corrective action.

14.1 Fractured Cells

Cell fractures are caused by excessive bending during handling or installation, by impact (dropped tools, foot traffic on uninstalled panels), or by long-term mechanical stress from an incorrectly installed bond that does not allow thermal expansion.

Fractured cells do not normally cause a total loss of output, but typically result in a measurable drop in current (Isc).

To check for cell damage, measure the panel short-circuit current (Isc) using a Multimeter. Isc is strongly dependent on irradiance and must always be measured with a calibrated solar irradiance meter (pyranometer) positioned at the same angle and orientation as the panel cells - even small angular differences will introduce significant measurement error.

Scale the expected Isc proportionally to the measured irradiance:

- 1000 W/m² → ~100% of rated Isc
- 500 W/m² → ~50% of rated Isc

A reading significantly below the expected scaled value indicates cell damage. Note that soiling or partial shading will also reduce Isc - ensure the panel is clean and unshaded before taking the measurement. Open-circuit voltage (Voc) is largely unaffected by cell fractures and is not a reliable indicator of cell damage.

PREVENTION

Never exceed the 1 m minimum bend radius during handling or installation.

Never walk on uninstalled panels.

Maintain minimum 4 mm expansion joints between panels.

Ensure the bond is fully cured before mechanical loading.

14.2 Water Ingress into Junction Box or Connector

Water ingress can occur due to mechanical damage, cable tension pulling the connector body away from the panel, or an incorrectly sealed StealthLink hole.

Symptoms: reduced or unstable output, visible moisture inside a transparent connector body, or corrosion at terminals. If water ingress is confirmed, disconnect the affected panel from the circuit immediately. The panel must be replaced.

Inspect cable strain relief at connector exits - cables must be clamped to prevent tension being transferred to the connector body.

- Confirm that StealthLink holes are sealed.

14.3 Hot-Spots

FIRE RISK - ACT IMMEDIATELY

A hot-spot is a condition in which a single cell or small group of cells becomes severely overloaded and overheats - potentially reaching temperatures above 200 °C (392 °F) on the affected area.

Although damage is usually localised, a hot-spot can in principle cause the panel encapsulant to smoke or ignite. Treat a suspected hot-spot as a fire hazard.

Hot-spots are caused by:

- One or more cells being completely or heavily shaded while the rest of the panel remains in full sun - the shaded cell is forced to dissipate the power generated by the unshaded cells.
- A fractured or otherwise damaged cell within an otherwise functional panel.
- A mis-matched panel connected in series with panels of a different current rating.

How to identify a hot-spot:

- The affected area of the panel may be visibly discoloured, soft, or deformed.
- In severe cases, smoke or a burning smell may be present.
- An infrared thermometer or thermal camera will show a localised temperature peak.

IBC Cell Construction and Hot-Spot Resistance

Activesol panels use IBC (Interdigitated Back Contact) cell technology, which by design generates significantly lower hot-spot temperatures compared to conventional cell types. However, this does not eliminate the risk entirely - severe cell can still produce dangerous temperature levels. Furthermore, operating a panel with known cell damage over an extended period accelerates degradation of both the affected cells and the bypass diodes, which can over time lead to more serious and potentially hazardous failures. A damaged panel should never remain in service long-term - replace it as soon as practically possible.

Immediate action if a hot-spot is suspected:

1. Disconnect the affected panel from the electrical circuit immediately, or cover the panel completely to stop light exposure. In a series string, the entire string must be disconnected.
2. Do not reconnect until the root cause has been identified and resolved.
3. If the panel surface shows burn marks, deformation, or has been smoking, treat the panel as damaged and do not put it back into service without technical assessment from Activesol.

PREVENTION

Keep the panel surface clean and completely free of shading objects at all times.

Never connect panels of different current ratings in series.

Inspect for cell damage after any impact event.

14.4 Reduced Output / Charge Controller Issues

A sustained drop in system output that is not explained by shading or soiling may indicate a charge controller fault.

Note that reduced output does not always indicate a fault. Charge controllers intentionally reduce charging current as the battery approaches full charge (high state of charge / SOC) - this is normal behaviour.

Controllers may also limit charging power to protect smaller battery banks from overcharging, even when available solar power is higher. Before troubleshooting the panel or wiring, check the battery SOC and controller charging mode to rule out normal charge regulation as the cause of apparently low output.

CHECK CONTROLLER BEFORE THE PANEL

Electronic controllers can fail - consult the controller's display or alarm indicators first. Then check the state of all electrical connections between the panel, controller, and battery. Measure Voc and Isc directly at the panel terminals to confirm whether the panel itself is producing correctly.

15. Warranty Notice

WARRANTY CONDITION

The product warranty for Activesol semi-flexible panels is conditional on installation being carried out strictly in accordance with this manual, using only the materials listed in Chapter 5 (or written-approved equivalents). Installations that deviate from this manual - including unauthorised materials, missing expansion joints, sealed ventilation paths, curing-time violations, or failure to remove the protective film - may have warranty coverage reduced or voided.

LIMITATION OF LIABILITY

The Activesol product warranty covers manufacturing defects in the panel and its factory-applied components. It does not cover: installation workmanship; adhesion failures at the substrate surface; damage resulting from incorrect substrate selection, preparation, or priming; or use of adhesives and tapes not listed in Chapter 5. The installer bears full responsibility for substrate assessment, surface preparation, adhesive compatibility with the substrate, and the overall quality of the mechanical installation.

16. Technical Support and Contact

For questions regarding substrate assessment, material approval, or installation issues not covered in this manual, contact technical support before proceeding:

XDISC® S.A.

ul. Heliotropów 45/53

04-796 Warszawa, Polska

contact@activesol.energy

[+48 691 114 118](tel:+48691114118)

www.activesol.energy

17. Recycling and Disposal

Activesol semi-flexible panels are electrical and electronic equipment (EEE) and must not be disposed of with general household or commercial waste. Disposal must comply with the applicable regulations in the country of use.

- In the European Union, photovoltaic panels fall under the WEEE Directive (Directive 2012/19/EU). They must be collected separately and processed by an approved recycling facility.
- In EU member states, Activesol participates in take-back and recycling schemes compliant with the WEEE Directive. Contact Activesol for disposal instructions.
- Outside the EU, consult your local environmental authority for the correct disposal pathway for photovoltaic modules.
- Do not incinerate, crush, or landfill panels - the encapsulant and electrical components may release hazardous substances if not processed correctly.

CONTACT FOR DISPOSAL

To arrange correct end-of-life disposal of Activesol panels, contact: [contact@activesol.energy or +48 691 114 118]. Proof of purchase or serial number may be required.

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