

# Roof Mounted Photovoltaic Solar Panel Systems - Installation and Construction

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Roof mounted solar arrays are present on many buildings and becoming more common. From planning to have them through to their end of life, these power generating devices present many additional hazards and exposures to a property.

This document is one of a series, to provide guidance to identify and mitigate the risks associated with these arrays.



# Roof Mounted Photovoltaic Solar Panel Systems – Installation and Construction



## Introduction

After considering all the variables that could go into a proposal and the project proceeds to the construction and installation phase. All of the previous Risk Management guidance should be followed.

For any array, **the OEM's** guidance for the installation should be followed. Each solar panel will have a technical data sheet that indicates the safe operating conditions of the panel. This should include:

- Clearances from the roof (to prevent build-up of debris).
- Separation distances between panels.
- String size etc.



Where appropriate, markings and signage should be used to support and enforce these OEM requirements.

In addition to the General Considerations and Planning for Installation Loss Prevention Standards, this standard outlines Risk Management advice for those property risks in the installation and construction phase of a roof mounted solar array.

## Panel Traceability and 2<sup>nd</sup> Hand Panels

When panels are received to site, diligence is required around the source of the panels being installed. There is a significant market for second hand panels (from decommissioned sites) and even stolen PV panels. In many cases these can be damaged, even if the damage is not immediately or overtly visible e.g., micro cracking. In addition, there are issues with the compatibility of components from different manufacturers, which may not be visible to the untrained eye and cause issues with moisture ingress over time e.g., different manufacturers for male and female connectors. Therefore, all panels are recommended to be **'new'** and **not be 'second hand' or recycled second life** devices. As a result, it is important to verify the traceability of the panels and have this formally confirmed.

- The manufacturer should provide a certificate of conformity for new panels.

## Cables and Connections

Cables and connections made by different manufacturers have slightly different fittings with each other. Therefore, it is critical that the installation proceeds with all the cables and connectors being made by the same manufacturer with connections being securely terminated. Even with the smallest incompatibility, over time this can lead to different thermal expansion rates, movement, fatigue, stress, overheating, short circuit, DC arcing, and water ingress. This will eventually cause performance issues, failure, and potential fire. The key is to ensure such connections are specified correctly at the outset of the project and verified during the installation phase.

- The manufacturers name should normally appear on the two connecting elements.
- During the installation, spot check male and female connection points to ensure they are the same manufacturer.

Electrical cables, connectors and/or junction boxes should be fire-resistant or enclosed in a fire-resistant material, conduit, or fire-rated compartment.

## LOSS PREVENTION STANDARDS

## Stepping on Cables and Damage

To help prevent cables being stepped on or items being placed on top of the cables there should be appropriate signage to state not to step on them. In some instances, appropriate steps or protection over the cables may need to be provided.

## Building and Roof Damage

### Panels

Damage can be caused to the building and the roof structure, roof deck, or roof covering by the process of staging and installing the PV panel array. This can be at any point in the installation process and can potentially cause structural issues or create an exposure to water ingress from the weather. Regardless, the project to install solar panels on the roof should not result in damage to the wider building needing subsequent (expensive) repairs.

The following should be formally documented within the Risk Assessments and Method Statements to protect the roof:

- The way the panels are taken to the roof.
- Where the panels can be stored on the roof awaiting installation.
  - Staging locations clearly marked and understood.
    - ✓ These may be via markings and appropriate signage.
- The number of panels that can be safely stacked on top of each other in one area on the roof and how to do this.
  - Also, from a panel damage perspective – how many panels can be safely stacked on each other with a sufficient safety margin?
  - The static point loading capacity needs to be calculated and the weight distribution of the staging of panels needs to be fully understood.
    - ✓ Maximum stack heights need to be prescribed.

### Panel Fixing

In addition, there are different ways to attach the panels to a roof, depending on the nature of the roof. Therefore, a formal review of the existing roof and the solar panel installation standard is needed to ensure they are compatible and do not cause roof damage.

## Panel Damage During Installation Phase

Damage to panels during installation can take many forms:

- Non-visible microcracking to layer below the protective outer glass.
- Impact damage to the glass – visible cracking.
- Protective beading/frame around the perimeter of the panel – this can be deformed or damaged which can impact the performance of the panel or cause water ingress.
- Equipment must be correctly specified and compatible for a PV solar panel system – including the same OEM for key elements, cabling, and components.

## Guidance to Help Reduce Panel Damage

- Consider using a protective film on the module's surface during installation.
  - This film safeguards the module against scratches and can be removed after all panels in the array are installed.
- Avoid stacking panels directly on top of each other to prevent excessive pressure on the cells.
  - Use appropriate padding or cardboard separators to provide a cushioning effect.
- During storage, keep the solar modules in a dry and clean area, away from direct sunlight, extreme temperatures, and excessive humidity. If possible, store them vertically to minimize the risk of accidental damage.
- Excessive bending can lead to cell cracking and reduced efficiency.
- Always handle solar modules with care and avoid bending or flexing them.
- The panels in some cases will be fitted on some type of mounting which can have bolted connections. Care should be taken to ensure bolts are not loose, or torqued too tight, which can cause damage to the panel or deformation of the structural beam.

## Weather

During the installation phase from staging materials and panels on the ground through to the roof, upcoming weather events must be considered. Things to consider:

- Do not stage unsecured panels on the ground or on a roof ahead of a wind event or storm.
- Do not do any work on the roof that could compromise the weather tightness ahead of a heavy rain events/storm.

The project team must consider upcoming weather patterns including hail, snow, and ice.

## Waste Management

Management of waste materials associated with the panel installation e.g., cardboard, packaging etc., must be considered part of the project.

Waste should be:

- Secured at roof level to prevent it from 'blowing away'.
- Removed from the roof at the end of every shift - at a minimum.
- Removed from site or to a secured area at least 10m from the building.

To help prevent the spread skips or bins etc., should not be located within 10m of any yard storage or building.

Please see Aviva's Loss Prevention Standard Management of Combustible Waste.

## Security

Theft is not normally a credible threat for roof mounted solar, once installed. This exposure usually applies to ground mounted arrays. However, during the construction phase when panels and components are staged on the ground or in situ, theft is an exposure. As a result, until panels are secured in place on the roof, a security risk assessment should be completed to assess the exposure.

- If there are any theft concerns, forensic DNA marking of panels and/cabling with appropriate signage can be a solution.

Selectamark, an Aviva Specialist Partner, can provide appropriate support in this area if needed. [Selectamark - Aviva Risk Management Solutions](#)

## Commissioning and Handover

With all the potential exposures the installation work must be carefully:

- Supervised.
- Inspected regularly.
- Commissioned with appropriate performance tests.

At the end of the project there could/should be:

- Formal installation conformity certification (or similar) issued, along with appropriate operating and maintenance OEM manuals, prior to handover.
- Tests witnessed on any fire detection, fire protection or safety interlock systems provided.
- Field review and/or acceptance tests by your Property Insurer.
- Guidance/Instructions on how to monitor solar PV panel output either at the inverter or remotely.

## Specialist Partner Solutions

Aviva Risk Management Solutions can offer access to a wide range of risk management products and services at preferential rates via our network of Specialist Partners, including:

- Electrical inspections and thermographic imaging: [Bureau Veritas](#)
- Thermographic imaging and PAT testing: [PASS](#)
- Automatic fire detection and portable extinguishers: [SECOM](#)
- Security marking: [Selectamark](#)

For more information please visit:

[Aviva Risk Management Solutions – Specialist Partners](#)

## Sources and Useful Links

- Guide to the Installation of Photovoltaic Systems: Published by the Microgeneration Certification Scheme (MCS) <https://mcs-certified.com/>

## Additional Information

Relevant Loss Prevention Standards include:

- Roof Mounted Photovoltaic Solar Panel Systems - General Considerations
- Roof Mounted Photovoltaic Solar Panel Systems - Installation and Construction
- Roof Mounted Photovoltaic Solar Panel Systems - Installed and Ongoing Care
- Roof Mounted Photovoltaic Solar Panel Systems - Isolated End of Life and Decommissioning
- 15 Top Tips for Roof Mounted Photovoltaic Solar Panel Systems
- Contamination Following a Fire
- Control and Management of Combustible Waste Materials
- Electrical Installations – Inspection and Testing
- Emergency Response Teams
- Third Party Property Exposures
- External Wall Insulation Systems
- Fire Compartmentation
- Fire Safety Inspections
- Heat and Smoke Venting Systems
- Housekeeping
- Managing Change - Property
- Managing Contractors
- Smoke Contamination
- Smoking and the Workplace
- Thermographic Surveys

To find out more, please visit [Aviva Risk Management Solutions](#) or speak to one of our advisors.

Email us at [riskadvice@aviva.com](mailto:riskadvice@aviva.com) or call 0345 366 6666.\*

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## LOSS PREVENTION STANDARDS