|  |
| --- |
| Use these notes to help avoid common defects and achieve better compliance in Solar Homes Program installations. |

Independent audits of solar panel (PV) installations under the Solar Homes Program have identified six non-compliance categories relating to questions in the [Solar Homes PV Audit Checklist](https://www.solar.vic.gov.au/solar-pv-audit-checklists-tips).

These notes were developed to help installers avoid common defects and to achieve better compliance. The top six non-compliance categories detected are currently:

1. Wiring and wiring systems not adequately protected.
2. Array has not been adequately installed.
3. Inadequate documentation.
4. Inadequate protection against weather and water provided for electrical equipment.
5. Equipment has not been adequately installed.
6. D.C. plug and socket connectors not adequately selected/installed.

Solar Victoria recognises there are different installation practices and urges installers to always refer to all relevant Australian Standards, network requirements and manufacturer’s installations requirements.

| 1. **Wiring and wiring systems not adequately protected**
 |
| --- |
| **Ref.** | **Solar PV checklist question:** | **Standards referenced:** | **Guidance:** |
| **Wiring 4, DP 4, Wiring 3 & Roof 21** | Where PV d.c. wiring system are not installed directly behind and adjacent to pv modules, have they been identified by distinctive labels with the word "SOLAR" at intervals not exceeding 2m and visible after mounting?Is any PV d.c. wiring located in a ceiling space between a disconnection point and a load break disconnection device, not installed within 0.6m above the surface of the ceiling unless it is within 1m from the internal surface of an external wall?For all PV d.c. cables that are installed within buildings has the following mechanical protection been provided?* Cables located within ceiling space, wall cavities or under a floor are enclosed in metal or heavy-duty insulating conduit.
* Installed in medium duty insulating wiring enclosure in all other internal locations within a building (e.g. non concealed surface mount).

Is any PV d.c. wiring located in a ceiling space between nonadjacent groups of PV modules, not installed within 0.6m above the surface of the ceiling unless it is within 1m from the internal surface of an external wall? | AS/NZS 5033:2021 Clause 4.4.5.2.2AS/NZS 5033:2021 Clause 4.4.5.2.3AS/NZS 5033:2021 Clause 5.3.1.1AS/NZS 5033:2021 Clause 4.4.5.2.4 | * Since the release of AS/NZS 5033:2021, the option to use a Disconnection Point (DP) instead of a roof top isolator has been available.
* When using a DP or multiple DP’s, there are strict requirements relating to the PV wiring system. These include the following but is not limited to:
	+ Ensuring the PV wiring system is installed and fixed in place at least 0.6m above the surface of the ceiling to a point at least 1m from the internal surface of the external wall. The same requirements apply for a PV wiring system that enters the ceiling space to connect groups on non-adjacent PV modules.
	+ The PV wiring system in the ceiling space, or externally mounted, must have the word SOLAR distinctly marked on it at least every two meters and be visible after mounting.
* Where the PV wiring system is installed within the ceiling space, wall cavities or under a floor, it must be either metal or heavy-duty conduit. PV wiring systems installed in any other non-concealed location, may be in medium duty conduit, but if exposed to UV it must be suitably rated or protected.
* There is an exception that allows for a maximum of 300mm of unprotected d.c. cable at the Load Breaking Disconnection Device (d.c. Switched Isolator) and Power Conversion Equipment (PCE – (inverter)).
 |

| 1. **Array has not been adequately installed**
 |
| --- |
| **Ref.** | **Solar PV checklist question:** | **Standards referenced:** | **Guidance:** |
|  **PVA 38** | If circuit breaker has been used as overcurrent protection, do they conform to the following requirements?* Are in accordance with AS/NZS 60898. or AS/NZS IES 60947.2
* Are not polarity sensitive.
* Are rated for D.C. use.
* Are rated to interrupt full load current and prospective fault currents from the PV array and any other connected power sources such as batteries, generators and the grid if present?
* Have a degree of protection of at least IPXXB or IP 2X.
 | AS/NZS 5033:2021 Clause 4.3.2.2.5AS/NZS 1170.2:2021 Appendix B6 | * Installing an array adequately includes several key processes.
* The design of systems is the responsibility of the accredited designer signing off on the job.

Things to consider when installing a system that has been designed by an accredited designer or installer: * Ensure the design will fit on the roof space compliantly before commencing the installation. To do this you need to consider the dimensions of the panels and the clamping zones as well as the fixing points to the roof structure. You can find this information on the panel manufacturer’s data sheet.
* Ensure water ingress protection does not change after the bracketing system is installed (a particular issue for tile roofs).
* Ensure the array can be installed so that it complies with AS/NZS 1170.2 in relation to the wind loading and roof zones. This information can be found in the rail manufacturers documentation.
* If the accredited designer/installer cannot confirm these requirements prior to installation, then a redesign and acceptance from the system owner will be required prior to installation.
* Make sure you have an agreement in place with any retailers you work for that protects you. For example, you should have the opportunity to conduct a site visit before the installation or be compensated for your time if you get to site, and it cannot be installed compliantly with the design provided.
 |

| 1. **Inadequate documentation**
 |
| --- |
| **Ref.** | **Solar PV checklist question:** | **Standards referenced:** | **Guidance:** |
| **Doc 1 & Doc 12** | Basic system information, including system rating and component ratings, and combining date.Equipment manufacturer's documentation and handbooks for all equipment supplied. As a minimum the following shall be included:(i) Panels.(ii) Mounting frame.(iii) Inverter.(iv) Isolators.(v) Cable.(vi) Monitoring devices. | AS/NZS 5033:2021 Section 6AS/NZS 4777.1 Section 7 | * The requirement for *site specific* documentation is mentioned in multiple standards relating to solar installations.
* Rightly or wrongly, the obligation to provide this documentation to the system owner is called up in Australian Standards and therefore is the responsibility of the accredited designer or installer responsible for the installation.
* Getting a signature to say “the installer has done a complete run through of the system operation and provided a copy of the documentation” is a good way to minimise having to reissue due to a non-compliant report.
* Installers should keep a copy of the documentation for all the installations they have signed off on, or at least a record of a statement signed by the system owner to say it was supplied.
 |

|  |
| --- |
| 1. **Inadequate protection against weather and water provided for electrical equipment**
 |
| **Ref.** | **Solar PV checklist question:** | **Standards referenced:** | **Guidance:** |
| **G-DCI 35, R-DCI 29 & R-DCI 34** | For all continuous conduit systems that have a section installed in an outdoor environment, and that terminate into an enclosure containing a disconnection device, has a liquid draining device been installed at the lowest point of the conduit system that is rated to at least IP56?Are all dedicated individual enclosures containing switch disconnection devices protected against the effects of weather and water as per appendix K of AS/NZS 5033:2021?For all continuous conduit systems that have a section installed in an outdoor environment, and that terminate into an enclosure containing a disconnection device, has a liquid draining device been installed at the lowest point of the conduit system that is rated to at least IP56? | AS/NZS 5033:2021 AS/NZS 4777.1:2016 | * The risk of UV damage and water ingress into wiring systems and equipment must be considered when installing a PV system.
* Ensure all conduit systems that connect to an enclosure that contains a disconnection device, (such as a roof top isolator or the PCE) if any section installed in an outdoor environment, must have a liquid draining device installed at the lowest point of the conduit system.
* Ensure all dedicated enclosures containing a switch disconnection device have a suitable shroud installed around them to protect them from the elements.
* It is especially important where d.c. energy is present to prevent water ingress into enclosures as there are less protections for d.c systems and issues can occur quickly and without failsafe devices like the ones available for a.c energy.
 |

|  |
| --- |
| 1. **Equipment has not been adequately installed**
 |
| **Ref.** | **Solar PV checklist question:** | **Standards referenced:** | **Guidance:** |
| **Wiring 23** | Has all electrical equipment (not previously covered in this checklist) been installed according to all applicable standards and additional manufacturers requirements? If not, could the applicable defects cause a potential safety concern at some stage now or in the future? | AS/NZS 3000:2018 clause 1.7.1(c) & 4.1.2 | * The compliant installation of all electrical equipment is a basic, fundamental principle of electrical work.
* Along with the requirement in the relevant Australian standards, ensure that all equipment manufacturer’s installation instructions are followed including:
	+ Mounting instructions – fixing specifications and locking screws
	+ Suitable locations – ventilation, direct sun, and moisture
	+ Specified clearances – ventilation around equipment, clearances from other equipment or services.
 |

| 1. **D.C. plug and socket connectors not adequately selected/installed**
 |
| --- |
| **Ref.** | **Solar PV checklist question:** | **Standards referenced:** | **Guidance:** |
| **PVA 19 & PCE 37** | Have all array plugs, sockets and connectors been installed to the following requirements?* Installed to minimize strain on the connectors.
* Installed to maintain the IP rating.
* Installed on PV d.c. cables conforming to the plug, socket and connector manufacturer's requirements.
* Only mated with those from the same manufacturer and designed to be mated together.

Terminated using a tool (where required) designed for the purpose and technique specified by the plug, socket or connector manufacturer's instructions.If installed have all PCE d.c. plugs, sockets and connectors been installed to the following requirements?* Installed to minimise strain on the connectors.
* Installed to maintain the IP rating.
* Installed on PV d.c. cables conforming to the plug, socket, and connector manufacturer's requirements.
* Only mated with those from the same manufacturer and designed to be mated together.

Terminated using a tool (where required) designed for the purpose and technique specified by the plug, socket or connector manufacturer's instructions. | AS/NZS 5033 Clause 4.3.9.1 | * The requirement for installers to only use d.c. connectors of the same type from the same manufacture.
* The reason this requirement exists is to prevent poor contact joins in d.c. connectors which can lead to several issues including string failure, overheating, arcing and potentially fire.
* The obligation to comply with this requirement is solely the responsibility of the accredited Installer that signs the Certificate of Electrical Safety for the installation.
* In order to comply with this requirement, the accredited installer must ensure they are only using the same connector from the same manufacturer. This can be done by reviewing the panel manufactures specification sheet for the panels you install and then making sure you have a separate supply of the correct make and model of connector for use in your installations. Having a good relationship with the solar retailer/s and wholesalers you work with is essential to meet this obligation.
* If you cannot install connectors of the same make, from the same manufacturer do not complete the installation until the appropriate connectors can be sourced. Note: cutting the manufactures connector off a panel will most likely void the panel warranty.
* Another important thing to remember is to use the correct size connector and tool for the cable.
* Poor connections and incorrectly sized cable glands often lead to water ingress into the connections.
 |
|  |  |  | Be wary of terms like “MC4 compatible” as this does not mean connecting to an MC4 meets the requirements of the standards. The term “MC4” is a term used by industry but is in fact a specific brand and type of connector in itself. There is one specific case where industry has been provided guidance that a genuine Staubli MC4 connector can be used with a Staubli MC4-EVO2© connector because they have been tested and certified as compatible by the manufacturer.See Energy Safe Victoria’s bulletin on [Identifying mismatched d.c. connectors in PV installations](file:///C%3A/Users/ke0m/Downloads/ESV_Guide_IdentifyingMismatchedDcConnectors_Nov2022.pdf) for more information.  |

## More information

For more information about Solar Victoria’s commitment to safety and quality, including our audit program, checklists and training and workforce development, visit: [solar.vic.gov.au/industry](https://www.solar.vic.gov.au/industry)

## Community languages

To speak with us in your language, please call the free National Translating and Interpreting Service on 131 450.

## Accessibility

If you would like to receive this publication in an alternative format, please contact Solar Victoria at comms@team.solar.vic.gov.au. This document is also available on the internet at [solar.vic.gov.au](https://www.solar.vic.gov.au/)

© The State of Victoria Department of Energy, Environment and Climate Action 2024.

**Disclaimer**

This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.