

AS/NZS 5033:2012 – Installation and safety requirements for photovoltaic (PV) arrays Amendments

Energy Safe Victoria on behalf of the Electrical Regulators Authority Council (ERAC) is represented on the EL-042 Standards Committee that oversees the development of Renewable Energy Standards, to ensure the safety and compliance of these installations. Other members of the committee include Clean Energy Council, fire brigade representatives, suppliers, training organisations and other relevant industry bodies.

This document has been prepared as a guide to understanding the changes announced within the updated standard. A copy of the standard can be purchased from SAI Global at www.infostore.saiglobal.com/store/ or by calling 131 242.

Changes do not become mandatory until 16 October 2012 with some changes having a 12 month or longer implementation period; refer to the standard for details.

General

- Modules in the same string shall be installed in the same orientation. (Clause 2.1.5)
- Domestic voltage rating of installation limited to 600 Volts DC. (Clause 3.1)
- Greater than 600 Volts DC requires restricted access to all installed equipment. (Clause 3.1)
- Change of safety class, from Class II to Class I, for PV module insulation system rating, (Clause 1.4.1.1) earthing is required of all exposed metal module frames and mounting rails. (AS/NZS 3000 1.4.27)
- **All equipment and wiring** shall be selected and installed in accordance with the provisions of AS/NZS 3000 and the requirements of this Standard. (Clause 4.1)
 - Please Note: Inverters must be installed in locations with safe access and adequate working space and be readily available (this does not apply to micro inverters).

Wiring

All PV wiring and components must be fit for purpose and installed to minimise exposure to detrimental environmental effects, (Clause 4.1) are protected from abrasion, tension, compression & cutting forces and are routed, supported and protected in accordance with AS/NZS 3000. (Clause 4.3.6.3)

- PV array cabling is to be double insulated (Clause 3.2) and be flexible (multi strand) to allow for movement. (Clause 4.3.6.2)
AND meet PV1-F specification and be tinned copper to reduce degradation of the cable over time. (Clause 4.3.6.2) TPS cable is not permitted.
- PV cabling must be identified with a permanent, indelible marking in English or coloured “SOLAR” labels attached at intervals of not more than 2 metres. When the PV cable is enclosed in conduit or other wiring enclosure a coloured “SOLAR” label must be attached at each end of the wiring enclosure and at each change of direction. (Clause 5.3.1)
- The solar array to inverter solar DC cables within buildings has to be in heavy duty plastic conduit. (Clause 4.3.6.3)

- All outdoor equipment must be suitable for the environment and be at least IP 54 and UV resistant. (Clause 4.3.3.1)
- If exposed to the environment shall be UV resistant or protected from UV by installation in UV resistant conduit marked with “T”. (Clauses 4.3.6.2 and 4.3.6.3)
- When installed on roofs or floors are mechanically protected (in enclosures or conduit) and do not obstruct natural water drain paths or promote accumulation of debris. (Clause 4.3.6.3)
- Are protected from abrasion, tension, compression & cutting forces. (Clause 4.3.6.3)
- Plastic cable ties are not to be used as a primary means of support. (Clause 4.3.6.3)
- Ensure wiring in enclosures and cable entries maintain the IP rating and are sealed to manufacturer’s specifications and double insulation between conductors is maintained and installed in such a way as to minimise strain on the connectors. (Clause 4.4.4.4)
- Connectors are mated with connectors of the same type from the same manufacturer. (Clause 4.3.7)
- String fuses in PV arrays are rated for DC (Clause 4.3.1) and are rated to interrupt fault currents from the PV arrays. (Clause 4.3.4)
- Fuse holders, shall have a current rating equal or greater than the corresponding fuse and provide protection suitable for the location. (Clause 4.3.9.1)

Disconnection devices

- An isolating / disconnection device shall be installed at the array if the PCE is more than 3 metres from the array. (Clause 4.4.1.4)
- An isolating / disconnection device shall be installed adjacent to the PCE. (Clause 4.4.1.4)
- Disconnection devices will be not be polarity sensitive and must operate in all active conductors. (Clause 4.3.5.2)
- If circuit breakers are used they are not to be polarity sensitive and must be rated to interrupt the full load when operated and have a voltage rating greater than VOC. (Clauses 4.3.1 & 4.3.4)
- Be certified to AS/NZ 60898 or IEC 60947. (Clause 4.3.5.2)
- All PV array switch-disconnectors are readily available (Clause 4.4.1.4) and are to be marked with an identification name or number according to the PV array wiring diagram and have clear indication of isolation position off and on e.g. O and I. (Clause 5.5.1)
- When the PCE has an internal means to isolate the solar array this switch-disconnector shall be mechanically interlocked so that it will isolate the array if repair or replaceable of a module is to be carried out within the PCE. (Clause 4.4.1.2)
- Where multiple disconnection devices are installed they are either - ganged so that they all operate simultaneously. Or shall be grouped in a common location with a warning sign indicating the need to operate all switch-disconnectors to isolate the equipment. (Clause 4.4.1.3).

Earthing

PV module and mounting frame earth connections are to be a purpose-made fitting providing earthing or bonding connections or purpose-made penetrating washers or equivalent between the PV modules and mounting frame for the connection of dissimilar metals purpose-made fittings are installed to manufacturer’s instructions. (Clause 4.4.2.2)

- Cable lugs, earthing termination and bonding cables are to be fixed by stainless steel bolts, washers and penetrating washers to aluminium frames. (Clause 4.4.2.2)

- Earthing or bonding connections **MUST BE** arranged so that the removal of a single module earth connection will not affect the continuity of the earthing or bonding connections to any other module. (Clauses 4.4.2.2 & 4.4.2.3)
- Self-tapping screws cannot be used for earth connections to the PV array framework. (Clause 4.4.2.2).

PV array functional earthing

Connection to earth is at a single point, connected to the main earthing terminal of the electrical installation. This connection point is between the PV array disconnection device and the PCE and as close as possible to or located inside the PCE. (Clause 4.4.3.1) The PV system functional earthing conductor has the same rating as the earth fault interrupter EFI (Clause 4.4.3.2)

LV PV Arrays with functional earthing

On an earth fault the EFI interrupts the earth fault, shuts the PV system down and provides a fault indication and an external fault alarm. (Clause 3.4.2)

System documentation and commissioning

(AS/NZS 5033 5.7 & AS/NZS 4777 7.1-7.3)

A system user manual has been provided including:

- a short description of the function and operation of installed equipment
- system rating and component ratings
- commissioning date and equipment location
- a list of equipment supplied – with serial numbers
- a list of actions to be taken in the event of an earth fault alarm
- the shutdown and isolation procedure for emergency and maintenance
- a system connection diagram
- the system performance estimate, including expected seasonal or operational variation
- recommended maintenance including a maintenance procedure and timetable
- commissioning records and installation checklist
- the array frame engineering certificate for wind and mechanical loading
- the installer/designer's declaration of compliance for wind and mechanical loading
- equipment and workmanship warranties
- equipment manufacturer's documentation [data sheets, handbooks, etc.]
- a copy of the shutdown procedure and any electrical safety warnings
- a procedure for verifying correct system operation
- actions in the case of a system failure
- contact personnel for installation queries and system support

Definitions – Clause 1.4

- **1.4.2 – AC module**
A PV module with an AC inverter mechanically secured to it so that the electrical output is AC.
- **1.4.3 – AC module inverter**
An inverter mechanically secured to a PV module in such a way that the connection between the module DC output and the inverter input is internal to the AC module inverter and there are no external DC terminals.
- **1.4.4 – Available, readily**
Capable of being reached for inspection, maintenance or repairs without necessitating the dismantling of structural parts, cupboards, benches or the like.
- **1.4.15 – Equipotential bonding**
Electrical connections intended to bring exposed conductive parts or extraneous conductive parts to the same or approximately the same potential, but not intended to carry current in normal service.
- **1.4.37 – Micro inverter**
A micro inverter is a small inverter designed to be located adjacent to a PV module so the DC cable length is less than one metre. The DC connection between the PV module/s and micro inverter is accessible and may be made at installation. The capacity of the micro inverter output is limited to 350 VA and DC connection is at ELV and is limited to no more than two PV modules.
- **1.4.40 – Power conversion equipment (PCE)**
An electrical device converting one kind of electrical power from a voltage or current source into another kind of electrical power with respect to voltage, current and frequency.
NOTE: Examples include DC- AC inverters, DC- DC converters, charge controllers, etc.
- **1.4.41 – Power conversion equipment, non-separated**
Power conversion equipment where there is no electrical separation between the input and output circuits.
NOTE: An example of a non-separated PCE is a transformer less (non-isolated) inverter.
- **1.4.42 – Power conversion equipment, separated**
Power conversion equipment where there is at least simple separation between the input and output circuits.
NOTE: Separation can be achieved by the use of a transformer with separate windings.
- **1.4.61 – Restricted access**
Access restricted to authorised persons only e.g. by a perimeter fence or barrier with access only via a padlocked or equivalently secured gate or door.

Appendix A – Examples of signs



Example of sign on PV Array junction box
(Clause 5.3.2)



Example of Fire emergency information
required at main switchboard (Clause 5.4)



Example of sign required adjacent to PV
Array DC isolator / switch-disconnector
(Clause 5.5.2)



Example of Fire emergency information
required at main switchboard (Clause 5.4)



Example of sign required where multiple
isolator / switch-disconnector devices are
used (Clause 5.5.2)



Example of authorised / restricted access
only sign (Clause 5.5.3)