

Australian/New Zealand Standard™

**Installation and safety requirements for
photovoltaic (PV) arrays**



AS/NZS 5033:2014

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-042, Renewable Energy Power Supply Systems and Equipment. It was approved on behalf of the Council of Standards Australia on 29 September 2014 and on behalf of the Council of Standards New Zealand on 4 September 2014. This Standard was published on 6 November 2014.

The following are represented on Committee EL-042:

ACT Planning and Land Authority
Australasian Fire and Emergency Service Authorities Council
Australian Energy Market Operator
Australian Industry Group
Australian PV Association
Australian Solar Council
Clean Energy Council
Clean Energy Regulator
Consumer Electronics Suppliers Association
CSIRO Energy Technology
Electrical Regulatory Authorities Council
Electrical Safety Organisation, New Zealand
Electricity Engineers Association, New Zealand
ElectroComms and Energy Utilities Industries Skills Council
Energy Networks Association
Engineers Australia
Institute of Electrical and Electronics Engineers
Institute of Electrical Inspectors
Institution of Professional Engineers New Zealand
Master Electricians Australia
Ministry of Business, Innovation and Employment, New Zealand
National Electrical and Communications Association
New Zealand Electrical Institute
Office of Fair Trading, NSW
Office of the Technical Regulator, SA
Solar Energy Industries Association
Sustainable Electricity Association New Zealand
Sustainable Energy Association
The University of New South Wales

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Australia Web Site at www.standards.org.au or Standards New Zealand web site at www.standards.govt.nz and looking up the relevant Standard in the on-line catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of Standards Australia or the New Zealand Standards Executive at the address shown on the back cover.

This Standard was issued in draft form for comment as DR2 AS/NZS 5033.

Australian/New Zealand Standard™

Installation and safety requirements for photovoltaic (PV) arrays

Originated as AS/NZS 5033:2005.
Previous edition 2012.
Third edition 2014.
Reissued incorporating Amendment No. 1 (June 2018).
Reissued with Amendment No. 2 (June 2018) attached.

COPYRIGHT

© Standards Australia Limited

© The Crown in right of New Zealand, administered by the New Zealand Standards Executive

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-042, Renewable Energy Power Supply Systems and Equipment, to supersede AS/NZS 5033:2012.

This Standard incorporates Amendment No. 1 (June 2018). Amendment No. 2 (June 2018) is attached at the end of the document. The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this Standard is to maintain and improve the safety of PV arrays. Committee EL-042 constantly strives to implement new methods of achieving safe PV arrays and systems.

At the time of publication there was very limited technology for arc detection and prevention in PV arrays and there were limited standards for arc signatures. When this technology is more fully developed there will be a revision of this Standard, which will require the use of this technology for PV arrays.

Many new protection features for arrays when used in grid connected applications will be implemented in inverter systems and are required by the International Standard for inverters—IEC 62109-2, Ed. 1.0 (2011), *Safety of power converters for use in photovoltaic power systems, Part 2: Particular requirements for inverters*. Both this Standard and AS 4777, *Grid connection of energy systems via inverters (series)* require inverters that comply with IEC 62109-2 for grid connected PV systems.

There are a number of changes in requirements in this revision. They include but are not limited to—

- (a) change in the scope of this Standard with respect to power limit;
- (b) additions of provisions relating to d.c. conditioning units applied at the module level;
- (c) revisions to small micro inverter and a.c. module installation requirements;
- (d) differentiation of Australian and New Zealand disconnecter requirements;
- (e) requirements for PV cables, cable protection and conduit; connector requirements; and
- (f) new signs and commissioning requirements.

A1 | Amendment 1 to this Standard includes additional requirements for d.c. isolators/disconnectors and their installation. This amendment is published to address fire risk issues and applies sound engineering principles and improved design and installation practices.

This Standard necessarily deals with existing types of systems, but is not intended to discourage innovation or to exclude materials equipment and methods that may be developed in the future. Revisions will be made from time to time in view of such developments, and amendments to this edition will be made when necessary.

Statements expressed in mandatory terms in notes to tables and figures are deemed to be requirements of this Standard.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

CONTENTS

	<i>Page</i>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE AND APPLICATION.....	4
1.2 OBJECTIVE.....	4
1.3 NORMATIVE REFERENCES	4
1.4 DEFINITIONS.....	6
SECTION 2 PV ARRAY SYSTEM CONFIGURATION	
2.1 CONFIGURATION.....	15
2.2 MECHANICAL DESIGN.....	26
SECTION 3 SAFETY ISSUES	
3.1 GENERAL.....	28
3.2 PROTECTION AGAINST ELECTRIC SHOCK.....	28
3.3 PROTECTION AGAINST OVERCURRENT	28
3.4 PROTECTION AGAINST EARTH FAULTS	32
3.5 PROTECTION AGAINST EFFECTS OF LIGHTNING AND OVERVOLTAGE	34
SECTION 4 SELECTION AND INSTALLATION OF ELECTRICAL EQUIPMENT	
4.1 GENERAL.....	36
4.2 PV ARRAY MAXIMUM VOLTAGE.....	36
4.3 COMPONENT REQUIREMENTS.....	37
4.4 LOCATION AND INSTALLATION REQUIREMENTS	46
4.5 COMMISSIONING	60
SECTION 5 MARKING AND DOCUMENTATION	
5.1 EQUIPMENT MARKING.....	61
5.2 REQUIREMENTS FOR LABELS AND SIGNS	61
5.3 LABELLING/SIGNS FOR PV CABLES AND ENCLOSURES	61
5.4 FIRE EMERGENCY INFORMATION	62
5.5 LABELLING/SIGNS FOR DISCONNECTION DEVICES	62
5.6 LABELLING OF FUSE HOLDERS.....	63
5.7 DOCUMENTATION.....	63
APPENDICES	
A EXAMPLES OF SIGNS	65
B EARTHING AND D.C. ISOLATION	68
C MAINTENANCE RECOMMENDATIONS	74
D TESTING AND COMMISSIONING.....	77
E ADDITIONAL COMMISSIONING TESTS.....	83
F PROTECTION AGAINST EFFECTS OF LIGHTNING AND OVERVOLTAGE	86
G GROUND FLASH DENSITY MAPS.....	93
H TRANSITIONAL PERIOD	96
BIBLIOGRAPHY.....	97

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Installation and safety requirements for photovoltaic (PV) arrays

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE AND APPLICATION**1.1.1 Scope**

This Standard sets out general installation and safety requirements for photovoltaic (PV) arrays, including d.c. array wiring, electrical protection devices, switching and earthing up to but not including energy storage devices or loads. Provisions relating to power conversion equipment are covered only where d.c. safety issues are involved. Small d.c. conditioning units intended for connection to one or two PV modules are included.

The safety requirements of this Standard are critically dependent on the inverters associated with PV arrays complying with the requirements of IEC 62109-1 and IEC 62109-2 and all power conversion equipment complying with IEC 62109 series standards.

PV arrays in portable equipment of less than 240 W and less than 50 V open circuit voltage at standard test condition (STC) are not covered by this Standard. PV arrays of greater than 240 kW at STC are not covered by this Standard.

NOTE: While this Standard applies to systems of up to 240 kW, the general requirements of this Standard may be applied to larger installations.

1.1.2 Application

This Standard shall apply three months from the date of publication with the exception of the issues identified in Appendix H.

1.2 OBJECTIVE

The object of this Standard is to address the safety requirements arising from the particular characteristics of photovoltaic systems. Direct current systems, and photovoltaic arrays in particular, pose hazards in addition to those derived from conventional a.c. power systems, including the ability to produce and sustain electrical arcs with currents that are not greater than normal operating currents.

NOTE: This Standard does not include installation requirements for batteries in systems but it does cover the extra protection requirements of PV arrays that result from the use of batteries in PV systems.

1.3 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard.

NOTE: Documents referenced for informative purposes are listed in the Bibliography.

AS

60529 Degrees of protection provided by enclosures (IP Code)

AS/NZS

1170 Structural design actions

1170.2 Part 2: Wind actions

1170.3 Part 3: Snow and ice actions