

AS/NZS IEC 62109.3:2023
IEC 62109-3:2020
IEC 62109-3:2020/COR1:2020



Australian/New Zealand Standard™

Safety of power converters for use in photovoltaic power systems

Part 3: Particular requirements for electronic devices in combination with photovoltaic elements



AS/NZS IEC 62109.3:2023

This Joint Australian/New Zealand Standard™ was prepared by Joint Technical Committee EL-042, Renewable Energy Power Supply Systems & Equipment. It was approved on behalf of the Council of Standards Australia on 24 May 2023 and by the New Zealand Standards Approval Board on 03 May 2023.

This Standard was published on 9 June 2023.

The following are represented on Committee EL-042:

Australasian Fire and Emergency Service Authorities Council
Australian Energy Council
Australian Energy Market Operator
Australian Industry Group
Australian PV Institute
Better Regulation Division (Fair Trading, SafeWork NSW, TestSafe)
Clean Energy Council
Clean Energy Regulator
Communications, Electrical and Plumbing Union — Electrical Division
Consumer Electronics Suppliers Association
Consumers Federation of Australia
CSIRO
Electrical Compliance Testing Association of Australia
Electrical Regulatory Authorities Council, Australia
Electrical Safety New Zealand
Electricity Authority Of New Zealand
Electricity Engineers Association of New Zealand
ElectroComms & Energy Utilities Industry Skills Council
Energy Efficiency & Conservation Authority of New Zealand
Energy Networks Australia
Engineers Australia
Institute of Electrical and Electronics Engineers
Institute of Electrical Inspectors
Institution of Fire Engineers (NZ Branch)
Joint Accreditation System of Australia & New Zealand
Master Electricians Australia
National Electrical and Communications Association
Office of the Technical Regulator (SA)
Smart Energy Council
Solar Energy Industries Association
Sustainable Electricity Association New Zealand
University of New South Wales
Vector
Wellington Electrical Association
WorkSafe New Zealand

This Standard was issued in draft form for comment as DR AS/NZS IEC 62109.3:2023.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:

www.standards.org.au

www.standards.govt.nz

ISBN 978 1 76139 224 5

Australian/New Zealand Standard™

Safety of power converters for use in photovoltaic power systems

Part 3: Particular requirements for electronic devices in combination with photovoltaic elements

First published as AS/NZS IEC 62109.3:2023.



© IEC Geneva Switzerland 2023 — All rights reserved

© Standards Australia Limited/the Crown in right of New Zealand, administered by the New Zealand Standards Executive 2023

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 either the IEC or the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth) or the Copyright Act 1994 (New Zealand). If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please see the contact details on the back cover or the contact us page of the website for further information.

Preface

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-042, Renewable Energy Power Supply Systems and Equipment.

The objective of this document is to specify the safety requirements for electronic elements that are mechanically and/or electrically incorporated with photovoltaic (PV) modules or systems.

Mechanically and/or electrically incorporated means that the whole combination of electronic device with the photovoltaic element is sold as one product. Nevertheless, tests provided in this document may also be used to evaluate compatibility of PV modules and electronic devices that are sold separately and are intended to be installed close to each other.

This document includes electronic devices combined with PV modules that perform functions such as, but not limited to —

- (a) DC-DC or DC-AC power conversion;
- (b) active diodes;
- (c) protection;
- (d) control;
- (e) monitoring; or
- (f) communication.

These requirements specifically address such electronic devices used in combination with flat-plate photovoltaic (PV) modules.

The purpose of the requirements of this document is to provide additional safety-related testing requirements for the following types of integrated electronics, collectively referred to as module integrated equipment (MIE):

- (i) Type A MIE where the PV element can be evaluated as a PV module according to IEC 61730-1 and IEC 61730-2 independently from the electronic element.
- (ii) Type B MIE where the PV element cannot be evaluated as a PV module according to IEC 61730-1 and IEC 61730-2 independently from the electronic element.

PV modules with only one or more bypass diodes as the combined or integrated element are excluded from this document. Such products are covered by IEC 61730-1 and IEC 61730-2.

All aspects of IEC 62109-1:2010 apply. Evaluating the MIE to AS/NZS 61215.1 is excluded from this document.

This document is identical with, and has been reproduced from, IEC 62109-3:2020, *Safety of power converters for use in photovoltaic power systems—Part 3: Particular requirements for electronic devices in combination with photovoltaic elements* and its Corrigendum No. 1 (2020) which has been added to the end of the source text.

As this document has been reproduced from an International Standard, the following applies:

- (A) In the source text “this part of 62109” should read “this document”.
- (B) A full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a Standard, whereas an “informative” appendix or annex is only for information and guidance.

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 General testing requirements.....	9
4.1 General.....	9
4.2 General conditions for testing	16
4.2.1 Sequence of tests.....	16
4.2.2 Reference test conditions	18
4.3 Thermal testing.....	18
4.3.2 Maximum temperatures	18
4.4 Testing in single fault condition.....	23
4.4.4 Single fault conditions to be applied	23
4.8 Additional tests for grid-interactive inverters	23
4.300 General requirements regarding protection of the PV element circuit of MIE	23
5 Marking and documentation.....	24
5.1 Marking.....	24
5.1.1 General	24
5.1.3 Identification.....	24
5.1.4 Equipment ratings.....	25
5.3 Documentation.....	25
5.3.2 Information related to installation.....	25
6 Environmental requirements and conditions.....	25
7 Protection against electric shock and energy hazards.....	25
8 Protection against mechanical hazards.....	25
9 Protection against fire hazards	25
10 Protection against sonic pressure hazards.....	26
11 Protection against liquid hazards	26
12 Protection against chemical hazards.....	26
13 Physical requirements	26
13.4 Internal wiring and connections.....	26
13.4.5 Interconnection between parts of the PCE	26
13.9 Fault indication	27
13.9.300 Fault indication for MIE	27
13.300 Requirements for field assembled MIE	27
14 Components	27
15 Software and firmware performing safety functions.....	27
Annex A (normative) Alternative method for PV module nominal backsheet temperature (T_{NBs})	28
A.1 General.....	28
A.2 Principle	28
A.3 Test procedure.....	28

Figure 300 – Test sequence.....	17
Figure 301 – Location of heating pads	20
Figure 302 – Test setup for Type B MIE (cross-section view)	22
Figure 303 – Test setup for Type A MIE (cross-section view)	22
Table 300 – IEC 61730-2:2016 test reference for Type A and Type B MIE	11

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SAFETY OF POWER CONVERTERS
FOR USE IN PHOTOVOLTAIC POWER SYSTEMS –****Part 3: Particular requirements for electronic devices
in combination with photovoltaic elements**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62109-3 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
82/1718/FDIS	82/1737/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 62109 series, under the general title, *Safety of power converters for use in photovoltaic power systems*, can be found on the IEC website.

The requirements in this document IEC 62109-3 are to be used with the requirements in IEC 62109-1:2010 and IEC 62109-2:2011. This document IEC 62109-3 supplements or modifies clauses in IEC 62109-1:2010 and IEC 62109-2:2011. When a particular clause or subclause of IEC 62109-1:2010 or IEC 62109-2:2011 is not mentioned in this document IEC 62109-3, that clause of IEC 62109-1:2010 and/or IEC 62109-2:2011 applies. When this document IEC 62109-3 contains clauses that add to, modify, or replace clauses in IEC 62109-1:2010 or IEC 62109-2:2011, the relevant text of IEC 62109-1:2010 and IEC 62109-2:2011 is to be applied with the required changes.

Subclauses, figures and tables additional to those in IEC 62109-1:2010 and IEC 62109-2:2011 are numbered starting from 300 to indicate that they are introduced in this document IEC 62109-3.

NOTE For example, new level 2 subclauses in clause 5 would be numbered 5.300, 5.301, etc. New level 4 subclauses in subclause 7.3.201 would be numbered 7.3.201.300, 7.3.201.301, etc.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

The contents of the corrigendum of November 2020 have been included in this copy.

INTRODUCTION

This part 3 of IEC 62109 gives requirements for products which consist of an electronic element and a PV element or PV module. For this type of equipment, specific safety aspects must be considered that arise from the combination of these two product types. This part 3 gives safety requirements by: referring to other parts of IEC 62109 and to PV module standards like IEC 61730, defining tests and requirements that are in addition to these product standards of the sub elements, defining modifications to the test procedures in IEC 62109 and IEC 61730, and providing guidance to apply these tests to the combination of PV module and electronics.

SAFETY OF POWER CONVERTERS FOR USE IN PHOTOVOLTAIC POWER SYSTEMS –

Part 3: Particular requirements for electronic devices in combination with photovoltaic elements

1 Scope

This Part 3 of IEC 62109 covers the particular safety requirements for electronic elements that are mechanically and/or electrically incorporated with photovoltaic (PV) modules or systems.

Mechanically and/or electrically incorporated means that the whole combination of electronic device with the photovoltaic element is sold as one product. Nevertheless, tests provided in this document may also be used to evaluate compatibility of PV modules and electronic devices that are sold separately and are intended to be installed close to each other.

Items included in the scope:

Electronic devices combined with PV modules that perform functions such as, but not limited to, DC-DC or DC-AC power conversion, active diodes, protection, control, monitoring, or communication. These requirements specifically address such electronic devices used in combination with flat-plate photovoltaic (PV) modules.

NOTE It is acknowledged that the physical design of products covered by this scope may vary widely, it is anticipated that the requirements of this document may need to evolve to meet the unique safety requirements of such products, particularly if the photovoltaic element of the product is not of a flat-plate configuration. As an example, this document does not fully address the safety requirements of building-integrated photovoltaics (BIPV) and building-attached photovoltaics (BAPV) products, although they would fall under the scope of this document.

The purpose of the requirements of this part of IEC 62109 is to provide additional safety-related testing requirements for the following types of integrated electronics, collectively referred to as module integrated equipment (MIE):

- a) Type A MIE where the PV element can be evaluated as a PV module according to IEC 61730-1 and IEC 61730-2 independently from the electronic element;
- b) Type B MIE where the PV element cannot be evaluated as a PV module according to IEC 61730-1 and IEC 61730-2 independently from the electronic element.

Items excluded from the scope:

PV modules with only one or more bypass diodes as the combined or integrated element. Such products are covered by IEC 61730-1 and IEC 61730-2.

Aspects included and excluded from scope:

All aspects of IEC 62109-1:2010 apply. Addition to the list “excluded from the scope” is evaluating the MIE to IEC 61215-1.

2 Normative references

Clause 2 of IEC 62109-1:2010 and IEC 62109-2:2011 is applicable with the following additions:

IEC 61215-2:2016, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 2: Test procedures*

IEC 61730-1:2016, *Photovoltaic module safety qualification – Part 1: Requirements for construction*

IEC 61730-2:2016, *Photovoltaic (PV) module safety qualification – Part 2: Requirements for testing*

IEC 61853-2:2016, *Photovoltaic (PV) module performance testing and energy rating – Part 2: Spectral responsivity, incidence angle and module operating temperature measurements*

IEC 62109-1:2010, *Safety of power converters for use in photovoltaic power systems – Part 1: General requirements*

IEC 62109-2:2011, *Safety of power converters for use in photovoltaic power systems – Part 2: Particular requirements for inverters*

IEC 62790:2014, *Junction boxes for photovoltaic modules – Safety requirements and tests*

3 Terms and definitions

Clause 3 of IEC 62109-1:2010 and IEC 62109-2:2011 is applicable with the following modifications:

Modification:

In all cases where the term “PCE” is used in a definition in Clause 3 of IEC 62109-1:2010 or IEC 62109-2:2011, it is replaced in this part with the term “MIE”, except for 3.66.

3.39

Isc PV

Modification:

Replace “array” with “PV element”.

3.58

Pluggable equipment type B

Modify Note:

Note 1 to entry: MIE PV AC and DC circuits that use connectors are considered pluggable equipment type B MIE and may also be considered fixed equipment.

3.97

Vmax PV

Modification:

Replace “array” with “PV element”.

Additional subclauses:

3.300

module integrated equipment

MIE

minimally, the complete combination of photovoltaic elements, electronic devices, wiring with connector(s), and mechanical mounting means

Note 1 to entry: This document uses two designations for MIE only for the purpose of describing test methods and what tests apply: Type A MIE and Type B MIE. These type designations have no meaning outside of this document.