

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Safety of power converters for use in photovoltaic power systems –
Part 3: Particular requirements for electronic devices in combination with
photovoltaic elements**

**Sécurité des convertisseurs de puissance utilisés dans les systèmes
photovoltaïques –
Partie 3: Exigences particulières pour les dispositifs électroniques combinés
aux éléments photovoltaïques**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2020 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Safety of power converters for use in photovoltaic power systems –
Part 3: Particular requirements for electronic devices in combination with
photovoltaic elements**

**Sécurité des convertisseurs de puissance utilisés dans les systèmes
photovoltaïques –
Partie 3: Exigences particulières pour les dispositifs électroniques combinés
aux éléments photovoltaïques**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 27.160

ISBN 978-2-8322-8483-4

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

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.....	17
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

Currently in preview, click buy full version

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, accept 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.

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.

Currently in preview, click buy full version

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*