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Standards

Irish Standard  
I.S. EN 62109-1:2010

# Safety of power converters for use in photovoltaic power systems -- Part 1: General requirements (IEC 62109 -1:2010 (EQV))

## I.S. EN 62109-1:2010

*Incorporating amendments/corrigenda issued since publication:*

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EUROPEAN STANDARD

**EN 62109-1**

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July 2010

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English version

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

Sécurité des convertisseurs de puissance  
utilisés dans les réseaux d'énergie  
photovoltaïque -  
Partie 1: Exigences générales  
(CEI 62109-1:2010)

Sicherheit von Wechselrichtern  
zur Anwendung in photovoltaischen  
Energiesystemen -  
Teil 1: Allgemeine Anforderungen  
(IEC 62109-1:2010)

This European Standard was approved by CENELEC on 2010-07-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

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## **Foreword**

The text of document 82/593/FDIS, future edition 1 of IEC 62109-1, prepared by IEC TC 82, Solar photovoltaic energy systems, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62109-1 on 2010-07-01.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

- latest date by which the EN has to be implemented  
at national level by publication of an identical  
national standard or by endorsement (dop) 2011-04-01
- latest date by which the national standards conflicting  
with the EN have to be withdrawn (dow) 2013-07-01

Annex ZA has been added by CENELEC.

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## **Endorsement notice**

The text of the International Standard IEC 62109-1:2010 was approved by CENELEC as a European Standard without any modification.

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## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60060-1	-	High-voltage test techniques - Part 1: General definitions and test requirements	HD 588.1	-
IEC 60085	-	Electrical insulation - Thermal evaluation and designation	EN 60085	-
IEC 60112	-	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN 60112	-
IEC 60216-1	-	Electrical insulating materials - Properties of thermal endurance - Part 1: Ageing procedures and evaluation of test results	EN 60216-1	-
IEC 60216-2	-	Electrical insulating materials - Thermal endurance properties - Part 2: Determination of thermal endurance properties of electrical insulating materials - Choice of test criteria	EN 60216-2	-
IEC 60216-3	-	Electrical insulating materials - Thermal endurance properties - Part 3: Instructions for calculating thermal endurance characteristics	EN 60216-3	-
IEC 60216-4-1	-	Electrical insulating materials - Thermal endurance properties - Part 4-1: Ageing ovens - Single-chamber ovens	EN 60216-4-1	-
IEC 60216-5	-	Electrical insulating materials - Thermal endurance properties - Part 5: Determination of relative thermal endurance index (RTE) of an insulating material	EN 60216-5	-
IEC 60216-6	-	Electrical insulating materials - Thermal endurance properties - Part 6: Determination of thermal endurance indices (TI and RTE) of an insulating material using the fixed time frame method	EN 60216-6	-
IEC 60227-1	2007	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 1: General requirements	-	-

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<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60245-1	2003	Rubber insulated cables - Rated voltages up to and including 450/750 V - Part 1: General requirements	-	-
IEC 60309	Series	Plugs, socket-outlets and couplers for industrial purposes	EN 60309	Series
IEC 60320	Series	Appliance couplers for household and similar general purposes	EN 60320	Series
IEC 60364-1 (mod)	2005	Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions	HD 60364-1	2008
IEC 60364-5-54 (mod)	-	Electrical installations of buildings - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements, protective conductors and protective bonding conductors	HD 60364-5-54	-
IEC 60417	-	Graphical symbols for use on equipment	-	-
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	EN 60529	-
IEC 60664	Series	Insulation coordination for equipment within low-voltage systems	EN 60664	Series
IEC 60664-1	2007	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests	EN 60664-1	2007
IEC 60664-3	2003	Insulation coordination for equipment within low-voltage systems - Part 3: Use of coating, potting or moulding for protection against pollution	EN 60664-3	2003
IEC 60664-4	2005	Insulation coordination for equipment within low-voltage systems - Part 4: Consideration of high-frequency voltage stress	EN 60664-4 + corr. October	2006 2006
IEC 60695-2-11	-	Fire hazard testing - Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end-products	EN 60695-2-11	-
IEC/TS 60695-2-20	-	Fire hazard testing - Part 2-20: Glowing/hot wire based test methods - Hot-wire coil ignitability - Apparatus, test method and guidance	-	-
IEC 60695-11-5	-	Fire hazard testing - Part 11-5: Test flames - Needle-flame test method - Apparatus, confirmatory test arrangement and guidance	EN 60695-11-5	-
IEC 60695-11-10	-	Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods	EN 60695-11-10	-
IEC 60695-11-20	-	Fire hazard testing - Part 11-20: Test flames - 500 W flame test methods	EN 60695-11-20	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60730-1 (mod)	2010	Automatic electrical controls for household and similar use - Part 1: General requirements	EN 60730-1	201X <sup>1)</sup>
IEC/TR 60755	-	General requirements for residual current operated protective devices	-	-
IEC 60950-1 (mod)	2005	Information technology equipment - Safety - Part 1: General requirements	EN 60950-1 + A11	2006 2009
IEC 60990	1999	Methods of measurement of touch current and protective conductor current	EN 60990	1999
IEC 61032	-	Protection of persons and equipment by enclosures - Probes for verification	EN 61032	-
IEC 61180-1	-	High-voltage test techniques for low-voltage equipment - Part 1: Definitions, test and procedure requirements	EN 61180-1	-
IEC 62020	-	Electrical accessories - Residual current monitors for household and similar uses (RCMs)	EN 62020	-
ISO 178	-	Plastics - Determination of flexural properties	EN ISO 178	-
ISO 179	Series	Plastics - Determination of Charpy impact properties	EN ISO 179	Series
ISO 180	-	Plastics - Determination of Izod impact strength	EN ISO 180	-
ISO 261	-	ISO general-purpose metric screw threads - General plan	-	-
ISO 262	-	ISO general-purpose metric screw threads - Selected sizes for screws, bolts and nuts	-	-
ISO 527	Series	Plastics - Determination of tensile properties	EN ISO 527	Series
ISO 3746	-	Acoustics - Determination of sound power levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane	EN ISO 3746	-
ISO 4892-1	-	Plastics - Methods of exposure to laboratory light sources - Part 1: General guidance	EN ISO 4892-1	-
ISO 4892-2	-	Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps	EN ISO 4892-2	-
ISO 4892-4	-	Plastics - Methods of exposure to laboratory light sources - Part 4: Open-flame carbon-arc lamps	-	-
ISO 7000	-	Graphical symbols for use on equipment - Index and synopsis	-	-
ISO 8256	-	Plastics - Determination of tensile-impact strength	EN ISO 8256	-
ISO 9614-1	-	Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 1: Measurement at discrete points	EN ISO 9614-1	-

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<sup>1)</sup> At draft stage.

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<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO 9614-2	-	Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 2: Measurement by scanning	EN ISO 9614-2	-
ISO 9614-3	-	Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 3: Precision method for measurement by scanning	EN ISO 9614-3	-
ANSI/ASTM E84	-	Standard Test Method for Surface Burning Characteristics of Building Materials	-	-
ANSI/UL 746B	-	Polymeric Materials - Long-Term Property Evaluations	-	-
ANSI/UL 746C	-	Polymeric Materials - Used in Electrical Equipment Evaluations	-	-
ASTM E162	-	Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source	-	-



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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**SAFETY OF POWER CONVERTERS FOR USE  
IN PHOTOVOLTAIC POWER SYSTEMS –**
**Part 1: General requirements**

## 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.
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International Standard IEC 62109-1 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

The text of this standard is based on the following documents:

FDIS	Report on voting
82/593/FDIS	82/597/RVD

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

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

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

A bilingual version of this publication may be issued at a later date.

**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 of IEC 62109 specifies the safety requirements that are generally applicable to all equipment within its scope. For certain types of equipment, these requirements will be supplemented or modified by the special requirements of one or more subsequent parts (for example IEC 62109-2, IEC 62109-3, etc.) of the standard which must be read in conjunction with the Part 1 requirements.

# **SAFETY OF POWER CONVERTERS FOR USE IN PHOTOVOLTAIC POWER SYSTEMS –**

## **Part 1: General requirements**

### **1 Scope and object**

#### **1.1 Scope**

This part of IEC 62109 applies to the power conversion equipment (PCE) for use in Photovoltaic (PV) systems where a uniform technical level with respect to safety is necessary. This standard defines the minimum requirements for the design and manufacture of PCE for protection against electric shock, energy, fire, mechanical and other hazards.

This standard provides general requirements applicable to all types of PV PCE. There are additional parts of this standard that provide specific requirements for the different types of power converters, such as Part 2 - inverters. Additional parts may be published as new products and technologies are commercialised.

##### **1.1.1 Equipment included in scope**

This standard covers PCE connected to systems not exceeding maximum PV source circuit voltage of 1 500 V d.c. The equipment may also be connected to systems not exceeding 1 000 V a.c. at the a.c. mains circuits, non-mains a.c. load circuits, and to other DC source or load circuits such as batteries. This standard may be used for accessories for use with PCE, except where more appropriate standards exist.

Evaluation of PCE to this standard includes evaluation of all features and functions incorporated in or available for the PCE, or referred to in the documentation provided with the PCE, if such features or functions can affect compliance with the requirements of this standard.

##### **1.1.2 Equipment for which other requirements may apply**

This standard has not been written to address characteristics of power sources other than photovoltaic systems, such as wind turbines, fuel cells, rotating machine sources, etc.

NOTE 1 Requirements for other sources may be incorporated in the IEC 62109 series in the future.

Additional or other requirements are necessary for equipment intended for use in explosive atmospheres (see IEC 60079), aircraft, marine installations, electromedical applications (see IEC 60601) or at elevations above 2 000 m.

NOTE 2 Requirements are included for adjustment of clearance distances for higher elevations, but not for other factors related to elevation, such as thermal considerations

### **1.2 Object**

#### **1.2.1 Aspects included in scope**

The purpose of the requirements of this part of IEC 62109 is to ensure that the design and methods of construction used provide adequate protection for the operator and the surrounding area against:

- a) electric shock and energy hazards;
- b) mechanical hazards;

- c) excessive temperature hazards;
- d) spread of fire from the equipment;
- e) chemical hazards;
- f) sonic pressure hazards;
- g) liberated fluids, gases and explosion hazards.

NOTE Servicing personnel are expected to have the necessary knowledge and skill to use reasonable care in dealing with hazards associated with the operation, repair and maintenance of this equipment. Based upon this premise, this standard provides only limited requirements (for example markings or guarding) intended to protect service personnel from hazards that may not be apparent even to trained personnel.

### 1.2.2 Aspects excluded from scope

Aspects not covered by this standard include, but are not limited to, the following:

- a) functional reliability, performance or other properties of the equipment not related to safety;
- b) effectiveness of transport packaging;
- c) EMC requirements;
- d) installation requirements, which are covered by local and national installation codes.

NOTE This standard does provide requirements for PCE intended to ensure that the PCE can be installed in a safe manner, including requirements for installation instructions provided with the product.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60085, *Electrical insulation – Thermal evaluation and designation*

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60216-1, *Electrical insulating materials – Properties of thermal endurance – Part 1: Ageing procedures and evaluation of test results*

IEC 60216-2, *Electrical insulating materials – Thermal endurance properties – Part 2: Determination of thermal endurance properties of electrical insulating materials – Choice of test criteria*

IEC 60216-3, *Electrical insulating materials – Thermal endurance properties – Part 3: Instructions for calculating thermal endurance characteristics*

IEC 60216-4-1, *Electrical insulating materials – Thermal endurance properties – Part 4-1: Ageing ovens – Section 1: Single-chamber ovens*

IEC 60216-5, *Electrical insulating materials – Thermal endurance properties – Part 5: Determination of relative thermal endurance index (RTE) of an insulating material*

IEC 60216-6, *Electrical insulating materials – Thermal endurance properties – Part 6: Determination of thermal endurance indices (TI and RTE) of an insulating material using the fixed time frame method*

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