



**The Gambia
Standards Bureau**

**Safety of power converters for use in photovoltaic power
systems –
Part 1: General Requirements**

ICS No.: 27.160

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TABLE OF CONTENTS

FOREWORD.....	8
INTRODUCTION.....	10
1 Scope and object.....	11
1.1 Scope.....	11
1.1.1 Equipment included in scope.....	11
1.1.2 Equipment for which other requirements may apply.....	11
1.2 Object.....	11
1.2.1 Aspects included in scope.....	11
1.2.2 Aspects excluded from scope.....	12
2 Normative references.....	12
3 Terms and definitions.....	15
4 General testing requirements.....	25
4.1 General.....	25
4.2 General conditions for testing.....	25
4.2.1 Sequence of tests.....	25
4.2.2 Reference test conditions.....	25
4.3 Thermal testing.....	28
4.3.1 General.....	28
4.3.2 Maximum temperatures.....	28
4.4 Testing in single fault condition.....	31
4.4.1 General.....	31
4.4.2 Test conditions and duration for testing under fault conditions.....	31
4.4.3 Pass/fail criteria for testing under fault conditions.....	32
4.4.4 Single fault conditions to be applied.....	33
4.5 Humidity preconditioning.....	36
4.5.1 General.....	36
4.5.2 Conditions.....	36
4.6 Backfeed voltage protection.....	36
4.6.1 Backfeed tests under normal conditions.....	37
4.6.2 Backfeed tests under single-fault conditions.....	37
4.6.3 Compliance with backfeed tests.....	37
4.7 Electrical ratings tests.....	37
4.7.1 Input ratings.....	37
4.7.2 Output ratings.....	37
5 Marking and documentation.....	37
5.1 Marking.....	37
5.1.1 General.....	37
5.1.2 Durability of markings.....	38
5.1.3 Identification.....	38
5.1.4 Equipment ratings.....	38
5.1.5 Fuse identification.....	38
5.1.6 Terminals, connections and controls.....	39
5.1.7 Switches and circuit-breakers.....	39
5.1.8 Class II equipment.....	39
5.1.9 Terminal boxes for external connections.....	40
5.2 Warning markings.....	40
5.2.1 Visibility and legibility requirements for warning markings.....	40
5.2.2 Content for warning markings.....	40
5.2.3 Sonic hazard markings and instructions.....	41

5.2.4	Equipment with multiple sources of supply.....	41
5.2.5	Excessive touch current.....	41
5.3	Documentation	42
5.3.1	General	42
5.3.2	Information related to installation.....	42
5.3.3	Information related to operation.....	43
5.3.4	Information related to maintenance.....	44
6	Environmental requirements and conditions.....	44
6.1	Environmental categories and minimum environmental conditions	45
6.1.1	Outdoor	45
6.1.2	Indoor, unconditioned	45
6.1.3	Indoor, conditioned.....	45
6.2	Pollution degree	46
6.3	Ingress protection.....	47
6.4	UV exposure	47
6.5	Temperature and humidity.....	47
7	Protection against electric shock and energy hazards.....	47
7.1	General.....	47
7.2	Fault conditions	47
7.3	Protection against electric shock	48
7.3.1	General	48
7.3.2	Decisive voltage classification	48
7.3.3	Protective separation.....	52
7.3.4	Protection against direct contact.....	52
7.3.5	Protection in case of direct contact.....	57
7.3.6	Protection against indirect contact.....	60
7.3.7	Insulation including clearance and creepage distances.....	68
7.3.8	Residual Current Detection (RCD) or Monitoring (RCM) device compatibility	79
7.3.9	Protection against shock hazard due to stored energy	80
7.4	Protection against energy hazards	80
7.4.1	Determination of hazardous energy level.....	80
7.4.2	Operator access areas	81
7.4.3	Service access areas	81
7.5	Electrical tests related to shock hazard	81
7.5.1	Impulse voltage test (type test).....	81
7.5.2	Voltage test (dielectric strength test) (type test and routine test).....	83
7.5.3	Partial discharge test (type test or sample test)	87
7.5.4	Touch current measurement (type test)	88
7.5.5	Equipment with multiple sources of supply.....	89
8	Protection against mechanical hazards.....	89
8.1	General.....	89
8.2	Moving parts	90
8.2.1	Protection of service persons	90
8.3	Stability.....	90
8.4	Provisions for lifting and carrying.....	91
8.5	Wall mounting	91
8.6	Expelled parts	92
9	Protection against fire hazards	92
9.1	Resistance to fire	92
9.1.1	Reducing the risk of ignition and spread of flame.....	92
9.1.2	Conditions for a fire enclosure	93

9.1.3	Materials requirements for protection against fire hazard.....	93
9.1.4	Openings in fire enclosures	96
9.2	Limited power sources.....	100
9.2.1	General	100
9.2.2	Limited power source tests	100
9.3	Short-circuit and overcurrent protection.....	101
9.3.1	General	101
9.3.2	Number and location of overcurrent protective devices	101
9.3.3	Short-circuit co-ordination (backup protection).....	102
10	Protection against sonic pressure hazards.....	102
10.1	General	102
10.2	Sonic pressure and sound level.....	102
10.2.1	Hazardous noise levels.....	102
11	Protection against liquid hazards	103
11.1	Liquid containment, pressure and leakage.....	103
11.2	Fluid pressure and leakage	103
11.2.1	Maximum pressure	103
11.2.2	Leakage from parts.....	104
11.2.3	Overpressure safety device	104
11.3	Oil and grease.....	104
12	Chemical hazards.....	104
12.1	General	104
13	Physical requirements	105
13.1	Handles and manual controls	105
13.1.1	Adjustable controls	105
13.2	Securing of parts	105
13.3	Provisions for external connections	105
13.3.1	General	105
13.3.2	Connection to an a.c. mains supply	106
13.3.3	Wiring terminals for connection of external conductors	110
13.3.4	Supply wiring space.....	111
13.3.5	Wire bending space for wires 10 mm ² and greater	112
13.3.6	Disconnection from supply sources.....	112
13.3.7	Connectors, plugs and sockets	112
13.3.8	Direct plug-in equipment.....	113
13.4	Internal wiring and connections	113
13.4.1	General	113
13.4.2	Routing.....	113
13.4.3	Colour coding	113
13.4.4	Splices and connections	114
13.4.5	Interconnections between parts of the PCE	114
13.5	Openings in enclosures	114
13.5.1	Top and side openings	114
13.6	Polymeric materials	116
13.6.1	General	116
13.6.2	Polymers serving as enclosures or barriers preventing access to hazards	117
13.6.3	Polymers serving as solid insulation	117
13.6.4	UV resistance	118
13.7	Mechanical resistance to deflection, impact, or drop.....	118

GAMBIAN STANDARD	GAMS IEC 62109-1:2010
13.7.1 General	118
13.7.2 250 N deflection test for metal enclosures	119
13.7.3 7 J impact test for polymeric enclosures	119
13.7.4 Drop test	119
13.8 Thickness requirements for metal enclosures	120
13.8.1 General	120
13.8.2 Cast metal	120
13.8.3 Sheet metal	120
14 Components	122
14.1 General	122
14.2 Motor overtemperature protection	124
14.3 Overtemperature protection devices	124
14.4 Fuse holders	124
14.5 Mains voltage selecting devices	124
14.6 Printed circuit boards	124
14.7 Circuits or components used as transient overvoltage limiting devices	125
14.8 Batteries	125
14.8.1 Battery enclosure ventilation	125
14.8.2 Battery mounting	126
14.8.3 Electrolyte spillage	126
14.8.4 Battery connections	127
14.8.5 Battery maintenance instructions	127
14.8.6 Battery accessibility and maintainability	127
15 Software and firmware performing safety functions	127

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For further information on and copies of Gambian Standards, please contact The Gambia Standards Bureau.

TECHNICAL COMMITTEE RESPONSIBLE: NATIONAL ELECTROTECHNICAL COMMITTEE

The National Electrotechnical Committee (NEC) developed this National Wiring Standard. The NEC was initially set up by PURA in 2008 when they became a member of IEC. Upon establishment of the Bureau and replacement of PURA at IEC, the Bureau took over the NEC in 2012 and began the work of development of standards in the electrotechnical field.

The NEC consists of representatives from the following Institutions/Organizations:

- Public Utilities Regulatory Authority
- National Water and Electricity Company
- Gambia Telecommunications Company
- Ministry of Energy
- Ministry of Information and Communication Infrastructure
- University of The Gambia
- Gambia Technical Training Institute
- New Gambia Industrialists
- ComAfrique Intelizon Initiative
- Renewable Energy Association of The Gambia
- Consumer Protection Association of The Gambia
- The Gambia Chamber of Commerce and Industry

The Gambia Standards Bureau is the Secretariat and Secretary to the NEC.

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 website 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.

INTRODUCTION

This Part of GAMS 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.

1. Scope and Object

1.1 Scope

This part of GAMS 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 commercialized.

1.1.1 Equipment included in scope

This standard covers PCE connected to systems not exceeding maximum PV source circuit voltage of 1500 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*

IEC 60227-1:2007, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 1: General requirements*

IEC 60245-1:2003, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 60309 (all parts), *Plugs, socket-outlets and couplers for industrial purposes*

IEC 60320 (all parts), *Appliance's couplers for household and similar general purposes*

IEC 60364-1:2005, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

IEC 60364-5-54, *Electrical installations of buildings – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements, protective conductors and protective bonding conductors*

IEC 60417, *Graphical symbols for use on equipment*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60664 (all parts), *Insulation coordination for equipment within low-voltage systems*

IEC 60664-3:2003, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

IEC 60664-4:2005, *Insulation coordination for equipment within low-voltage systems – Part 4: Consideration of high-frequency voltage stress*

IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*

IEC 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*

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 60695-11-20, *Fire hazard testing – Part 11-20: Test flames – 500 W flame test methods*

IEC 60730-1:2010, *Automatic electrical controls for household and similar use – Part 1: General requirements*

IEC 60755, *General requirements for residual current operated protective devices*

IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*

IEC 60990:1999, *Methods of measurement of touch current and protective conductor current*

IEC 61032, *Protection of persons and equipment by enclosures – Probes for verification*

GAMBIAN STANDARD

GAMS IEC 62109-1:2010

IEC 61180-1, *High-voltage test techniques for low voltage equipment – Part 1: Definitions, test and procedure requirements*

IEC 62020, *Electrical accessories – Residual current monitors for household and similar uses (RCMs)*

ISO 178, *Plastics – Determination of flexural properties*

ISO 179 (all parts), *Plastics – Determination of Charpy impact properties*

ISO 180, *Plastics – Determination of Izod impact strength*

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 (all parts), *Plastics – Determination of tensile properties*

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*

ISO 4892-1, *Plastics – Methods of exposure to laboratory light sources – Part 1: General guidance*

ISO 4892-2, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*

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*

ISO 9614-1, *Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 1: Measurement at discrete points*

ISO 9614-2, *Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 2: Measurement by scanning*

ISO 9614-3, *Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 3: Precision method for measurement by scanning*

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 – Use in Electrical Equipment Evaluations*

ASTM E162, *Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source*