



IEC 62108

Edition 3.0 2022-06
REDLINE VERSION

INTERNATIONAL STANDARD



Concentrator photovoltaic (CPV) modules and assemblies – Design qualification and type approval

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 27.160

ISBN 978-2-8322-3825-7

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	5
1 Scope and object	7
2 Normative references	7
3 Terms and definitions	9
4 Sampling	10
5 Marking	11
6 Testing	11
7 Pass criteria	12
8 Report	20
9 Modifications	21
10 Test procedures	21
10.1 Visual inspection	21
10.1.1 General	21
10.1.2 Procedure	21
10.1.3 Major visual defects	22
10.1.4 Requirements	22
10.2 Electrical performance measurement	22
10.2.1 Purpose	22
10.2.2 Outdoor side-by-side I-V measurement	22
10.2.3 Solar simulator I-V measurement	24
10.2.4 Dark I-V measurement	24
10.3 Ground path continuity test	25
10.3.1 General	25
10.3.2 Purpose	25
10.3.3 Procedure	25
10.3.4 Requirements	25
10.4 Electrical insulation test	26
10.4.1 Purpose	26
10.4.2 Procedure	26
10.4.3 Requirements	26
10.5 Wet insulation test	27
10.5.1 Purpose	27
10.5.2 Procedure	27
10.5.3 Requirements	27
10.6 Thermal cycling test	27
10.6.1 Purpose	27
10.6.2 Test sample	28
10.6.3 Procedure	28
10.6.4 Procedure for active cooling system	30
10.6.5 Requirements	30
10.7 Damp heat test	31
10.7.1 Purpose	31
10.7.2 Test sample	31
10.7.3 Procedure	31
10.7.4 Requirements	32

10.8	Humidity freeze test	32
10.8.1	Purpose	32
10.8.2	Test sample	32
10.8.3	Procedure	32
10.8.4	Requirements	32
10.9	Hail impact test	33
10.9.1	Purpose	33
10.9.2	Apparatus	33
10.9.3	Procedure	34
10.9.4	Requirements	34
10.10	Water spray test	35
10.10.1	General	35
10.10.2	Purpose	35
10.10.3	Procedure	35
10.10.4	Requirements	35
10.10	Dust and water ingress protection test	35
10.10.1	Purpose	35
10.10.2	Procedure	35
10.10.3	Requirements	35
10.11	Bypass/blocking diode thermal test	36
10.11.1	Purpose	36
10.11.2	Test sample	36
10.11.3	Apparatus	36
10.11.4	Procedure	36
10.11.5	Requirements	37
10.11.6	Procedure 2 – Alternate method	37
10.12	Robustness of terminations test	38
10.12.1	Purpose	38
10.12.2	Types of terminations	35
10.12.2	Procedure	39
10.12.3	Requirements	39
10.13	Mechanical load test	39
10.13.1	Purpose	39
10.13.2	Procedure	40
10.13.3	Requirements	40
10.14	Off-axis beam damage test	41
10.14.1	General	41
10.14.2	Purpose	41
10.14.3	Special case	41
10.14.4	Procedure	41
10.14.5	Requirements	41
10.15	Outdoor exposure test	42
10.15.1	Purpose	42
10.15.2	Procedure	42
10.15.3	Requirements	42
10.16	Hot-spot endurance test	42
Annex A (informative)	Summary of test conditions and requirements	43
Annex B (normative)	Retesting guideline	46

B.1	Product or process modifications requiring limited retesting to maintain certification	46
B.2	Modifications of CPV cell technology	46
B.3	Modifications in optical encapsulation on the cell (Includes optical coupling between the cell and a glass secondary optical element bonded to the cell).....	47
B.4	Modification in cell encapsulation outside of intended light path.....	47
B.5	Modification of cell package substrate used for heat transfer	47
B.6	Accessible optics (primary or secondary)	48
B.7	Inaccessible optics (secondary)	48
B.8	Frame and/or mounting structure	48
B.9	Enclosure	49
B.10	Wiring compartment/junction box	49
B.11	Interconnection terminals	49
B.12	Interconnection materials or technique (to cells and between receivers)	50
B.13	Change in electrical circuit design in an identical package	50
B.14	Output power	50
B.15	Thermal energy transfer means	51
B.16	Adhesives	51
Figure 1	– Schematic of point-focus dish PV concentrator.....	14
Figure 2	– Schematic of linear-focus trough PV concentrator	15
Figure 3	– Schematic of point-focus Fresnel lens PV concentrator	16
Figure 4	– Schematic of linear-focus Fresnel lens PV concentrator	17
Figure 5	– Schematic of a heliostat CPV	18
Figure 6	– Qualification test sequence for CPV modules	19
Figure 7	– Qualification test sequence for CPV assemblies.....	20
Figure 8	– Temperature and current profile of thermal cycle test (not to scale)	31
Figure 9	– Profile of humidity-freeze test conditions	33
Figure 10	– Bypass diode thermal test	37
Table 1	– Terms used for CPV	10
Table 2	– Allocation of test samples to typical test sequences	12
Table 3	– Thermal cycle test options for sequence A	29
Table 4	– Humidity freeze test options for sequence B.....	32
Table 5	– Minimum wind loads	40
Table A.1	– Summary of test conditions and requirements	43

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CONCENTRATOR PHOTOVOLTAIC (CPV) MODULES AND ASSEMBLIES –
DESIGN QUALIFICATION AND TYPE APPROVAL****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.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62108:2016. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 62108 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems. It is an International Standard.

This third edition cancels and replaces the second edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Changes in the procedure of the thermal cycling test for the active cooling module.
- b) Solar simulator I-V measurement.

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

Draft	Report on voting
82/2024/FDIS	82/2046/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under 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 document 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.

CONCENTRATOR PHOTOVOLTAIC (CPV) MODULES AND ASSEMBLIES – DESIGN QUALIFICATION AND TYPE APPROVAL

1 ~~Scope and object~~

This document specifies the minimum requirements for the design qualification and type approval of concentrator photovoltaic (CPV) modules and assemblies suitable for long-term operation in general open-air climates as defined in IEC 60721-2-1. The test sequence is partially based on that specified in IEC 61215-1 for the design qualification and type approval of flat-plate terrestrial crystalline silicon PV modules. However, some changes have been made to account for the special features of CPV receivers and modules, particularly with regard to the separation of on-site and in-lab tests, effects of tracking alignment, high current density, and rapid temperature changes, which have resulted in the formulation of some new test procedures or new requirements.

The object of this test document is to determine the electrical, mechanical, and thermal characteristics of the CPV modules and assemblies and to show, as far as possible within reasonable constraints of cost and time, that the CPV modules and assemblies are capable of withstanding prolonged exposure in climates described in the scope. The actual life of CPV modules and assemblies so qualified will depend on their design, production, environment, and the conditions under which they are operated.

This document ~~shall be~~ is used in conjunction with the retest guidelines described in Annex B.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60068-2-21:2006, Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices~~

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

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

IEC 60721-2-1, *Classification of environmental conditions – Part 2-1: Environmental conditions appearing in nature – Temperature and humidity*

IEC 60904-1:2020, *Photovoltaic devices – Part 1: Measurement of photovoltaic current-voltage characteristics*

IEC 60904-1-1:2017, *Photovoltaic devices – Part 1-1: Measurement of current-voltage characteristics of multi-junction photovoltaic (PV) devices*

IEC TS 60904-1-2:2019, *Photovoltaic devices – Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices*

IEC 60904-2:2015, *Photovoltaic devices – Part 2: Requirements for photovoltaic reference devices*

IEC 60904-3:2019, *Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data*

IEC 60904-4:2019, *Photovoltaic devices – Part 4: Photovoltaic reference devices – Procedures for establishing calibration traceability*

IEC 60904-5:2011, *Photovoltaic devices – Part 5: Determination of the equivalent cell temperature (ECT) of photovoltaic (PV) devices by the open-circuit voltage method*

IEC 60904-7:2019, *Photovoltaic devices – Part 7: Computation of the spectral mismatch correction for measurements of photovoltaic devices*

IEC 60904-8:2014, *Photovoltaic devices – Part 8: Measurement of spectral responsivity of a photovoltaic (PV) device*

IEC 60904-8-1:2017, *Photovoltaic devices – Part 8-1: Measurement of spectral responsivity of multi-junction photovoltaic (PV) devices*

IEC 61140:2016, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61210:2010, *Connecting devices – Flat quick-connect terminations for electrical copper conductors – Safety requirements*

IEC 61215-1:2021, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1: Test requirements*

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

IEC TS 61836:2016, *Solar photovoltaic energy systems – Terms, definitions and symbols*

IEC 61853-1:2011, *Photovoltaic (PV) module performance testing and energy rating – Part 1: Irradiance and temperature performance measurements and power rating*

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

IEC 61853-3:2018, *Photovoltaic (PV) module performance testing and energy rating – Part 3: Energy rating of PV modules*

IEC 62670-1, *Photovoltaic concentrators (CPV) – Performance testing – Part 1: Standard conditions*

IEC 62670-3:2017, *Photovoltaic concentrators (CPV) – Performance testing – Part 3: Performance measurements and power rating*

IEC 62790:2020, *Junction boxes for photovoltaic modules – Safety requirements and tests*

IEC 62852:2014, *Connectors for DC-application in photovoltaic systems – Safety requirements and tests*

IEC 62852:2014/AMD1:2020

~~ANSI/UL 1703:2002, Standard for Safety: Flat-Plate Photovoltaic Modules and Panels~~

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Concentrator photovoltaic (CPV) modules and assemblies – Design qualification and type approval

Modules et ensembles photovoltaïques à concentration – Qualification de la conception et homologation

CONTENTS

FOREWORD	5
1 Scope	7
2 Normative references	7
3 Terms and definitions	9
4 Sampling	10
5 Marking	11
6 Testing	11
7 Pass criteria	12
8 Report	20
9 Modifications	21
10 Test procedures	21
10.1 Visual inspection	21
10.1.1 General	21
10.1.2 Procedure	21
10.1.3 Major visual defects	22
10.1.4 Requirements	22
10.2 Electrical performance measurement	22
10.2.1 Purpose	22
10.2.2 Outdoor side-by-side I-V measurement	22
10.2.3 Solar simulator I-V measurement	24
10.2.4 Dark I-V measurement	24
10.3 Ground path continuity test	25
10.3.1 General	25
10.3.2 Purpose	25
10.3.3 Procedure	25
10.3.4 Requirements	25
10.4 Electrical insulation test	26
10.4.1 Purpose	26
10.4.2 Procedure	26
10.4.3 Requirements	26
10.5 Wet insulation test	27
10.5.1 Purpose	27
10.5.2 Procedure	27
10.5.3 Requirements	27
10.6 Thermal cycling test	27
10.6.1 Purpose	27
10.6.2 Test sample	28
10.6.3 Procedure	28
10.6.4 Procedure for active cooling system	30
10.6.5 Requirements	30
10.7 Damp heat test	31
10.7.1 Purpose	31
10.7.2 Test sample	31
10.7.3 Procedure	31
10.7.4 Requirements	32

10.8	Humidity freeze test	32
10.8.1	Purpose	32
10.8.2	Test sample	32
10.8.3	Procedure	32
10.8.4	Requirements	32
10.9	Hail impact test	33
10.9.1	Purpose	33
10.9.2	Apparatus	33
10.9.3	Procedure	34
10.9.4	Requirements	34
10.10	Dust and water ingress protection test	34
10.10.1	Purpose	34
10.10.2	Procedure	35
10.10.3	Requirements	35
10.11	Bypass/blocking diode thermal test	35
10.11.1	Purpose	35
10.11.2	Test sample	35
10.11.3	Apparatus	35
10.11.4	Procedure	36
10.11.5	Requirements	36
10.11.6	Procedure 2 – Alternate method	36
10.12	Robustness of terminations test	37
10.12.1	Purpose	37
10.12.2	Procedure	38
10.12.3	Requirements	38
10.13	Mechanical load test	38
10.13.1	Purpose	38
10.13.2	Procedure	39
10.13.3	Requirements	39
10.14	Off-axis beam damage test	39
10.14.1	General	39
10.14.2	Purpose	39
10.14.3	Special case	39
10.14.4	Procedure	40
10.14.5	Requirements	40
10.15	Outdoor exposure test	40
10.15.1	Purpose	40
10.15.2	Procedure	40
10.15.3	Requirements	41
10.16	Hot-spot endurance test	41
Annex A (informative)	Summary of test conditions and requirements	42
Annex B (normative)	Retesting guideline	45
B.1	Product or process modifications requiring limited retesting to maintain certification	45
B.2	Modifications of CPV cell technology	45
B.3	Modifications in optical encapsulation on the cell (Includes optical coupling between the cell and a glass secondary optical element bonded to the cell)	46
B.4	Modification in cell encapsulation outside of intended light path	46
B.5	Modification of cell package substrate used for heat transfer	46

B.6	Accessible optics (primary or secondary)	47
B.7	Inaccessible optics (secondary)	47
B.8	Frame and/or mounting structure	47
B.9	Enclosure	48
B.10	Wiring compartment/junction box	48
B.11	Interconnection terminals	48
B.12	Interconnection materials or technique (to cells and between receivers)	49
B.13	Change in electrical circuit design in an identical package	49
B.14	Output power	49
B.15	Thermal energy transfer means	50
B.16	Adhesives	50
Figure 1	– Schematic of point-focus dish PV concentrator.....	14
Figure 2	– Schematic of linear-focus trough PV concentrator	15
Figure 3	– Schematic of point-focus Fresnel lens PV concentrator	16
Figure 4	– Schematic of linear-focus Fresnel lens PV concentrator	17
Figure 5	– Schematic of a heliostat CPV	18
Figure 6	– Qualification test sequence for CPV modules	19
Figure 7	– Qualification test sequence for CPV assemblies.....	20
Figure 8	– Temperature and current profile of thermal cycle test (not to scale)	31
Figure 9	– Profile of humidity-freeze test conditions	33
Figure 10	– Bypass diode thermal test	37
Table 1	– Terms used for CPV	10
Table 2	– Allocation of test samples to typical test sequences	12
Table 3	– Thermal cycle test options for sequence A	29
Table 4	– Humidity freeze test options for sequence B.....	32
Table 5	– Minimum wind loads	38
Table A.1	– Summary of test conditions and requirements	42

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CONCENTRATOR PHOTOVOLTAIC (CPV) MODULES AND ASSEMBLIES –
DESIGN QUALIFICATION AND TYPE APPROVAL**

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.

IEC 62108 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems. It is an International Standard.

This third edition cancels and replaces the second edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Changes in the procedure of the thermal cycling test for the active cooling module.
- b) Solar simulator I-V measurement.

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

Draft	Report on voting
82/2024/FDIS	82/2046/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under 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.

CONCENTRATOR PHOTOVOLTAIC (CPV) MODULES AND ASSEMBLIES – DESIGN QUALIFICATION AND TYPE APPROVAL

1 Scope

This document specifies the minimum requirements for the design qualification and type approval of concentrator photovoltaic (CPV) modules and assemblies suitable for long-term operation in general open-air climates as defined in IEC 60721-2-1. The test sequence is partially based on that specified in IEC 61215-1 for the design qualification and type approval of flat-plate terrestrial crystalline silicon PV modules. However, some changes have been made to account for the special features of CPV receivers and modules, particularly with regard to the separation of on-site and in-lab tests, effects of tracking alignment, high current density, and rapid temperature changes, which have resulted in the formulation of some new test procedures or new requirements.

The object of this test document is to determine the electrical, mechanical, and thermal characteristics of the CPV modules and assemblies and to show, as far as possible within reasonable constraints of cost and time, that the CPV modules and assemblies are capable of withstanding prolonged exposure in climates described in the scope. The actual life of CPV modules and assemblies so qualified will depend on their design, production, environment, and the conditions under which they are operated.

This document is used in conjunction with the retest guidelines described in Annex B.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

IEC 60721-2-1, *Classification of environmental conditions – Part 2-1: Environmental conditions appearing in nature – Temperature and humidity*

IEC 60904-1:2020, *Photovoltaic devices – Part 1: Measurement of photovoltaic current-voltage characteristics*

IEC 60904-1-1:2017, *Photovoltaic devices – Part 1-1: Measurement of current-voltage characteristics of multi-junction photovoltaic (PV) devices*

IEC TS 60904-1-2:2019, *Photovoltaic devices – Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices*

IEC 60904-2:2015, *Photovoltaic devices – Part 2: Requirements for photovoltaic reference devices*

IEC 60904-3:2019, *Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data*

IEC 60904-4:2019, *Photovoltaic devices – Part 4: Photovoltaic reference devices – Procedures for establishing calibration traceability*

IEC 60904-5:2011, *Photovoltaic devices – Part 5: Determination of the equivalent cell temperature (ECT) of photovoltaic (PV) devices by the open-circuit voltage method*

IEC 60904-7:2019, *Photovoltaic devices – Part 7: Computation of the spectral mismatch correction for measurements of photovoltaic devices*

IEC 60904-8:2014, *Photovoltaic devices – Part 8: Measurement of spectral responsivity of a photovoltaic (PV) device*

IEC 60904-8-1:2017, *Photovoltaic devices – Part 8-1: Measurement of spectral responsivity of multi-junction photovoltaic (PV) devices*

IEC 61140:2016, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61210:2010, *Connecting devices – Flat quick-connect terminations for electrical copper conductors – Safety requirements*

IEC 61215-1:2021, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1: Test requirements*

IEC 61215-2:2021, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 2: Test procedures*

IEC TS 61836:2016, *Solar photovoltaic energy systems – Terms, definitions and symbols*

IEC 61853-1:2011, *Photovoltaic (PV) module performance testing and energy rating – Part 1: Irradiance and temperature performance measurements and power rating*

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

IEC 61853-3:2018, *Photovoltaic (PV) module performance testing and energy rating – Part 3: Energy rating of PV modules*

IEC 62670-1, *Photovoltaic concentrators (CPV) – Performance testing – Part 1: Standard conditions*

IEC 62670-3:2017, *Photovoltaic concentrators (CPV) – Performance testing – Part 3: Performance measurements and power rating*

IEC 62790:2020, *Junction boxes for photovoltaic modules – Safety requirements and tests*

IEC 62852:2014, *Connectors for DC-application in photovoltaic systems – Safety requirements and tests*

IEC 62852:2014/AMD1:2020

SOMMAIRE

AVANT-PROPOS	55
1 Domaine d'application	57
2 Références normatives	57
3 Termes et définitions	59
4 Échantillonnage	60
5 Marquage	61
6 Essais	62
7 Critères d'acceptation	63
8 Rapport	70
9 Modifications	71
10 Procédures d'essai	71
10.1 Examen visuel	71
10.1.1 Généralités	71
10.1.2 Mode opératoire	72
10.1.3 Défauts visuels majeurs	72
10.1.4 Exigences	72
10.2 Mesurage des performances électriques	72
10.2.1 Objet	72
10.2.2 Mesurage I-V de l'ensemble en site naturel	73
10.2.3 Mesurage I-V sous simulateur solaire	74
10.2.4 Mesurage I-V d'obscurité	74
10.3 Essai de continuité de mise à la terre	75
10.3.1 Généralités	75
10.3.2 Objet	76
10.3.3 Mode opératoire	76
10.3.4 Exigences	76
10.4 Essai d'isolation électrique	76
10.4.1 Objet	76
10.4.2 Mode opératoire	76
10.4.3 Exigences	77
10.5 Essai d'isolement en milieu humide	77
10.5.1 Objet	77
10.5.2 Mode opératoire	77
10.5.3 Exigences	78
10.6 Essai de cyclage thermique	78
10.6.1 Objet	78
10.6.2 Échantillon d'essai	78
10.6.3 Mode opératoire	79
10.6.4 Procédure pour le système de refroidissement actif	81
10.6.5 Exigences	81
10.7 Essai de chaleur humide	82
10.7.1 Objet	82
10.7.2 Échantillon d'essai	82
10.7.3 Mode opératoire	83
10.7.4 Exigences	83

10.8	Essai d'humidité-gel.....	83
10.8.1	Objet	83
10.8.2	Échantillon d'essai.....	83
10.8.3	Mode opératoire	83
10.8.4	Exigences.....	84
10.9	Essai de tenue à la grêle	84
10.9.1	Objet	84
10.9.2	Équipement	85
10.9.3	Mode opératoire	85
10.9.4	Exigences.....	86
10.10	Essai de protection contre la pénétration de poussière et d'eau.....	86
10.10.1	Objet	86
10.10.2	Mode opératoire	86
10.10.3	Exigences.....	86
10.11	Essai thermique de la diode de dérivation/diode antiretour.....	87
10.11.1	Objet	87
10.11.2	Échantillon d'essai.....	87
10.11.3	Équipement	87
10.11.4	Mode opératoire	87
10.11.5	Exigences.....	88
10.11.6	Procédure 2 – Méthode alternative	88
10.12	Essai de robustesse des sorties.....	89
10.12.1	Objet	89
10.12.2	Mode opératoire	90
10.12.3	Exigences.....	90
10.13	Essai de charge mécanique	90
10.13.1	Objet	90
10.13.2	Mode opératoire	91
10.13.3	Exigences.....	91
10.14	Essai de dommages du faisceau hors axe.....	91
10.14.1	Généralités	91
10.14.2	Objet	91
10.14.3	Cas particulier	91
10.14.4	Mode opératoire	92
10.14.5	Exigences.....	92
10.15	Essai d'exposition en site naturel.....	92
10.15.1	Objet	92
10.15.2	Mode opératoire	92
10.15.3	Exigences.....	93
10.16	Essai de tenue à l'échauffement localisé.....	93
Annexe A (informative) Résumé des conditions et exigences d'essai		94
Annexe B (normative) Lignes directrices de contre-essai		97
B.1	Modifications de produit/processus exigeant un contre-essai limité pour conserver la certification	97
B.2	Modifications de la technologie de cellules CPV.....	97
B.3	Modifications de l'enrobage optique sur la cellule (incluant le couplage optique entre la cellule et un élément d'optique secondaire en verre appliqué à la cellule)	98
B.4	Modification de l'enrobage des cellules à l'extérieur du chemin du faisceau lumineux	98

B.5	Modification du substrat du boîtier de cellule utilisé pour le transfert thermique	98
B.6	Optique accessible (primaire ou secondaire).....	99
B.7	Optique inaccessible (secondaire)	99
B.8	Châssis et/ou structure de montage	100
B.9	Enveloppe.....	100
B.10	Compartiment de câblage/boîte de jonction.....	100
B.11	Bornes d'interconnexion.....	101
B.12	Matériaux ou technique d'interconnexion (aux cellules et entre les récepteurs)	101
B.13	Modification de la conception du circuit électrique dans un boîtier identique	102
B.14	Puissance de sortie	102
B.15	Dispositifs de transfert d'énergie thermique	102
B.16	Adhésifs.....	103
Figure 1	– Schéma d'un système PV à concentration parabolique avec point de focalisation	64
Figure 2	– Schéma d'un système PV à concentration à réceptacle avec focalisation linéaire	65
Figure 3	– Schéma d'un système PV à concentration à lentille de Fresnel avec point de focalisation	66
Figure 4	– Schéma d'un système PV à concentration à lentille de Fresnel avec focalisation linéaire	67
Figure 5	– Schéma d'un CPV à héliostat	68
Figure 6	– Séquence d'essais de qualification pour modules CPV.....	69
Figure 7	– Séquence d'essais de qualification pour ensembles CPV	70
Figure 8	– Profil de température et de courant de l'essai de cyclage thermique (pas à l'échelle).....	82
Figure 9	– Profil des conditions de l'essai d'humidité-gel	84
Figure 10	– Essai thermique de la diode de dérivation	89
Tableau 1	– Termes utilisés pour les CPV.....	60
Tableau 2	– Attribution des échantillons d'essai à des séquences d'essais types.....	62
Tableau 3	– Options de l'essai de cyclage thermique pour la séquence A	80
Tableau 4	– Options de l'essai d'humidité-gel pour la séquence B	84
Tableau 5	– Charges minimales de vent	90
Tableau A.1	– Résumé des conditions et exigences d'essai.....	94

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

**MODULES ET ENSEMBLES PHOTOVOLTAÏQUES À CONCENTRATION –
QUALIFICATION DE LA CONCEPTION ET HOMOLOGATION****AVANT-PROPOS**

- 1) La Commission Électrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
- 2) Les décisions ou accords officiels de l'IEC concernant les questions techniques représentent, dans la mesure du possible, un accord international sur les sujets étudiés, étant donné que les Comités nationaux de l'IEC intéressés sont représentés dans chaque comité d'études.
- 3) Les Publications de l'IEC se présentent sous la forme de recommandations internationales et sont agréées comme telles par les Comités nationaux de l'IEC. Tous les efforts raisonnables sont entrepris afin que l'IEC s'assure de l'exactitude du contenu technique de ses publications; l'IEC ne peut pas être tenue responsable de l'éventuelle mauvaise utilisation ou interprétation qui en est faite par un quelconque utilisateur final.
- 4) Dans le but d'encourager l'uniformité internationale, les Comités nationaux de l'IEC s'engagent, dans toute la mesure possible, à appliquer de façon transparente les Publications de l'IEC dans leurs publications nationales et régionales. Toutes divergences entre toutes Publications de l'IEC et toutes publications nationales ou régionales correspondantes doivent être indiquées en termes clairs dans ces dernières.
- 5) L'IEC elle-même ne fournit aucune attestation de conformité. Des organismes de certification indépendants fournissent des services d'évaluation de conformité et, dans certains secteurs, accèdent aux marques de conformité de l'IEC. L'IEC n'est responsable d'aucun des services effectués par les organismes de certification indépendants.
- 6) Tous les utilisateurs doivent s'assurer qu'ils sont en possession de la dernière édition de cette publication.
- 7) Aucune responsabilité ne doit être imputée à l'IEC, à ses administrateurs, employés, auxiliaires ou mandataires, y compris ses experts particuliers et les membres de ses comités d'études et des Comités nationaux de l'IEC, pour tout préjudice causé en cas de dommages corporels et matériels, ou de tout autre dommage de quelque nature que ce soit, directe ou indirecte, ou pour supporter les coûts (y compris les frais de justice) et les dépenses découlant de la publication ou de l'utilisation de cette Publication de l'IEC ou de toute autre Publication de l'IEC, ou au crédit qui lui est accordé.
- 8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
- 9) L'attention est attirée sur le fait que certains des éléments de la présente Publication de l'IEC peuvent faire l'objet de droits de brevet. L'IEC ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de brevets.

L'IEC 62108 a été établie par le comité d'études 82 de l'IEC: Systèmes de conversion photovoltaïque de l'énergie solaire. Il s'agit d'une Norme internationale.

Cette troisième édition annule et remplace la deuxième édition parue en 2016. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) Modifications de la procédure de l'essai de cyclage thermique pour le module de refroidissement actif.
- b) Mesurage I-V sous simulateur solaire.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
82/2024/FDIS	82/2046/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/standardsdev/publications.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

MODULES ET ENSEMBLES PHOTOVOLTAÏQUES À CONCENTRATION – QUALIFICATION DE LA CONCEPTION ET HOMOLOGATION

1 Domaine d'application

Le présent document spécifie les exigences minimales relatives à la qualification de la conception et l'homologation des modules et ensembles photovoltaïques à concentration (CPV - *concentrator photovoltaic*) pour une utilisation de longue durée dans les climats généraux d'air libre, comme cela est défini dans l'IEC 60721-2-1. La séquence d'essais est partiellement issue de celle spécifiée dans l'IEC 61215-1 pour la qualification de la conception et l'homologation des modules PV au silicium cristallin pour application terrestre à plaque plane. Certaines modifications ont cependant été effectuées pour tenir compte des particularités des récepteurs et modules CPV, en particulier en ce qui concerne la séparation des essais sur site et en laboratoire, les effets de la répartition, de la densité de courant élevée et des variations rapides de température, qui ont entraîné la formulation de certaines nouvelles procédures d'essai ou exigences.

Le présent document d'essai a pour objet de déterminer les caractéristiques électriques, mécaniques et thermiques des modules et ensembles CPV et de montrer, autant que possible avec des contraintes de coût et de temps raisonnables, que les modules et ensembles CPV peuvent supporter une exposition prolongée aux climats définis dans le domaine d'application. La durée de vie réelle des modules et ensembles CPV ainsi qualifiés dépend de leur conception, de leur production ainsi que de l'environnement et des conditions dans lesquelles ils fonctionnent.

Le présent document doit être utilisé conjointement avec les lignes directrices de contre-essai décrites à l'Annexe B.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60529, *Degrés de protection procurés par les enveloppes (Code IP)*

IEC 60664-1:2020, *Coordination de l'isolement des matériels dans les réseaux d'énergie électrique à basse tension – Partie 1: Principes, exigences et essais*

IEC 60721-2-1, *Classification des conditions d'environnement – Partie 2-1: Conditions d'environnement présentes dans la nature – Température et humidité*

IEC 60904-1:2020, *Dispositifs photovoltaïques – Partie 1: Mesurage des caractéristiques courant-tension des dispositifs photovoltaïques*

IEC 60904-1-1:2017, *Dispositifs photovoltaïques – Partie 1-1: Mesurage des caractéristiques courant-tension des dispositifs photovoltaïques (PV) multijonctions*

IEC TS 60904-1-2:2019, *Photovoltaic devices – Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices* (disponible en anglais seulement)

IEC 60904-2:2015, *Dispositifs photovoltaïques – Partie 2: Exigences applicables aux dispositifs photovoltaïques de référence*

IEC 60904-3:2019, *Dispositifs photovoltaïques – Partie 3: Principes de mesure des dispositifs solaires photovoltaïques (PV) à usage terrestre incluant les données de l'éclairement énergétique spectral de référence*

IEC 60904-4:2019, *Dispositifs photovoltaïques – Partie 4: Dispositifs photovoltaïques de référence – Procédures pour établir la traçabilité de l'étalonnage*

IEC 60904-5:2011, *Dispositifs photovoltaïques – Partie 5: Détermination de la température de cellule équivalente (ECT) des dispositifs photovoltaïques (PV) par la méthode de la tension en circuit ouvert*

IEC 60904-7:2019, *Dispositifs photovoltaïques – Partie 7: Calcul de la correction de désadaptation des réponses spectrales dans les mesures de dispositifs photovoltaïques*

IEC 60904-8:2014, *Dispositifs photovoltaïques – Partie 8: Mesure de la sensibilité spectrale d'un dispositif photovoltaïque (PV)*

IEC 60904-8-1:2017, *Dispositifs photovoltaïques – Partie 8-1: Mesurage de la sensibilité spectrale des dispositifs photovoltaïques (PV) multijonctions*

IEC 61140:2016, *Protection contre les chocs électriques – Aspects communs aux installations et aux matériels*

IEC 61210:2010, *Dispositifs de connexion – Bornes plates à connexion rapide pour conducteurs électriques en cuivre – Exigences de sécurité*

IEC 61215-1:2021, *Modules photovoltaïques (PV) pour applications terrestres – Qualification de la conception et homologation – Partie 1: Exigences d'essai*

IEC 61215-2:2021, *Modules photovoltaïques (PV) pour applications terrestres – Qualification de la conception et homologation – Partie 2: Procédures d'essai*

IEC TS 61836:2016, *Solar photovoltaic energy systems – Terms, definitions and symbols* (disponible en anglais seulement)

IEC 61853-1:2011, *Essais de performance et caractéristiques assignées d'énergie des modules photovoltaïques (PV) – Partie 1: Mesures de performance en fonction de l'éclairement et de la température, et caractéristiques de puissance*

IEC 61853-2:2016, *Essais de performance et caractéristiques assignées d'énergie des modules photovoltaïques (PV) – Partie 2: Mesurages de réponse spectrale, d'angle d'incidence et de température de fonctionnement des modules*

IEC 61853-3:2018, *Essais de performance et caractéristiques assignées d'énergie des modules photovoltaïques (PV) – Partie 3: Caractéristiques assignées d'énergie des modules PV*

IEC 62670-1, *Concentrateurs photovoltaïques (CPV) – Essai de performances – Partie 1: Conditions normales*

IEC 62670-3:2017 *Concentrateurs photovoltaïques (CPV) – Essai de performances – Partie 3: Mesurages de performances et rapport de puissance*

IEC 62790:2020, *Boîtes de jonction pour modules photovoltaïques – Exigences de sécurité et essais*

IEC 62852:2014, *Connecteurs pour applications en courant continu pour systèmes photovoltaïques – Exigences de sécurité et essais*

IEC 62852:2014/AMD1:2020