

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Terrestrial photovoltaic (PV) modules – Design qualification and type approval –
Part 1: Test requirements**

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

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CONTENTS

FOREWORD	4
INTRODUCTION	6
1 Scope	7
2 Normative references	7
3 Terms, definitions and abbreviated terms	9
4 Test samples	11
5 Marking and documentation	13
5.1 Name plate	13
5.2 Documentation	13
5.2.1 Minimum requirements	13
5.2.2 Information to be given in the documentation	13
5.2.3 Assembly instructions	15
6 Testing	15
7 Pass criteria	17
7.1 General	17
7.2 Power output and electric circuitry	18
7.2.1 Identification of rated values and tolerances	18
7.2.2 Verification of rated label values → Gate No. 1	20
7.2.3 Maximum power degradation during type approval testing → Gate No. 2	23
7.2.4 Electrical circuitry	23
7.3 Visual defects	23
7.4 Electrical safety	23
8 Major visual defects	24
9 Report	24
10 Modifications	25
11 Test flow and procedures	26
Annex A (informative) Changes from previous edition	28
A.1 General	28
A.2 Procedures for bifacial modules	28
A.3 Use of representative samples	30
A.4 Addition of dynamic mechanical load test	31
A.5 Addition of test for potential induced degradation	31
A.6 Simulator requirements	33
A.6.1 General	33
A.6.2 Rationale for changes to spectral requirements	34
A.6.3 Rationale for changes to uniformity requirements	35
A.7 References to retest guidelines	36
A.8 Weight on junction boxes	36
A.9 Correction to monolithically-integrated hot-spot endurance test	36
A.10 Number of modules in sequence	38
A.11 Removal of nominal module operating temperature (NMOT)	39
A.12 Very low currents during thin-film tests	40
A.13 Limit bypass diode testing to three diodes	40
A.14 Revert the insulation test to 2005 version	40
A.15 Bending test	41

A.16 Stabilization option for boron oxygen LID (MQT 19.3)	41
Bibliography	42
Figure 1 – Geometry that shows radius of curvature of a flexible module	10
Figure 2 – Full test flow for design qualification and type approval of photovoltaic modules	17
Figure 3 – Examples of hypothetical partial nameplates (left column), datasheets (center column), and derived rated values and tolerances (right column)	20
Figure A.1 – Derived temperature coefficients (α) for nine different mc-Si products types	38
Table 1 – Required component tests	17
Table 2 – Summary of Gate No. 1 requirements	17
Table 3 – Summary of test levels	26
Table A.1 – Published uncertainty values as a function of simulator uniformity class	35
Table A.2 – Summary of foil placement during insulation test in three different versions	40

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**TERRESTRIAL PHOTOVOLTAIC (PV) MODULES –
DESIGN QUALIFICATION AND TYPE APPROVAL –****Part 1: Test requirements**

FOREWORD

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International Standard IEC 61215-1 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

This second edition of IEC 61215-1 cancels and replaces the first edition of IEC 61215-1, published in 2016; it constitutes a technical revision.

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

- a) Addition of a test taken from IEC TS 62782.
- b) Addition of a test taken from IEC TS 62804-1.
- c) Addition of test methods required for flexible modules. This includes the addition of the bending test (MQT 22).
- d) Addition of definitions, references and instructions on how to perform the IEC 61215 design qualification and type approval on bifacial PV modules.

- e) Clarification of the requirements related to power output measurements.
- f) Addition of weights to junction box during 200 thermal cycles.
- g) Requirement that retesting be performed according to IEC TS 62915.
- h) Removal of the nominal module operating test (NMOT), and associated test of performance at NMOT, from the IEC 61215 series.

Informative Annex A explains the background and reasoning behind some of the more substantial changes that were made in the IEC 61215 series in progressing from edition 1 to edition 2.

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

FDIS	Report on voting
82/1828A/FDIS	82/1848/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 in the IEC 61215 series, published under the general title *Terrestrial photovoltaic (PV) modules – Design qualification and type approval*, can be found on the IEC website.

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
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INTRODUCTION

Whereas Part 1 of this standards series describes requirements (both in general and specific with respect to device technology), the sub-parts of Part 1 define technology variations and Part 2 defines a set of test procedures necessary for design qualification and type approval. The test procedures described in Part 2 are valid for all device technologies.

TERRESTRIAL PHOTOVOLTAIC (PV) MODULES – DESIGN QUALIFICATION AND TYPE APPROVAL –

Part 1: Test requirements

1 Scope

This document lays down requirements for the design qualification of terrestrial photovoltaic modules suitable for long-term operation in open-air climates. The useful service life of modules so qualified will depend on their design, their environment and the conditions under which they are operated. Test results are not construed as a quantitative prediction of module lifetime.

In climates where 98th percentile operating temperatures exceed 70 °C, users are recommended to consider testing to higher temperature test conditions as described in IEC TS 63126. Users desiring qualification of PV products with lesser lifetime expectations are recommended to consider testing designed for PV in consumer electronics, as described in IEC TS 63163 (under development). Users wishing to gain confidence that the characteristics tested in IEC 61215 appear consistently in a manufactured product may wish to utilize IEC 62941 regarding quality systems in PV manufacturing.

This document is intended to apply to all terrestrial flat plate module materials such as crystalline silicon module types as well as thin-film modules. It does not apply to systems that are not long-term applications, such as flexible modules installed in awnings or tenting.

This document does not apply to modules used with concentrated sunlight although it may be utilized for low concentrator modules (1 to 3 suns). For low concentration modules, all tests are performed using the irradiance, current, voltage and power levels expected at the design concentration.

This document does not address the particularities of PV modules with integrated electronics. It may however be used as a basis for testing such PV modules.

The objective of this test sequence is to determine the electrical characteristics of the module and to show, as far as possible within reasonable constraints of cost and time, that the module is capable of withstanding prolonged exposure outdoors. Accelerated test conditions are empirically based on those necessary to reproduce selected observed field failures and are applied equally across module types. Acceleration factors may vary with product design, and thus not all degradation mechanisms may manifest. Further general information on accelerated test methods including definitions of terms may be found in IEC 62506.

Some long-term degradation mechanisms can only reasonably be detected via component testing, due to long times required to produce the failure and necessity of stress conditions that are expensive to produce over large areas. Component tests that have reached a sufficient level of maturity to set pass/fail criteria with high confidence are incorporated into the IEC 61215 series via addition to Table 1. In contrast, the tests procedures described in this series, in IEC 61215-2, are performed on modules.

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 60269-6, *Low-voltage fuses – Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems*

IEC 60891, *Photovoltaic devices – Procedures for temperature and irradiance corrections to measured I-V characteristics*

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

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

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

IEC 60904-10, *Photovoltaic devices – Part 10: Methods of linear dependence and linearity measurements*

IEC TS 60904-13, *Photovoltaic devices – Part 13: Electroluminescence of photovoltaic modules*

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

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

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

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

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

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

IEC TS 62782, *Photovoltaic (PV) modules – Cyclic (dynamic) mechanical load testing*

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

IEC TS 62804-1, *Photovoltaic (PV) modules – Test methods for the detection of potential-induced degradation – Part 1: Crystalline silicon*

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

IEC TS 62915, *Photovoltaic (PV) modules – Type approval, design and safety qualification – Retesting*

IEC 62941, *Terrestrial photovoltaic (PV) modules – Quality system for PV module manufacturing*

IEC TS 63163: –¹*Terrestrial photovoltaic (PV) modules for consumer products – Design qualification and type approval*

ISO/IEC Guide 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions in IEC TS 61836 apply, as well as the following.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

bins of power classes

power (typically maximum power) sorting criteria from the PV module manufacturer

3.2

tolerances <on label>

value range of electrical parameters on the label of the PV module as given by the manufacturer

3.3

MQT

Module Quality Test

3.4

type approval

conformity test made on one or more items representative of the production

[SOURCE: IEC 60050-581:2008, 581-21-08 – Type test]

3.5

reproducibility <of measurements>

closeness of agreement between the results of measurements of the same value of a quantity, when the individual measurements are made under different conditions of measurement:

- principle of measurement,
- method of measurement,
- observer,
- measuring instruments,
- reference standards,
- laboratory,

¹ Under preparation. Stage at the time of publication: ADTS.