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**Prizemni fotonapetostni (PV) moduli iz kristalnega silicija – Ocena zasnove in  
odobritev tipa (IEC 61215:2005)**

Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and  
type approval (IEC 61215:2005)

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EUROPEAN STANDARD

**EN 61215**

NORME EUROPÉENNE

EUROPÄISCHE NORM

May 2005

ICS 27.160

Supersedes EN 61215:1995

English version

**Crystalline silicon terrestrial photovoltaic (PV) modules –  
Design qualification and type approval  
(IEC 61215:2005)**

Modules photovoltaïques (PV) au silicium  
cristallin pour application terrestre -  
Qualification de la conception  
et homologation  
(CEI 61215:2005)

Terrestrische kristalline Silizium-  
Photovoltaik-(PV)-Module –  
Bauartegnung und Bauartzulassung  
(IEC 61215:2005)

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This European Standard was approved by CENELEC on 2005-05-01. 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.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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**CENELEC**

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

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

The text of document 82/376/FDIS, future edition 2 of IEC 61215, prepared by IEC TC 82, Solar photovoltaic energy systems, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61215 on 2005-05-01.

This European Standard supersedes EN 61215:1995.

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) 2006-02-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2008-05-01

Annex ZA has been added by CENELEC.

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### Endorsement notice

The text of the International Standard IEC 61215:2005 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 Where 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 60068-1	1988	Environmental testing Part 1: General and guidance	EN 60068-1 <sup>1)</sup>	1994
IEC 60068-2-21	1999	Part 2-21: Tests - Test U: Robustness of terminations and integral mounting devices	EN 60068-2-21	1999
IEC 60068-2-78	2001	Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	2001
IEC 60410	1973	Sampling plans and procedures for inspection by attributes	-	-
IEC 60721-2-1	1982	Classification of environmental conditions Part 2: Environmental conditions appearing in nature - Temperature and humidity	HD 478.2.1 S1 <sup>2)</sup>	1989
IEC 60891	1987	Procedures for temperature and irradiance corrections to measured I-V characteristics of crystalline silicon photovoltaic devices		
+ A1	1992		EN 60891	1994
IEC 60904-1	1987	Photovoltaic devices Part 1: Measurement of photovoltaic current-voltage characteristics	EN 60904-1	1993
IEC 60904-2	1989	Part 2: Requirements for reference solar cells	EN 60904-2	1993
IEC 60904-3	1989	Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data	EN 60904-3	1993
IEC 60904-6	1994	Part 6: Requirements for reference solar modules	EN 60904-6	1994

1) EN 60068-1 includes corrigendum October 1988 + A1:1992 to IEC 60068-1.

2) HD 478.2.1 includes A1:1987 to IEC 60721-2-1.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60904-7	1998	Part 7: Computation of spectral mismatch error introduced in the testing of a photovoltaic device	EN 60904-7	1998
IEC 60904-9	1995	Part 9: Solar simulator performance requirements	-	-
IEC 60904-10	1998	Part 10: Methods of linearity measurement	EN 60904-10	1998
IEC 61853	- 3)	Performance testing and energy rating of terrestrial photovoltaic (PV) modules	-	-
ISO/IEC 17025	1999	General requirements for the competence of testing and calibration laboratories	EN ISO/IEC 17025	2000

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3) Under consideration.

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

**Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval**

**(standards.iteh.ai)**

**Modules photovoltaïques (PV) au silicium cristallin pour application terrestre – Qualification de la conception et homologation**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX



## CONTENTS

FOREWORD.....	4
1 Scope and object.....	6
2 Normative references .....	6
3 Sampling .....	7
4 Marking .....	7
5 Testing .....	8
6 Pass criteria .....	8
7 Major visual defects.....	8
8 Report .....	9
9 Modifications .....	12
10 Test procedures .....	12
10.1 Visual inspection .....	12
10.2 Maximum power determination .....	12
10.3 Insulation test.....	13
10.4 Measurement of temperature coefficients .....	14
10.5 Measurement of nominal operating cell temperature (NOCT).....	17
10.6 Performance at STC and NOCT .....	25
10.7 Performance at low irradiance .....	26
10.8 Outdoor exposure test .....	27
10.9 Hot-spot endurance test .....	28
10.10 UV preconditioning test.....	33
10.11 Thermal cycling test.....	34
10.12 Humidity-freeze test.....	36
10.13 Damp-heat test.....	37
10.14 Robustness of terminations test.....	38
10.15 Wet leakage current test.....	39
10.16 Mechanical load test.....	40
10.17 Hail test.....	41
10.18 Bypass diode thermal test.....	44
Annex A (informative) Changes in this second edition with respect to the first edition of IEC 61215.....	46
Figure 1 – Qualification test sequence .....	10
Figure 2 – NOCT correction factor .....	23
Figure 3 – Reference plate.....	24
Figure 4 – NOCT measurement by reference plate method .....	24
Figure 5 – Wind correction factor .....	25
Figure 6 – Hot-spot effect in Type A cell .....	28
Figure 7 – Reverse characteristics .....	29
Figure 8 – Hot-spot effect in type B cell .....	29
Figure 9 – Case SP: Series-parallel connection .....	30



Figure 10 – Case SPS: series-parallel-series connection .....	31
Figure 11 – Thermal cycling test .....	35
Figure 12 – Humidity-freeze cycle .....	37
Figure 13 – Hail-test equipment .....	42
Figure 14 – Impact locations illustrated .....	44
Table 1 – Summary of test levels .....	11
Table 2 – Ice-ball masses and test velocities .....	42
Table 3 – Impact locations .....	43

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SIST EN 61215:2005

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CRYSTALLINE SILICON TERRESTRIAL  
PHOTOVOLTAIC (PV) MODULES –  
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.
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- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

This second edition cancels and replaces the first edition published in 1993 and constitutes a technical revision.

The main changes with respect to the previous edition (published in 1993) are detailed in Annex A.

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

FDIS	Report on voting
82/376/FDIS	82/382/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

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[SIST EN 61215:2005](#)

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

## 1 Scope and object

This International Standard lays down IEC requirements for the design qualification and type approval of terrestrial photovoltaic modules suitable for long-term operation in general open-air climates, as defined in IEC 60721-2-1. It applies only to crystalline silicon modules types. A standard for thin-film modules has been published as IEC 61646.

This standard does not apply to modules used with concentrated sunlight.

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

## 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.

- <https://standards.iteh.ai/catalog/standards/sist/18a24363-44d8-4ea4-bb25-ac576f46c0fd/sist-cn-61215-2005>  
 IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*
- IEC 60068-2-21:1999, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*
- IEC 60068-2-78:2001, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*
- IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*
- IEC 60721-2-1:1982, *Classification of environmental conditions – Part 2: Environmental conditions appearing in nature – Temperature and humidity*
- IEC 60891:1987, *Procedures for temperature and irradiance corrections to measured I-V characteristics of crystalline silicon photovoltaic devices*  
 Amendment 1 (1992)
- IEC 60904-1:1987, *Photovoltaic devices – Part 1: Measurements of photovoltaic current-voltage characteristics*
- IEC 60904-2:1989, *Photovoltaic devices – Part 2: Requirements for reference solar cells*
- IEC 60904-3:1989, *Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data*

IEC 60904-6:1994, *Photovoltaic devices – Part 6: Requirements for reference solar modules*

IEC 60904-7:1998, *Photovoltaic devices – Part 7: Computation of spectral mismatch error introduced in the testing of a photovoltaic device*

IEC 60904-9:1995, *Photovoltaic devices – Part 9: Solar simulator performance requirements*

IEC 60904-10:1998, *Photovoltaic devices – Part 10: Methods of linearity measurements*

IEC 61853: *Performance testing and energy rating of terrestrial photovoltaic (PV) modules*<sup>1</sup>

ISO/IEC 17025:1999, *General requirements for competence of testing and calibration laboratories.*

### 3 Sampling

Eight modules for qualification testing (plus spares as desired) shall be taken at random from a production batch or batches, in accordance with the procedure given in IEC 60410. The modules shall have been manufactured from specified materials and components in accordance with the relevant drawings and process sheets and have been subjected to the manufacturer's normal inspection, quality control and production acceptance procedures. The modules shall be complete in every detail and shall be accompanied by the manufacturer's handling, mounting and connection instructions, including the maximum permissible system voltage.

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If the bypass diodes are not accessible in the standard modules, a special sample can be prepared for the bypass diode thermal test (10.18). The bypass diode should be mounted physically as it would be in a standard module, with a thermal sensor placed on the diode as required in 10.18.2. This sample does not have to go through the other tests in the sequence depicted in Figure 1.

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When the modules to be tested are prototypes of a new design and not from production, this fact shall be noted in the test report (see Clause 8).

### 4 Marking

Each module shall carry the following clear and indelible markings:

- name, monogram or symbol of manufacturer;
- type or model number;
- serial number;
- polarity of terminals or leads (colour coding is permissible);
- maximum system voltage for which the module is suitable.

The date and place of manufacture shall be marked on the module or be traceable from the serial number.

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<sup>1</sup> Under consideration.

## 5 Testing

Before beginning the testing, all modules, including the control, shall be exposed to sunlight (either real or simulated) to an irradiation level of  $5 \text{ kWh}\cdot\text{m}^{-2}$  to  $5,5 \text{ kWh}\cdot\text{m}^{-2}$  while open-circuited.

The modules shall be divided into groups and subjected to the qualification test sequences in Figure 1, carried out in the order laid down. Each box refers to the corresponding subclause in this standard. Test procedures and severities, including initial and final measurements where necessary, are detailed in Clause 10.

NOTE 1 Where the final measurements for one test serve as the initial measurements for the next test in the sequence, they need not be repeated. In these cases, the initial measurements are omitted from the test.

In carrying out the tests, the tester shall strictly observe the manufacturer's handling, mounting and connection instructions. Tests given in 10.4, 10.5, 10.6 and 10.7 may be omitted if future IEC 61853 has been or is scheduled to be run on this module type.

Test conditions are summarized in Table 1.

NOTE 2 The test levels in Table 1 are the minimum levels required for qualification. If the laboratory and the module manufacturer agree, the tests may be performed with increased severities.

## 6 Pass criteria

A module design shall be judged to have passed the qualification tests, and therefore to be IEC type approved, if each test sample meets all the following criteria:

- a) the degradation of maximum output power does not exceed the prescribed limit after each test nor 8 % after each test sequence;
- b) no sample has exhibited any open circuit during the tests;
- c) there is no visual evidence of a major defect, as defined in Clause 7;
- d) the insulation test requirements are met after the tests;
- e) the wet leakage current test requirements are met at the beginning and the end of each sequence and after the damp heat test;
- f) specific requirements of the individual tests are met.

If two or more modules do not meet these test criteria, the design shall be deemed not to have met the qualification requirements. Should one module fail any test, another two modules meeting the requirements of Clause 3 shall be subjected to the whole of the relevant test sequence from the beginning. If one or both of these modules also fail, the design shall be deemed not to have met the qualification requirements. If, however, both modules pass the test sequence, the design shall be judged to have met the qualification requirements.

## 7 Major visual defects

For the purposes of design qualification and type approval, the following are considered to be major visual defects:

- a) broken, cracked, or torn external surfaces, including superstrates, substrates, frames and junction boxes;

- b) bent or misaligned external surfaces, including superstrates, substrates, frames and junction boxes to the extent that the installation and/or operation of the module would be impaired.
- c) a crack in a cell the propagation of which could remove more than 10 % of that cell's area from the electrical circuit of the module;
- d) bubbles or delaminations forming a continuous path between any part of the electrical circuit and the edge of the module;
- e) loss of mechanical integrity, to the extent that the installation and/or operation of the module would be impaired.

## 8 Report

Following type approval, a certified report of the qualification tests, with measured performance characteristics and details of any failures and re-tests, shall be prepared by the test agency in accordance with ISO/IEC 17025. The report shall contain the detail specification for the module. Each certificate or test report shall include at least the following information:

- a) a title;
- b) name and address of the test laboratory and location where the tests were carried out;
- c) unique identification of the certification or report and of each page;
- d) name and address of client, where appropriate;
- e) description and identification of the item tested;
- f) characterization and condition of the test item;
- g) date of receipt of test item and date(s) of test, where appropriate;
- h) identification of test method used; [SIST EN 61215:2005](#)
- i) reference to sampling procedure, where relevant; <https://standards.iteh.ai/catalog/standards/sist/18a24363-44d8-4ea4-bb25-ae37bf46c0fd/sist-en-61215-2005>
- j) any deviations from, additions to or exclusions from the test method, and any other information relevant to a specific tests, such as environmental conditions;
- k) measurements, examinations and derived results supported by tables, graphs, sketches and photographs as appropriate including temperature coefficients of short-circuit current, open-circuit voltage and peak power, NOCT, power at NOCT, STC and low irradiance, spectrum of the lamp used for the UV pre-screening test, maximum power loss observed after all of the tests, and any failures observed;
- l) a statement of the estimated uncertainty of the test results (where relevant);
- m) a signature and title, or equivalent identification of the person(s) accepting responsibility for the content of the certificate or report, and the date of issue;
- n) where relevant, a statement to the effect that the results relate only to the items tested;
- o) a statement that the certificate or report shall not be reproduced except in full, without the written approval of the laboratory.

A copy of this report shall be kept by the manufacturer for reference purposes.