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REDLINE VERSION

INTERNATIONAL STANDARD

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Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1-3: Special requirements for testing of thin-film amorphous silicon based photovoltaic (PV) modules

IEC 61215-1-3:2021-02 RLV(en)

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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

Part 1-3: Special requirements for testing of thin-film amorphous silicon based photovoltaic (PV) modules

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 61215-1-3:2016. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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International Standard IEC 61215-1-3 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

This second edition cancels and replaces the first edition of IEC 61215-1-3, issued in 2016, and constitutes a technical revision.

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

a) A cyclic (dynamic) mechanical load test (MQT 20) added.

b) A test for detection of potential-induced degradation (MQT 21) added.

c) A bending test (MQT 22) for flexible modules.

Informative Annex A of 61215-1:2021 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 standard is based on the following documents:

FDIS	Report on voting
82/1826/FDIS	82/1851/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.

This standard is to be read in conjunction with IEC 61215-1:2021 and IEC 61215-2:2021.

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
- amended.

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

Part 1-3: Special requirements for testing of thin-film amorphous silicon based photovoltaic (PV) modules

1 Scope ~~and object~~

~~This part of IEC 61215 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.~~

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 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 thin-film amorphous silicon (a-Si; a-Si/µc-Si) based terrestrial flat plate modules. As such, it addresses special requirements for testing of this technology supplementing IEC 61215-1:~~2016~~2021 and IEC 61215-2:~~2016~~2021 requirements for testing.

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.

~~The object of this test sequence is to determine the electrical and thermal 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 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.~~

The object 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.

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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 IEC 61215-1. In contrast, the tests procedures described in this series, in IEC 61215-2, are performed on modules.

This document defines PV technology dependent modifications to the testing procedures and requirements per IEC 61215-1:~~2016~~2021 and IEC 61215-2:~~2016~~2021.

2 Normative references

The normative references of IEC 61215-1:~~2016~~2021 and IEC 61215-2:~~2016~~2021 are applicable without modifications.

3 Terms and definitions

This clause of IEC 61215-1:~~2016~~2021 is applicable without modifications.

4 Test samples

This clause of IEC 61215-1:~~2016~~2021 is applicable without modifications.

5 Marking and documentation

This clause of IEC 61215-1:~~2016~~2021 is applicable without modifications.

6 Testing

This clause of IEC 61215-1:~~2016~~2021 is applicable with the following modifications:

Special care has to be taken for stabilizing the power output of the module using MQT 19 procedure with specific requirements stated in 11.19 below.

7 Pass criteria

This clause of IEC 61215-1:~~2016~~2021 is applicable with the following modifications:

The maximum allowable value of reproducibility is set to r = 2,0 %.

The maximum allowable value of measurement uncertainty is set to m_1 = 4,0 % for modules containing single-junction cells, and m_1 = 5,0 % for modules containing multi-junction cells.

8 Major visual defects

This clause of IEC 61215-1:~~2016~~2021 is applicable without modifications.

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9 Report

This clause of IEC 61215-1:~~2016~~2021 is applicable without modifications.

10 Modifications

This clause of IEC 61215-1:~~2016~~2021 is applicable without modifications.

11 Test flow and procedures

The test flow from IEC 61215-1:~~2016~~2021 is applicable.

11.1 Visual inspection (MQT 01)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.2 Maximum power determination (MQT 02)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.3 Insulation test (MQT 03)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.4 Measurement of temperature coefficients (MQT 04)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.5 ~~Measurement of nominal module operating temperature (NMOT) (MQT 05)~~ Placeholder section, formerly NMOT

~~This test of IEC 61215-2:2016 is applicable without modifications.~~

This subclause of IEC 61215-2:2021 does not require technology-specific modifications.

11.6 Performance at STC (MQT 06.1) ~~and NMOT (MQT 06.2)~~

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.7 Performance at low irradiance (MQT 07)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.8 Outdoor exposure test (MQT 08)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.9 Hot-spot endurance test (MQT 09)

~~This test of IEC 61215-2:2016 is applicable with the following modifications:~~

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This subclause of IEC 61215-2:2021, test MQT 09, is applicable without modifications.

11.9.1 Purpose

This subclause of IEC 61215-2:~~2016~~2021, test MQT 09, is applicable without modifications.

11.9.2 Hot-spot effect

This subclause of IEC 61215-2:~~2016~~2021, test MQT 09, is applicable without modifications.

11.9.3 Classification of cell interconnection

This subclause of IEC 61215-2:~~2016~~2021, test MQT 09, is applicable without modifications.

11.9.4 Apparatus

This subclause of IEC 61215-2:~~2016~~2021, test MQT 09, is applicable without modifications.

11.9.5 Procedure

MQT 09.2 of IEC 61215-2:~~2016~~2021 shall be performed for any MLI module design.

If the module is constructed by interconnection of cell-like substructures, MQT 09.1 of IEC 61215-2:~~2016~~2021 may be applicable.

11.9.6 Final measurements

This subclause of IEC 61215-2:~~2016~~2021, test MQT 09, is applicable without modifications.

11.9.7 Requirements

This subclause of IEC 61215-2:~~2016~~2021, test MQT 09, is applicable without modifications.

11.10 UV preconditioning test (MQT 10)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.11 Thermal cycling test (MQT 11)

This test of IEC 61215-2:~~2016~~2021 is applicable with the following modifications:

The technology specific current which needs to be applied according to MQT 11 of IEC 61215-2:~~2016~~2021 shall be equal to 0,1 × STC peak power current. If 0,1 × STC peak power current is less than 100 mA, then 100 mA may be applied instead.

11.12 Humidity-freeze test (MQT 12)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.13 Damp heat test (MQT 13)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

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11.14 Robustness of terminations ~~test~~ (MQT 14)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.15 Wet leakage current test (MQT 15)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.16 Static mechanical load test (MQT 16)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.17 Hail test (MQT 17)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.18 Bypass diode testing (MQT 18)

This test of IEC 61215-2:~~2016~~2021 is applicable without modifications.

11.19 Stabilization (MQT 19)

This test of IEC 61215-2:~~2016~~2021 is applicable with the following modifications:

Amorphous silicon based thin-film PV modules shall only be stabilized through indoor light soaking. Due to the non-controllable outdoor conditions, an outdoor method is considered not to deliver reproducible results.

11.19.1 Criterion definition for stabilization

For the definition of stabilization as per MQT 19 of IEC 61215-2:~~2016~~2021 x = 0,02 shall be used.

Any kind of storage shall be done at temperature below 25 °C to avoid thermally activated processes affecting MQT 06.1 of IEC 61215-2:~~2016~~2021 measurement.

11.19.2 Light induced stabilization procedures

This test of IEC 61215-2:~~2016~~2021 is applicable with the following modifications.

11.19.2.1 Apparatus for indoor stabilization

In IEC 61215-2:~~2016~~2021, 4.19.3.1 replace item d) with: "Use the reference device to set the irradiance between 600 W/m^2 and 1 000 W/m^2. Record the irradiance."

In IEC 61215-2:~~2016~~2021, 4.19.3.1 replace item e) with: "During the simulator exposure, the module temperature shall stay below 55 °C."

NOTE Most a-Si containing active layers are known to anneal at module temperatures above 55 °C very quickly.

11.19.2.2 Requirements for outdoor exposure for stabilization

This test of IEC 61215-2:~~2016~~2021 is not applicable.

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