Extended thermal cycling of PV modules – Test procedure

Cycle thermique étendu de modules PV – Procédure d'essai
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXTENDED THERMAL CYCLING OF PV MODULES – TEST PROCEDURE

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International Standard IEC 62892 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

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

<table>
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<tr>
<th>FDIS</th>
<th>Report on voting</th>
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<tr>
<td>82/1537/FDIS</td>
<td>82/1560/RVD</td>
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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.
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- withdrawn,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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INTRODUCTION

The IEC 61215 series defines test requirements for the design qualification of flat-plate PV modules for long-term operation in general open-air climates. IEC TS 62941 provides technical guidance in application of the type-approval testing.

This document, IEC 62892, supplements IEC 61215 by providing an extended thermal cycling test intended to differentiate PV modules with improved durability to thermal cycling and evaluate modules for deployment in locations most susceptible to thermal cycling type stress.
EXTENDED THERMAL CYCLING OF PV MODULES – TEST PROCEDURE

1 Scope

This document defines a test sequence that extends the thermal cycling test of IEC 61215-2. It is intended to differentiate PV modules with improved durability to thermal cycling and evaluate modules for deployment in locations most susceptible to thermal cycling type stress\(^1\). This document is based on the ability for 95 \% of the modules represented by the samples submitted for this test to pass an equivalency of 500 thermal cycles, as defined in IEC 61215-2:2016, 4.11.3, with a maximum power degradation of less than 5 \%. Provisions are also provided to reduce overall test time by increasing the maximum cycle temperature and/or the number of modules submitted for test.

The test procedure in this document was developed based on analysis of the stress on tin-lead solder bonds on crystalline silicon solar cells in a glass superstrate type package. Changes to lead-free solder have an effect on the acceleration factors but not enough to change the overall results of this test. Monolithic type modules with integral cell interconnection do not suffer from this specific type of stress but there are still electrical connections within the module, for example between the integrated cell circuit and the module bus bars, that may be subject to wear out from thermal cycling. Flexible modules (without glass) are not stressed in the same way as those with glass superstrates or substrates, therefore use of the equivalency factor employed in this document may not be applicable to these 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 61215-1:2016, Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1: Test requirements

IEC 61215-1-1, Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1-1: Special requirements for testing of crystalline silicon terrestrial photovoltaic (PV) modules

IEC 61215-1-2, Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1-2: Special requirements for testing of thin-film Cadmium Telluride (CdTe) based photovoltaic (PV) modules

IEC 61215-1-3, 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 61215-1-4, Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1-4: Special requirements for testing of thin-film Cu(In,Ga)(S,Se)\(_2\) based photovoltaic (PV) modules

\(^1\) Guidance is provided in Annex B to assess if this test is warranted for the targeted deployment location.
Terms and definitions
For the purposes of this document, the terms and definitions given in IEC TS 61836 as well as the following apply.

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

- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 equivalent cycles
number of thermal cycles that imparts the same amount of solder fatigue damage

4 Sampling
Modules for these tests shall be taken at random from a production batch or batches of a module type that is already certified to IEC 61215, IEC 61730-1 and IEC 61730-2. 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.

The relation between the number of modules submitted for testing and the required number of cycles is detailed Table 1 and Annex A. A minimum of three modules shall be submitted for testing, two for the actual testing and one as control.

Because these tests are designed for accelerated stress testing of production modules, engineering samples are not allowed.

5 Marking and documentation
Each module shall include clear and indelible markings as defined in IEC 61215-1. Modules shall be supplied with documentation conforming to the requirements in IEC 61215-1.

Documentation consistent with the requirements of Clause 4 of IEC TS 62941:2016 shall also be available for inspection by the test agency to ensure adequacy of the Quality Management System.