IEC TS 62915

Edition 2.0 2023-09

TECHNICAL SPECIFICATION

colour inside

Photovoltaic (PV) modules – Type approval, design and safety qualification – Retesting



IEC TS 62915:2023-09(en)



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

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

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

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC TS 62915

Edition 2.0 2023-09

TECHNICAL SPECIFICATION

colour inside

Photovoltaic (PV) modules – Type approval, design and safety qualification – Retesting

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 27.160

ISBN 978-2-8322-7444-6

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

® Registered trademark of the International Electrotechnical Commission

CONTENTS

FOREWORD 4
1 Scope 6
2 Normative references 6
3 Terms and definitions 7
4 Retesting 8
4.1 General 8
4.2 Test programs for WBT PV modules (including crystalline silicon) 9
4.2.1 Modification to frontsheet 9
4.2.2 Modification to encapsulation system 11
4.2.3 Modification to cell technology (specific to wafer-based technologies (WBT)) 13
4.2.4 Modification to cell and string interconnect material (specific to WBT) 14
4.2.5 Modification to backsheet 15
4.2.6 Modification to electrical termination 17
4.2.7 Modification to bypass diode 19
4.2.8 Modification to electrical circuitry (specific to WBT) 20
4.2.9 Modification to edge sealing 20
4.2.10 Modification to frame and/or mounting structure 21
4.2.11 Change in PV module size 23
4.2.12 Higher or lower output power with the identical design and size 23
4.2.13 Increase of over-current protection rating 24
4.2.14 Increase of system voltage by more than 5 % 24
4.2.15 Change in cell fixing or internal insulation tape (specific to WBT) 25
4.2.16 Change in label material (external nameplate label) 25
4.2.17 Change from monofacial to bifacial module 25
4.2.18 Changes to module operating temperature 26
4.2.19 Changes affecting system compatibility with variants of the same model 26
4.3 Test programs for MLI thin-film PV modules 27
4.3.1 Modification to frontsheet 27
4.3.2 Modification to encapsulation system 27
4.3.3 Modification to front contact (e. g. TCO) 27
4.3.4 Modification to cell technology 27
4.3.5 Modification to cell layout 28
4.3.6 Modification to back contact 28
4.3.7 Modification to edge deletion 29
4.3.8 Modification to interconnect material or technique 29
4.3.9 Modification to backsheet 30
4.3.10 Modification to electrical termination 30
4.3.11 Modification to bypass diode 30
4.3.12 Modification to edge sealing 30
4.3.13 Modification to frame and/or mounting structure 30
4.3.14 Change in PV module size 30
4.3.15 Higher or lower output power with the identical design and size 31
4.3.16 Increase of over-current protection rating 31
4.3.17 Increase of system voltage 31
4.3.18 Change in label material (external nameplate label) 31
4.3.19 Change from monofacial to bifacial module 31

4.3.20 Changes to module operating temperature 31
4.3.21 Changes affecting compatibility with variants of the same model 31
4.3.22 Changes to documentation 31
Annex A (normative) Retests and test flow 32
A.1 Required retests for PV modules, tabular overview 32
A.2 Combined test flow IEC 61215 and IEC 61730 (see Figure A.1 and Table A.2) 39
A.3 Tests for new combinations of materials and/or components 41
Bibliography 43

Figure 1 – X-X and Y-Y axes relevant for the elastic section modulus of a typical PV frame 21
Figure A.1 – Combined test flow IEC 61215 and IEC 61730 39
Figure A.2 – Illustration of example for required tests for new material combinations 42

Table A.1 – Required retests for PV modules 32
Table A.2 – IEC identifiers for test sequences 40

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

PHOTOVOLTAIC (PV) MODULES – TYPE APPROVAL, DESIGN AND SAFETY QUALIFICATION – RETESTING

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC TS 62915 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems. It is a Technical Specification.

This publication contains attached files in the form of xls document. These files are intended to be used as a complement and do not form an integral part of the publication.

This second edition cancels and replaces the first edition published in 2018. This edition constitutes a technical revision.

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

- Prior references to specific process-related changes to PV modules have been removed in this edition and replaced with a general requirement to ensure that a consistent quality management system is in place per IEC 62941

- References to IEC 61215 and IEC 61730 have been updated to the latest editions (2021 and 2023 respectively)
    - Retest requirements with respect to new added tests such as cyclic (dynamic) mechanical load (MQT 20) and potential-induced degradation (MQT 21) are addressed in this edition
- Retest requirements for IEC 61215 and IEC 61730 have been separated for the sake of clarity
- A comprehensive matrix table summarizing all the retest requirements for each possible change in material(s) or design modification is provided in this edition
- References to component level standards, namely IEC 62788-1 series and IEC 62788-2 series, are included in this edition to address changes that could be made to the critical sub-components going into new PV module constructions
- Crystalline silicon and thin film references have been updated to be consistent with nomenclature in the updated IEC 61215 and IEC 61730 standards; namely, wafer-based technology (WBT) and monolithically integrated (MLI) thin film PV modules
- In this edition, 4.3 which addresses retest requirements for MLI thin film PV modules has been truncated and simplified by removing redundant sections that are identical with the subclauses in 4.2
- Guidance for retesting modules according to IEC TS 63126, “Guidelines for qualifying PV modules, components and materials for operation at high temperatures” has been added to this edition
- In this edition, requirements have been added for changes affecting system compatibility with variants of the same model

The text of this technical specification is based on the following documents:

Enquiry draft	Reports on voting
82/2121/DTS	82/2157A/RVDTS

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

The language used for the development of this Technical Specification 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/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, or
- revised.

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.

PHOTOVOLTAIC (PV) MODULES – TYPE APPROVAL, DESIGN AND SAFETY QUALIFICATION – RETESTING

1 Scope

This document sets forth a uniform approach to maintain type approval, design and safety qualification of terrestrial PV modules that have undergone or will undergo modification from their originally assessed design. This document addresses two types of PV module technologies, wafer-based technologies (WBT) and monolithically-integrated (MLI) thin-film based technologies.

Changes in material selection, components and manufacturing process can impact electrical performance, reliability and safety of the modified product. This document lists typical modifications and the resulting requirements for retesting based on the different test standards. It provides assistance; at some level, engineering judgement may be needed.

The test sequences are selected to identify adverse changes to the modified product.

Those products successfully following the herein defined test sequences are considered to be compliant with the standard against which they have originally been assessed in a full qualification.

The number of samples to be included in the retesting program and the pass/fail criteria are listed in the referenced standards IEC 61215 and IEC 61730. In addition, a representative sample may be used as described in IEC 61215 and IEC 61730 as applicable.

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 61215-1:2021, *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 61730-1:2023, *Photovoltaic (PV) module safety qualification – Part 1: Requirements for construction*

IEC 61730-2:2023, *Photovoltaic (PV) module safety qualification – Part 2: Requirements for testing*

IEC TS 61836, *Solar photovoltaic energy systems – Terms, definitions and symbols*IEC 62788-2-1, *Measurement procedures for materials used in photovoltaic modules – Part 2-1: Polymeric materials – Frontsheet and backsheet – Safety requirements*

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

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

IEC 62930, *Electric cables for photovoltaic systems with a voltage rating of 1,5 kV DC*

IEC 62941:2019, *Terrestrial photovoltaic (PV) modules - Quality system for PV module manufacturing*

IEC TS 63126 2020, *Guidelines for qualifying PV modules, components, and materials for operation at high temperatures*

ISO 9001, *Quality management systems – Requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61215-1, IEC 61215-2, IEC 61730-1 and IEC TS 61836, as well as the following apply.

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
different material
material that differs in its chemical composition, type designation, or specification from the material it replaces (including, e.g., electrical, optical, mechanical properties; the nominal values including tolerances shall be considered)

Note 1 to entry: However the same material provided by a different supplier or manufacturing location is not necessarily a different material as long as it can be clearly demonstrated.

Note 2 to entry: See relevant component clauses for further definition and clarification. For polymeric components, refer to the relevant standards, IEC 62788-1 and, IEC 62788-2 series, for more specific definition of materials with alternate constructions that could qualify as the same model designation.

3.2
control plan
documented description of the systems and processes required for controlling the product and process quality by addressing the key characteristics and engineering requirements

[SOURCE IEC 62941:2019, 3.2]

3.3
nominal value
value of a quantity used to designate and identify a component, device, equipment, or system

[SOURCE IEC 60050-151:2001, 151-16-09]

3.4
UV cut-off wavelength
λ_{cUV}
wavelength of light below which the material is considered optically absorbing and above which the material is considered transmitting

Note 1 to entry: In this procedure, the absolute transmittance of 10 % (corresponding to the optical absorbance of 1) is considered as the threshold of the UV cut-off wavelength.

[SOURCE IEC 62788-1-4:2016, 3.3]