



UL 61730-2

STANDARD FOR SAFETY

Photovoltaic (PV) Module Safety
Qualification – Part 2: Requirements for
Testing

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UL Standard for Safety for Photovoltaic (PV) Module Safety Qualification – Part 2: Requirements for Testing, UL 61730-2

Second Edition, Dated October 28, 2022

Summary of Topics

This new edition of ANSI/UL 61730-2 dated October 28, 2022 includes the following changes in requirements:

- Update of IEC TS 62915 References to UL 62915***
- Correction of Clause DVA.1 to Correlate with the Intent of Clause DVA.3***
- Change Fire Type Glass Description in Table 10.17DV.4.6.1 to not Overlap***
- New Fire Type Additions 35 – 40 in Fire Type Testing, Section 10.17DV.4***

UL 61730-2 second edition is an adoption of IEC 61730-2, Photovoltaic (PV) Module Safety Qualification – Part 2: Requirements for Testing (Second Edition, issued by the IEC August 2016). Please note that the National Difference document incorporates all of the U.S. national differences for UL 61730-2.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated July 8, 2022.

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1

UL 61730-2

**Photovoltaic (PV) Module Safety Qualification – Part 2: Requirements for
Testing**

First Edition – December, 2017

Second Edition

October 28, 2022

This ANSI/UL Standard for Safety consists of the Second Edition.

The most recent designation of ANSI/UL 61730-2 as an American National Standard (ANSI) occurred on October 28, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <https://csds.ul.com>.

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CONTENTS

PREFACE	5
NATIONAL DIFFERENCES	7
FOREWORD	9
1 Scope	13
2 Normative references	13
2DV Addition of the following:	14
3 Terms and definitions	15
4 Test categories	15
4.1 General	15
4.2 Environmental stress tests	15
4.3 General inspection	16
Table 2DV Modification of Table 2:	16
4.4 Electric shock hazard tests	16
4.5 Fire hazard tests	16
Table 4DV Modification of Table 4:	17
4.6 Mechanical stress tests	17
5 Classes and their necessary test procedures	17
Table 6DV Modification of Table 6:	19
6 Sampling	19
7 Test report	19
8 Testing	20
Figure 1DV Modification of Figure 1:	23
9 Pass criteria	23
9DV Modification in accordance with the following:	23
10 Test procedures	23
10.1 General	23
10.2 Visual inspection MST 01	23
10.3 Performance at STC MST 02	26
10.4 Maximum power determination MST 03	26
10.5 Insulation thickness test MST 04	27
10.6 Durability of markings MST 05	27
10.7 Sharp edge test MST 06	28
10.8 Bypass diode functionality test MST 07	28
10.9 Accessibility test MST 11	28
10.10 Cut susceptibility test MST 12	29
10.11 Continuity test of equipotential bonding MST 13	32
10.12 Impulse voltage test MST 14	33
10.13 Insulation test MST 16	36
10.14 Wet leakage current test MST 17	36
10.15 Temperature test MST 21	36
10.16 Hot-spot endurance test MST 22	40
10.17 Fire test MST 23	40
10.17DV Modification by replacing Clause 10.17 with the following new Fire test MST 23:	41
10.18 Ignitability test MST 24	49
10.18DV Deletion:	52
10.19 Bypass diode thermal test MST 25	52
10.20 Reverse current overload test MST 26	52
10.21 Module breakage test MST 32	54
10.22 Screw connections test MST 33	59
10.23 Static mechanical load test MST 34	60

10.23DV Modification by replacing Clause 10.23 with the following:	60
10.24 Peel test MST 35	62
10.25 Lap shear strength test MST 36	67
10.26 Materials creep test MST 37	71
10.27 Robustness of terminations test MST 42.....	72
10.27DV Modification by replacing Clause 10.27 with the following:	72
10.28 Thermal cycling test MST 51	72
10.29 Humidity freeze test MST 52	73
10.30 Damp heat test MST 53.....	73
10.31 UV test MST 54	73
10.32 Cold conditioning MST 55.....	73
10.33 Dry heat conditioning MST 56	74

Annex A (informative) Recommendations for testing of PV modules from production

A.1 General.....	75
A.2 Module output power.....	75
A.3 Wet insulation test.....	75
A.4 Visual inspection.....	76
A.5 Bypass diodes	76
A.6 Continuity test of equipotential bonding.....	76

Annex DVA (Normative) Testing of PV modules from production

Annex DVA Modification by replacing Annex A with the following Normative Annex DVA:.....	77
--	----

Annex B (informative) Fire tests, spread-of-flame and burning-brand tests for PV modules

B.1 General.....	80
B.2 Fire test for PV modules based on ENV 1187	80
B.2.1 General	80
B.2.2 External fire exposure to roofs	80
B.2.3 Classification according to ISO 13501-5	82
B.3 Fire test for PV modules based on ANSI/UL 1703	82

Annex DVB (Normative) Type tests for fire performance characterization of modules independent of roof coverings

Annex DVB Modification by replacing Annex B with the following Normative Annex DVB:	84
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PREFACE

This UL Standard is based on IEC Publication IEC 61730-2: Second edition Photovoltaic (PV) Module Safety Qualification – Part 2: Requirements for Testing. IEC publication IEC 61730-2 is copyrighted by the IEC.

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Note – Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

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NATIONAL DIFFERENCES

National Differences from the text of International Electrotechnical Commission (IEC) Publication IEC 61730-2, Photovoltaic (PV) Module Safety Qualification – Part 2: Requirements for Testing, copyright 2016, are indicated by notations (differences) and are presented in bold text.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PHOTOVOLTAIC (PV) MODULE SAFETY QUALIFICATION – Part 2: Requirements for testing

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 nongovernmental 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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International Standard IEC 61730-2 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

This second edition cancels and replaces the first edition of IEC 61730-2, issued in 2004 and its amendment 1 (2011), and constitutes a technical revision.

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

- a) Rearrange test sequences.
- b) MST 01: Visual inspection: added nameplate requirement and modified pass criteria.
- c) Added sharp edge test MST 06.
- d) Added insulation thickness test MST 04.

- e) MST 11: Accessibility test: defined force for test finger.
- f) MST 12: Cut susceptibility test: defined blade radius for cut test.
- g) MST 14: removed preconditioning requirement TC200 from [Figure 1](#).
- h) MST 15: Partial discharge test removed.
- i) Renamed dielectric breakdown test MST 16 to insulation test.
- j) MST 21: Temperature test: rewritten test procedure; removed short circuit mode; allow alternative indoor test method.
- k) MST 23: Fire test: subclause rewritten; fire test requirements related to national building codes; moved optional test description to informative annex.
- l) Added ignitability test MST 24.
- m) MST 26: Reverse current overload test: changed specification of wooden board.
- n) MST 32: Module breakage test: defined new dimensions of impactor to allow other filling compounds; consider variety of mounting techniques for glass breakage test; reduced impact height to only 300 mm; corrected diameter of opening according to referenced standard (65 cm² instead of 6,5 cm²).
- o) Added screw connection test MST 33.
- p) Added peel test MST 35 for proof of cemented joints.
- q) Added lap shear strength test MST 36 for proof of cemented joints.
- r) Added materials creep test MST 37.
- s) Added PV module test sequence with moisture and UV to stress polymers to [Figure 1](#). The new UV sequence was added as a response to the Kyoto meeting, where it was decided to add a coupon test and a PV module test sequence. As it is not possible to perform the ISO UV test on PV modules (no affordable equipment available) it was decided to rely on already available PV module test equipment. R&D work has shown that cycling UV and HF are best to age polymers in PV modules.
- t) Added new sequence for Pollution Degree (PD) testing (sequence B1).
- u) Added annex: Recommendations for testing of PV modules from production.

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

FDIS	Report on voting
82/1129/FDIS	82/1147/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 stability date indicated on the IEC website 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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PHOTOVOLTAIC (PV) MODULE SAFETY QUALIFICATION – Part 2: Requirements for Testing

1 Scope

The scope of IEC 61730-1 is also applicable to this part of IEC 61730. While IEC 61730-1 outlines the requirements of construction, this part of the standard lists the tests a PV module is required to fulfill for safety qualification. IEC 61730-2 is applied for safety qualification only in conjunction with IEC 61730-1.

The sequence of tests required in this standard may not test for all possible safety aspects associated with the use of PV modules in all possible applications. This standard utilizes the best sequence of tests available at the time of its writing. There are some issues – such as the potential danger of electric shock posed by a broken PV module in a high voltage system – that should be addressed by the system design, location, restrictions on access and maintenance procedures.

The objective of this standard is to provide the testing sequence intended to verify the safety of PV modules whose construction has been assessed by IEC 61730-1. The test sequence and pass criteria are designed to detect the potential breakdown of internal and external components of PV modules that would result in fire, electric shock, and/or personal injury. The standard defines the basic safety test requirements and additional tests that are a function of the PV module end-use applications. Test categories include general inspection, electrical shock hazard, fire hazard, mechanical stress, and environmental stress.

The additional testing requirements outlined in relevant ISO standards, or the national or local codes which govern the installation and use of these PV modules in their intended locations, should be considered in addition to the requirements contained within this standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-3-5, *Environmental testing – Part 3-5: Supporting documentation and guidance; Confirmation of the performance of temperature chambers*

IEC 60598-1:2014, *Luminaires – Part 1: General requirements and tests*

IEC 60664-1:2007, *Insulation co-ordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60695-2-10, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60904-2, *Photovoltaic devices – Part 2: Requirements for photovoltaic reference devices*

- IEC 60904-9, *Photovoltaic devices – Part 9: Solar simulator performance requirements*
- IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*
- IEC 61010-1, *Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements*
- IEC 61032:1997, *Protection of persons and equipment by enclosures – Probes for verification*
- IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*
- IEC 61215 (all parts), *Terrestrial photovoltaic (PV) modules – Design qualification and type approval*
- IEC 61215-2, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 2: Test procedures*
- IEC 61730-1:2016, *Photovoltaic (PV) module safety qualification – Part 1: Requirements for construction*
- IEC 62790, *Junction boxes for photovoltaic modules – Safety requirements and tests*
- ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*
- ISO 813, *Rubber, vulcanized or thermoplastic – Determination of adhesion to a rigid substrate – 90 degree peel method*
- ISO 4046-4, *Paper, board, pulps and related terms – Vocabulary – Part 4: Paper and board grades and converted products*
- ISO 4587:2003, *Adhesives – Determination of tensile lap-shear strength of rigid-to-rigid bonded assemblies*
- ISO 5893, *Rubber and plastics test equipment – Tensile, flexural and compression types (constant rate of traverse) – Specification*
- ISO 8124-1, *Safety of toys – Part 1: Safety aspects related to mechanical and physical properties*
- ISO 11925-2:2010, *Reaction to fire tests – Ignitability of products subjected to direct impingement of flame – Part 2: Single-flame source test*
- ISO 23529, *Rubber – General procedures for preparing and conditioning test pieces for physical test methods*
- ANSI Z97.1:2009, *Standard – Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test*
- ANSI/UL 1703: 2015, *Flat-Plate Photovoltaic Modules and Panels*

2DV DR Addition of the following:

UL 790, Standard Test Methods for Fire Tests of Roof Coverings