

Photovoltaic (PV) module safety qualification —

Part 2: Requirements for testing

ICS 27.160

National foreword

This British Standard is the UK implementation of EN 61730-2:2007+A1:2012. It is derived from IEC 61730-2:2004, incorporating amendment 1:2011. It supersedes BS EN 61730-2:2007, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by **A1** **A1**.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modification is indicated in the text by **C** **C**.

The UK participation in its preparation was entrusted to Technical Committee GEL/82, Photovoltaic Energy Systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

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**Photovoltaic (PV) module safety qualification –
Part 2: Requirements for testing
(IEC 61730-2:2004, modified)**

Qualification pour la sûreté de
fonctionnement des modules
photovoltaïques (PV) –
Partie 2: Exigences pour les essais
(CEI 61730-2:2004, modifiée)

Photovoltaik (PV) -Module –
Sicherheitsqualifikation –
Teil 2: Anforderungen an die Prüfung
(IEC 61730-2:2004, modifiziert)

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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.

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

The text of the International Standard IEC 61730-2:2004, prepared by IEC TC 82, Solar photovoltaic energy systems, together with the common modifications prepared by the Technical Committee CENELEC TC 82, Solar photovoltaic energy systems, was submitted to the formal vote and was approved by CENELEC as EN 61730-2 on 2006-12-01.

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) 2008-02-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2010-02-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61730-2:2004 was approved by CENELEC as a European Standard with agreed common modifications as given below.

Foreword to amendment A1

The text of document 82/660/FDIS, future edition 1 of IEC 61730-2:2004/A1, prepared by IEC/TC 82 "Solar photovoltaic energy systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61730-2:2007/A1:2012.

The following dates are fixed:

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- latest date by which the national (dow) 2014-12-19
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document have to be withdrawn

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61730-2:2004/A1:2011 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When 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>
–	–	Glass in building - Thermally toughened soda lime silicate safety glass – Part 1: Definition and description	EN 12150-1	–
–	–	Datasheet and nameplate information for photovoltaic modules	EN 50380	–
IEC 60060-1	–	High-voltage test techniques – Part 1: General definitions and test requirements	HD 588.1 S1	–
IEC 60068-1	–	Environmental testing – Part 1: General and guidance	EN 60068-1	–
IEC 60243-1	–	Electrical strength of insulating materials - Test methods – Part 1: Tests at power frequencies	EN 60243-1	–
IEC 60410	–	Sampling plans and procedures for inspection by attributes	–	–
IEC 60664-1 + A1 + A2	–	Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests	EN 60664-1	–
IEC 60904-2	–	Photovoltaic devices – Part 2: Requirements for reference solar devices	EN 60904-2	–
IEC 61032	–	Protection of persons and equipment by enclosures - Probes for verification	EN 61032	–
IEC 61140	–	Protection against electric shock - Common aspects for installation and equipment	EN 61140	–
IEC 61215	–	Crystalline silicon terrestrial photovoltaic (PV) modules - Design qualification and type approval	EN 61215	–
IEC 61646	–	Thin-film terrestrial photovoltaic (PV) modules - Design qualification and type approval	EN 61646	–
IEC 61730-1 (mod)	–	Photovoltaic (PV) module safety qualification– Part 1: Requirements for construction	EN 61730-1	–
ISO/IEC 17025	–	General requirements for the competence of testing and calibration laboratories	EN ISO/IEC 17025	–
ANSI/UL 514C	–	Non-metallic outlet boxes, flush device boxes and covers	–	–

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ANSI/UL 790	–	Tests for Fire Resistance of Roof Covering Materials	–	–
ANSI/UL 1703	–	Flat – Plate Photovoltaic Modules and Panels	–	–
ANSI Z97.1	–	American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test	–	–

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PHOTOVOLTAIC (PV) MODULE SAFETY QUALIFICATION –

Part 2: Requirements for testing

1 Scope and object

This part of [C] EN 61730 [C] describes the testing requirements for photovoltaic (PV) modules in order to provide safe electrical and mechanical operation during their expected lifetime. Specific topics are provided to assess the prevention of electrical shock, fire hazards, and personal injury due to mechanical and environmental stresses. [C] EN 61730-1 [C] pertains to the particular requirements of construction. This part of [C] EN 61730 [C] outlines the requirements of testing.

This standard attempts to define the basic requirements for various application classes of photovoltaic modules, but it cannot be considered to encompass all national or regional building codes. The specific requirements for marine and vehicle applications are not covered. This standard is not applicable to modules with integrated AC inverters (AC modules).

This standard is designed so that its test sequence can co-ordinate with those of IEC 61215 or IEC 61646, so that a single set of samples may be used to perform both the safety and performance evaluation of a photovoltaic module design.

The test-sequences of this standard are arranged in an optimal way so that tests of IEC 61215 or IEC 61646 can be used as basic preconditioning tests.

NOTE 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 module in a high voltage system, that should be addressed by the systems design, location, restrictions on access and maintenance procedures.

The object of this document is to provide the testing sequence intended to verify the safety of PV modules whose construction has been assessed by [C] EN 61730-1 [C]. 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 personal injury. The standard defines the basic safety test requirements and additional tests that are a function of the module end-use applications.

Test categories include general inspection, electrical shock hazard, fire hazard, mechanical stress, and environmental stress.

NOTE 2 The additional testing requirements outlined in relevant ISO standards, or the national or local codes which govern the installation and use of these modules in their intended locations, should be considered in addition to the requirements contained within this document.

2 Normative references

See Annex ZA.

3 Application classes

3.1 General

Photovoltaic modules may be installed in many different applications. Therefore, it is important to evaluate the potential hazards associated with those applications and to evaluate the construction of the module accordingly.

Relevant safety requirements and necessary tests shall be performed to verify the conformance to the requirements of that application class. This clause defines those application classes and construction qualities required for each class.

Application classes for PV-modules are defined as follows:

3.2 Class A: General access, hazardous voltage, hazardous power applications

Modules rated for use in this application class may be used in systems operating at greater than 120 V DC. Modules qualified for safety through EN 61730-1 and this part of EN 61730 within this application class are considered to meet the requirements for safety class II.

3.3 Class B: Restricted access, hazardous voltage, hazardous power applications

Modules rated for use in this application class are restricted to systems protected from public access by fences, location, etc. Modules evaluated within this application class provide protection by basic insulation, are considered to meet the requirements for safety class 0.

3.4 Class C: Limited voltage

Modules rated for use in this application class are restricted to systems operating at less than 120 V DC. Modules qualified for safety through EN 61730-1 and this part of EN 61730 within this application class are considered to meet the requirements for safety class III.

NOTE Safety classes are defined within EN 61140.

4 Test categories

4.1 General

The following hazards might influence the lifetime and the safety of PV modules. In accordance with these hazards, test procedures and criteria are described. The specific tests to which a module will be subjected will depend on the end use application for which the minimum tests are specified in Clause 5.

NOTE Module safety tests are labelled MST.

Tables 1 to 6 show the origin of the required tests. For some tests, the third column shows for information the origin of the tests, but the appropriate test requirements are given in Clauses 10 and 11. The rest of the tests are based on or identical to IEC 61215/IEC 61646, and references to the relevant Clauses are given in the last two columns. Some of the IEC 61215/IEC 61646-based tests were modified for EN 61730-2 and are included in Clauses 10 and 11.

4.2 Preconditioning tests

Table 1 – Preconditioning tests

Test	Title	References in Standards	According to	
			IEC 61215	IEC 61646
MST 51	Thermal cycling (TC50 or TC200)		10.11	10.11
MST 52	Humidity freeze (HF10)		10.12	10.12
MST 53	Damp heat (DH1000)		10.13	10.13
MST 54	UV preconditioning test		10.10	10.10

4.3 General inspection

Table 2 – General inspection test

Test	Title	References in Standards	According to	
			IEC 61215	IEC 61646
MST 01	Visual inspection		10.1	10.1

4.4 Electrical shock hazard tests

These tests are designed to assess the risk to personnel due to shock or injury because of contact with parts of a module that are electrically energised as a result of design, construction, or faults caused by environment or operation.

Table 3 – Electrical shock hazard tests

Test	Title	References in Standards	According to	
			IEC 61215	IEC 61646
MST 11	Accessibility test	ANSI/UL 1703		
MST 12	Cut susceptibility test (not required for glass surfaces)	ANSI/UL 1703		
MST 13	Ground continuity test (not required unless metal framed)	ANSI/UL 1703		
MST 14	Impulse voltage test	IEC 60664-1		
MST 16	Dielectric withstand test		10.3*	10.3*
MST 17	Wet leakage current test		10.15	10.20
MST 42	Robustness of terminations test		10.14	10.14
* The pass/fail criteria differ from those given in IEC 61215 and IEC 61646.				

4.5 Fire hazard tests

These tests assess the potential fire hazard due to the operation of a module or failure of its components.

Table 4 – Fire hazard tests

Test	Title	References in Standards	According to	
			IEC 61215	IEC 61646
MST 21	Temperature test	ANSI/UL 1703		
MST 22	Hot-spot test		10.9	10.9
MST 23	Fire test	ANSI/UL 790		
MST 25	Bypass diode thermal test		10.18	A1 10.18 A1
MST 26	Reverse current overload test	ANSI/UL 1703		

4.6 Mechanical stress tests

These tests are to minimise potential injury due to mechanical failure.

Table 5 – Mechanical stress tests

Test	Title	References in Standards	According to	
			IEC 61215	IEC 61646
MST 32	Module breakage test	ANSI Z97.1		
MST 34	Mechanical load test		10.16	10.16

4.7 Component tests

Table 6 – Component tests

Test	Title	References in Standards	According to	
			IEC 61215	IEC 61646
MST 15	Partial discharge test	IEC 60664-1		
MST 33	Conduit bending	ANSI/UL 514C		
MST 44	Terminal box knock out test	ANSI/UL 514C		

5 Application classes and their necessary test procedures

The specific tests to which a module will be subjected, depending on the application class defined in **EN 61730-1**, is described in Table 7. The order in which the tests are carried out shall be in accordance with Figure 1.

Some tests shall be carried out as preconditioning tests.

NOTE This test sequence has been designed so that **EN 61730-2** can be performed in conjunction with IEC 61215 or IEC 61646. In this way, the environmental stress tests in IEC 61215 or IEC 61646 can serve as the preconditioning tests for **EN 61730-2**.