

TECHNICAL SPECIFICATION

Terrestrial photovoltaic (PV) modules for consumer products – Design
qualification and type approval

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IEC TS 63163:2021

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

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IEC TS 63163 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

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

Draft	Report on voting
82/1899/DTS	82/1931/RVDTs

Full information on the voting for its approval 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/standardsdev/publications.

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

1 Scope

This document is intended to apply to terrestrial modules for consumer applications for outdoor operation shorter than those qualified to IEC 61215. The useful service life of modules so qualified depends on their design, their environment and the conditions under which they are operated.

This document classes those PV modules into Category 1, Category 2, and Category 3 with respectively low, medium and high expected outdoor exposure. For the purposes of designing this document, Category 1 (mobile applications) is for applications such as smart phone charging which most likely have “low” outdoor exposure. Category 2 (portable applications) is for emergency power/hiking/camping applications with “medium” outdoor exposure and it needs to have mechanical durability testing due to repeated deployment, potential for being dropped, and other mechanical stresses. Category 3 (attached applications) is for “high” outdoor exposure for applications, such as for motor homes, but is not intended for long-term utility or long-term household rooftop applications. A summary of product categories and potential applications is presented in Annex A.

Category 1 products are intended for installation where general user access and contact to uninsulated live parts is anticipated. Modules are not be combined in series strings operating at more than 35 V (V_{oc}) and do not have a system voltage rating above 35 V. These PV modules are not intended for use in parallel with other PV modules or energy sources, unless the combination provides protection from reverse current and overvoltage protection. The short-circuit current is less than 8 A and the maximum power is less than 240 W when tested under standard test conditions.

This document does not address the particularities of PV modules with integrated electronics, such as energy storage devices, charge controllers, batteries, inverters which may be sold in conjunction with the PV modules. This specification is intended to qualify the PV portion of these devices. It may, however, be used as a basis for testing such PV modules, but does not qualify the electronic portion.

This document does not apply to modules used with concentrators.

The purpose of the test sequence is to determine the electrical, thermal, and mechanical durability characteristics of the module, and to show that the module is capable of withstanding outdoor exposure for different outdoor durations designated as “low”, “medium”, and “high”. Mobile and attached applications are considered to require lower mechanical durability than portable applications, which are more prone to mechanical damage. However, the actual outdoor exposure limits of the modules depend on their design, their environment and the conditions under which they are operated.

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 60269-6, *Low-voltage fuses – Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems*

IEC 60904-1, *Photovoltaic devices – Part 1: Measurement of photovoltaic current-voltage characteristics*

IEC TS 60904-1-2:2019, *Photovoltaic devices – Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices*

IEC 60904-3, *Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data*

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61215-1:2021, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1: Test requirements*

IEC 61215-1-1:2021, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules*

IEC 61215-1-2:2021, *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 61215-1-3:2021, *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 61215-1-4:2021, *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*

IEC 61215-2:2021, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 2: Test procedures*

IEC 61730-1, *Photovoltaic (PV) module safety qualification – Part 1 Requirements for construction*

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

IEC TS 61836, *Solar photovoltaic energy systems – Terms, definitions and symbols*

IEC TS 62915, *Photovoltaic (PV) modules – Type approval, design and safety qualification – Retesting*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions given in IEC TS 61836 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>

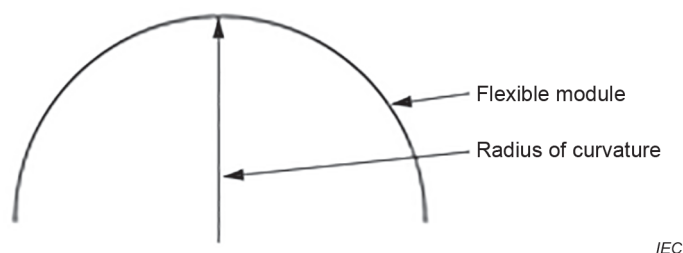
3.1

flexible module

PV module that exhibits a radius of curvature of 500 mm or less in at least one direction according to the manufacturer's specification and is capable of bending to conform to a flat or curved surface

Note 1 to entry: A curved module with a rigid shape is not considered a flexible module.

Note 2 to entry: Radius of curvature is defined as shown in Figure 1. During testing, the applied radius of curvature is no smaller than that specified by the manufacturer.



IEC

Figure 1 – Geometry that shows radius of curvature of a flexible module

[SOURCE: IEC 61215-1:2021, 3.6]

3.2 foldable module

PV module that is separated into distinct PV sections nominally of the same size and connected by a section that does not contain cells, but has the interconnecting busbars

3.3 representative sample

sample that includes all the components of the module, except some repeated parts

Note 1 to entry: The representative samples shall use all key materials and subassemblies, as detailed in Clause 4 of IEC 61215-1:2021.

3.4 very large module

module that exceeds the size of standard 2,2 m × 1,5 m commercially-available simulators

Note 1 to entry: A very large module exceeds 2,2 m in length or width, or exceeds 1,5 m in both dimensions. Thus a 3 m × 0,3 m module is considered very large, as is a 2,2 m × 2,2 m module.

Note 2 to entry: Very large modules are exempt from class A simulator spatial irradiance uniformity requirements, as detailed in IEC 61215-2 MQT 02.

Note 3 to entry: During test sequences representative samples may be substituted for very large modules, within the limits described in Clause 4.

Note 4 to entry: In future editions, the size threshold to be considered a very large module will likely increase to larger dimensions.

[SOURCE: IEC 61215-1:2021, 3.8]

3.5 consumer product category 1 (mobile applications)

PV module for applications such as smart phone charging with low outdoor exposure

Note 1 to entry: Modules shall not be combined in series strings operating at more than 35 V (V_{oc}) and shall not have a system voltage rating above 35 V.

3.6 consumer product category 2 (portable applications)

PV module applications such as used for emergency power/hiking/camping applications with medium outdoor exposure and mechanical strength withstanding repeated deployment, potential for being dropped, and other mechanical stresses

3.7 consumer product category 3 (attached applications)

PV module for attached applications with high outdoor exposure, such as for motor homes, but not for long-term utility or household rooftop applications

3.8 consumer product module quality test CQMT

3.9

bifacial PV modules

modules that can convert irradiation received on both the front-side and rear-side into electric energy by means of the photovoltaic effect

[SOURCE: IEC 61215-1:2021, 3.9]

3.10

bifaciality coefficients

ratios between the I - V characteristics of the rear-side and the front-side of a bifacial module each measured under Standard Test Conditions (STC – IEC TS 61836), namely the short-circuit current bifaciality coefficient ϕ_{ISC} , the open-circuit voltage bifaciality coefficient ϕ_{VOC} and the maximum power bifaciality coefficient ϕ_{Pmax}

Note 1 to entry: Bifaciality coefficients are fully defined in IEC TS 60904-1-2:2019, 6.2.

[SOURCE: IEC 61215-1:2021, 3.10]

3.11

bifacial nameplate irradiance

BNPI

higher irradiance at which nameplate verification is performed for bifacial modules, corresponding to 1 000 W/m² on the module front and 135 W/m² on the module rear, applied in any method allowed by IEC TS 60904-1-2

[SOURCE: IEC 61215-1:2021, 3.11]

3.12

bifacial stress irradiance

higher irradiance at which currents for stress are measured on bifacial modules, corresponding to 1 000 W/m² on the module front and 300 W/m² on the module rear, applied by any method allowed in IEC TS 60904-1-2, I - V characteristic at which may be extrapolated from lower irradiances

[SOURCE: IEC 61215-1:2021, 3.12]

3.13

type approval

conformity test made on one or more items representative of the production

4 Selection of test samples

The PV module samples 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 PV modules shall be complete in every detail and shall be accompanied by the manufacturer's handling, mounting, and connection instructions. When the PV modules to be tested are prototypes of a new design and not from production, this fact shall be noted in the test report (see Clause 8).

The number of test samples required is derived from the applicable test sequences.

For very large modules (as defined in 3.4), representative samples (as defined in 3.3) may be used for all qualification tests. During the design and manufacturing of the representative samples, attention should be paid to reach the maximum similarity to the full-size product in all electrical, mechanical, and thermal characteristics related to quality and reliability. The cell, encapsulation methods, interconnects, terminations, clearance and creepage distances around all edges, and distance through solid insulation (relied upon insulation and cemented joints) shall be the same as on the actual full-size products.