BS EN IEC 62788-2-1:2023

BSI Standards Publication

Measurement procedures for materials used in photovoltaic modules

Part 2-1: Polymeric materials — Frontsheet and backsheet — Safety requirements

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This British Standard is the UK implementation of EN IEC 62788-2-1:2023. It is identical to IEC 62788-2-1:2023.

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 committee manager.

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English Version

Measurement procedures for materials used in photovoltaic modules - Part 2-1: Polymeric materials - Frontsheet and backsheet - Safety requirements (IEC 62788-2-1:2023)

Procédures de mesure des matériaux utilisés dans les modules photovoltaïques - Partie 2-1: Matériaux polymères - Face avant et face arrière - Exigences de sécurité (IEC 62788-2-1:2023)

Messverfahren für Werkstoffe, die in Photovoltaik-Modulen verwendet werden - Teil 2-1: Polymerwerkstoffe - Frontsheets und Backsheets - Sicherheitsanforderungen (IEC 62788-2-1:2023)

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European foreword

The text of document 82/2123/FDIS, future edition 1 of IEC 62788-2-1, prepared by IEC/TC 82 "Solar photovoltaic energy systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62788-2-1:2023.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2024-06-29
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2026-09-29

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In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60112:2020 NOTE Approved as EN IEC 60112:2020 (not modified)

IEC 62941:2019 NOTE Approved as EN IEC 62941:2020 (not modified)

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60216-1	-	Electrical insulating materials - Thermal endurance properties - Part 1: Ageing procedures and evaluation of test results	EN 60216-1	-
IEC 60216-3	-	Electrical insulating materials - Thermal endurance properties - Part 3: Instructions for calculating thermal endurance characteristics	EN IEC 60216-3	-
IEC 60216-5	-	Electrical insulating materials - Thermal endurance properties - Part 5: Determination of relative temperature index (RTI) of an insulating material	EN IEC 60216-5	-
IEC 60664-1	-	Insulation coordination for equipment within low-voltage supply systems - Part 1: Principles, requirements and tests	EN IEC 60664-1	-
IEC 61215-1	-	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1: Test requirements	EN IEC 61215-1	-
IEC 61215-2	-	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 2: Test procedures	EN IEC 61215-2	-
IEC 61730-1	-	Photovoltaic (PV) module safety qualification - Part 1: Requirements for construction	EN IEC 61730-1	-
IEC 61730-2	-	Photovoltaic (PV) module safety qualification - Part 2: Requirements for testing	EN IEC 61730-2	-
IEC/TS 61836	-	Solar photovoltaic energy systems - Terms, definitions and symbols	-	-
IEC TS 62788-2	-	Measurement procedures for materials used in photovoltaic modules - Part 2: Polymeric materials - Frontsheets and backsheets	-	-

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IEC/TS 62915	-	Photovoltaic (PV) modules - Type approval, design and safety qualification - Retesting	-	-
IEC TS 63126	2020	Guidelines for qualifying PV modules, components and materials for operation at high temperatures	-	-
ISO 527-3	-	Plastics - Determination of tensile properties - Part 3: Test conditions for films and sheets	EN ISO 527-3	-

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MEASUREMENT PROCEDURES FOR MATERIALS USED IN PHOTOVOLTAIC MODULES –

Part 2-1: Polymeric materials – Frontsheet and backsheet – Safety requirements

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

Draft	Report on voting
82/2123/FDIS	82/2148/RVD

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 International Standard is English.

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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.

A list of all parts in the IEC 62788 series, published under the general title *Measurement procedures for materials used in photovoltaic modules*, can be found on the IEC website.

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,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

This document provides test procedures and specifications for polymeric front- and backsheet constructions employed in a PV module for safety qualification on a component level. Test methods have been compiled to match the general requirements for polymeric materials used as relied-upon insulation defined in the IEC 61730 standard series in consideration of test methods in IEC TS 62788-2 (characterization of front- and backsheets), IEC TS 62788-7-2 [4][1](UV weathering test) and the retesting guidelines IEC TS 62915. This document provides clarifications on definitions of front- and backsheet construction types and related test requirements, and additional environmental stress testing, to which IEC 61730-1 refers. Separating out the component level testing into this document was considered to limit the complexity of the IEC 61730 standard series, also in view of the implementation of the test methods in the frame of IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components (IECEE).

Test methods on a component level and PV module level are different for practical reasons. On a component level, the daylight filtered xenon test (IEC TS 62788-7-2) is applied for UV weathering, which is regarded as more representative to assess the durability of polymeric materials under outdoor weather conditions than the UVA test of IEC 61215-2. The latter has been developed in view of practicality of applying UV exposure to larger scale PV modules.

This document focusses on the safety relevant properties of front- and backsheets as required by IEC 61730.

The lamination protrusion test (aka DTI test) is required to measure the thickness of relied-upon insulation on the component level. The thickness of the RUI layer(s) is verified by MST 04 of IEC 61730-2 on PV module level. The test provides additional information needed for evaluation of the Comparative Tracking Index (CTI) and dielectric strength / breakdown voltage.

– The lamination protrusion test applies default lamination conditions, that are representative for a typical PV module manufacturing process. Using a 800 μm diameter solder wire that mimics severe solder peaks and/or slanted ribbons, the test serves as worst case scenario for measurement of potential displacement of material under lamination conditions. Even more harsh lamination process conditions can be selected as recommended by the manufacturer of the front- or backsheet.
– The lamination protrusion test is also used to identify additional inner layers of the front- or backsheet that potentially may be in contact with live parts and for which CTI shall be determined. Additional layers may require CTI depending on the construction of the PV module, e.g., due to specific sheet openings and through wiring for junction box connections with background provided in IEC 61730-1.
– The ratio of the measured distance through insulation (t_{DTI}) to the total thickness is used to calculate the effective dielectric strength or required withstand voltage when measured on final products that contain inner layers, which can be displaced under lamination conditions (see breakdown voltage test in 6.4).
– Because of the relationship with thermal endurance, t_{DTI} can be listed as a function of the module operating temperature rating.

[1] Numbers in square brackets refer to the Bibliography.

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This document specifies a suite of environmental stress tests to characterize the durability of the relied-upon insulation. In the evaluation of tensile testing a minimum elongation at break is considered in addition to retention of tensile strength, as this allows to differentiate known-bad and known-good materials. The thermal endurance performance, which is historically evaluated by tensile strength and dielectric strength in terms of TI or RTE (RTI), is therefore complemented by a thermal failsafe test to also evaluate elongation at break. The combination of these elements, tests covering thermal, damp heat and UV weathering stresses and evaluation of elongation at break, represents a step forward in safety testing of polymeric front- and backsheets that is still balanced in terms or practicality (duration) of testing.

The requirements in this document for model or variant designations and (re)testing of similar materials have been aligned with developments for the IEC TS 62915 module retesting guidelines. The current requirements provide a first step towards more detailed requirements which may be developed in a future revision of this document or a dedicated component retesting standard.

A future revision of this document may consider sequential testing on engineering coupons with (solder wire) bumps to better mimic the combination of UV and cyclic stress fatigue, that is currently discussed as the next level in endurance testing of polymeric front- and backsheets in IEC TS 62788-2 and IEC TS 63209-2[6]. However, method consolidation requires more time than available for this project.

In view of requirements for material identification in the context of the retesting guidelines (IEC TS 62915), approaches for “finger-printing” are provided in Annex A.

The requirements in this document may be used in the context of Manufacturing Quality Assurance of polymeric front- and backsheets as explained in the guideline IEC 62941[5].

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