BS EN 50583-1:2016

BSI Standards Publication

Photovoltaics in buildings

Part 1: BIPV modules

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National foreword

This British Standard is the UK implementation of EN 50583-1:2016.

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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Date	Text affected

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European foreword

This document (EN 50583-1:2016) has been prepared by CLC/TC 82 "Solar photovoltaic energy systems".

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2016-10-05
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1 Scope

This document applies to photovoltaic modules used as construction products. It focuses on the properties of these photovoltaic modules relevant to essential building requirements as specified in the European Construction Product Regulation CPR 305/2011, and the applicable electro-technical requirements as stated in the Low Voltage Directive 2006/95/EC / or CENELEC standards. This document references international standards, technical reports and guidelines. For some applications in addition national standards (or regulations) for building products may apply in individual countries, which are not explicitly referenced here and for which harmonized European Standards are not yet available.

The document is addressed to manufacturers, planners, system designers, installers, testing institutes and building authorities.

This document does not apply to concentrating or building-attached photovoltaic modules. [1]

This document addresses requirements on the PV modules in the specific ways they are intended to be mounted but not the mounting structure itself, which is within the scope of EN 50583-2.

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.

EN 410, *Glass in building — Determination of luminous and solar characteristics of glazing*

EN 673, *Glass in building — Determination of thermal transmittance (U value) — Calculation method*

EN 674, *Glass in building — Determination of thermal transmittance (U value) — Guarded hot plate method*

EN 675, *Glass in building — Determination of thermal transmittance (U value) — Heat flow meter method*

prEN 1279-5, *Glass in building — Insulating glass units — Part 5: Evaluation of conformity*

EN 1990, *Eurocode: Basis of structural design*

EN 1991 (all parts), *Eurocode 1: Actions on structures*

EN 1993 (all parts), *Eurocode 3: Design of steel structures*

EN 1999 (all parts), *Eurocode 9: Design of aluminium structures*

EN 12179, *Curtain walling — Resistance to wind load — Test method*

prEN 12488, *Glass in buildings — Glazing recommendations — Assembly principles for vertical and sloping glazing*

EN 12519, *Windows and pedestrian doors — Terminology*

EN 12600, *Glass in building — Pendulum test — Impact test method and classification for flat glass*

EN 12758, *Glass in building — Glazing and airborne sound insulation — Product descriptions and determination of properties*

[1] For the definition of building-attached photovoltaic modules refer to 3.2

EN 13022 (all parts), *Glass in building — Structural sealant glazing*

EN 13116, *Curtain walling — Resistance to wind load — Performance requirements*

EN 13119, *Curtain walling — Terminology*

EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

EN 13501-2, *Fire classification of construction products and building elements — Part 2: Classification using data from fire resistance tests, excluding ventilation services*

EN 13501-5, *Fire classification of construction products and building elements — Part 5: Classification using data from external fire exposure to roofs tests*

EN 13830, *Curtain walling — Product standard*

EN 13956, *Flexible sheets for waterproofing — Plastic and rubber sheets for roof waterproofing — Definitions and characteristics*

EN 14351-1, *Windows and doors — Product standard, performance characteristics — Part 1: Windows and external pedestrian doorsets without resistance to fire and/or smoke leakage characteristics*

EN 14449, *Glass in building — Laminated glass and laminated safety glass — Evaluation of conformity/ Product standard*

EN 14500, *Blinds and shutters — Thermal and visual comfort — Test and calculation methods*

EN 14782, *Self-supporting metal sheet for roofing, external cladding and internal lining — Product specification and requirements*

EN 14783, *Fully supported metal sheet and strip for roofing, external cladding and internal lining — Product specification and requirements*

EN 15804, *Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products*

CEN/TR 15941, *Sustainability of construction works — Environmental product declarations — Methodology for selection and use of generic data*

EN 15942, *Sustainability of construction works — Environmental product declarations — Communication format business-to-business*

EN 15978, *Sustainability of construction works — Assessment of environmental performance of buildings — Calculation method*

EN 16002, *Flexible sheets for waterproofing — Determination of the resistance to wind load of mechanically fastened flexible sheets for roof waterproofing*

EN 50380, *Datasheet and nameplate information for photovoltaic modules*

EN 61082-1, *Preparation of documents used in electrotechnology — Part 1: Rules (IEC 61082-1)*

EN 61215, *Crystalline silicon terrestrial photovoltaic (PV) modules — Design qualification and type approval (IEC 61215)*

EN 61646, *Thin-film terrestrial photovoltaic (PV) modules — Design qualification and type approval (IEC 61646)*

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

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

CLC/TS 61836, *Solar photovoltaic energy systems — Terms, definitions, symbols (IEC/TS 61836)*

EN 62446, *Grid connected photovoltaic systems — Minimum requirements for system documentation, commissioning tests and inspection (IEC 62446)*

EN 82079-1, *Preparation of instructions for use — Structuring, content and presentation — Part 1: General principles and detailed requirements (IEC 82079-1*)

EN ISO 12543-1, *Glass in building — Laminated glass and laminated safety glass — Part 1: Definitions and description of component parts (ISO 12543-1)*

EN ISO 12543-2, *Glass in building — Laminated glass and laminated safety glass — Part 2: Laminated safety glass (ISO 12543-2)*

EN ISO 12543-3, *Glass in building — Laminated glass and laminated safety glass — Part 3: Laminated glass (ISO 12543-3)*

EN ISO 12543-4, *Glass in building — Laminated glass and laminated safety glass — Part 4: Test methods for durability (ISO 12543-4)*

EN ISO 12543-5, *Glass in building — Laminated glass and laminated safety glass — Part 5: Dimensions and edge finishing (ISO 12543-5)*

EN ISO 12543-6, *Glass in building — Laminated glass and laminated safety glass — Part 6: Appearance (ISO 12543-6)*

EN ISO 12631, *Thermal performance of curtain walling — Calculation of thermal transmittance (ISO 12631)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1990, EN ISO 12543 (Parts 1 to 6), EN 12519, EN 13119, EN 13956, EN 14782, EN 14783, CLC/TS 61836, EN 13022, EN 16002 and the following apply.

Annex-specific definitions are included in the annexes themselves.

NOTE Additional information are provided in the Low Voltage Directive 2006/95/EC, the Construction Product Regulation 305/2011 and the Electromagnetic Compatibility Directive ECD 2004/108/EC.

3.1
Building-Integrated Photovoltaic modules
BIPV modules
photovoltaic modules are considered to be building-integrated, if the PV modules form a construction product providing a function as defined in the European Construction Product Regulation CPR 305/2011. Thus the BIPV module is a prerequisite for the integrity of the building's functionality. If the integrated PV module is dismounted (in the case of structurally bonded modules, dismounting includes the adjacent construction product), the PV module would have to be replaced by an appropriate construction product.

The building's functions in the context of BIPV are one or more of the following:

- mechanical rigidity or structural integrity
- primary weather impact protection: rain, snow, wind, hail

- energy economy, such as shading, daylighting, thermal insulation
- fire protection
- noise protection
- separation between indoor and outdoor environments
- security, shelter or safety

Inherent electro-technical properties of PV such as antenna function, power generation and electromagnetic shielding etc. alone do not qualify PV modules as to be building-integrated.

3.2
Building-Attached Photovoltaic Modules
BAPV modules
photovoltaic modules are considered to be building-attached, if the PV modules are mounted on a building envelope and do not fulfil the above criteria for building integration

(Negation: The integrity of the building functionality is independent of the existence of a building-attached photovoltaic module.)

Note 1 to entry: Further important information on this type of photovoltaic system on roofs is provided by the Technical Report by CEN/TC 128/WG3 - Solar energy systems for roofs: Requirements for structural connections to solar panels.

4 Requirements

4.1 General

As electrical components, BIPV modules are subject to the applicable electro-technical requirements as stated in the Low Voltage Directive 2006/95/EC / or CENELEC standards.

The essential requirements defined in the LVD 2006/95/EC are:

1. Protection against hazards arising from the electrical equipment,

2. Protection against hazards which may be caused by external influences on the electrical equipment.

As construction products, BIPV modules are subject to the Essential Requirements as specified in the European Construction Product Regulation CPR 305/2011.
The essential requirements defined in the CPR 305/2011 are:

3. Mechanical resistance and stability

4. Safety in case of fire

5 Hygiene, health and the environment [2]

6 Safety and accessibility in use

7. Protection against noise

8. Energy economy and heat retention

9. Sustainable use of natural resources

[2] As per Directive 2011/65/EU of the European parliament from 8th June 2011, photovoltaic modules have been exempted from the ROHS directive.

4.2 Electrical requirements

The BIPV modules shall comply with one of the following electrical standards:

– EN 61215 for crystalline silicon terrestrial photovoltaic (PV) modules

– EN 61646 for thin-film terrestrial photovoltaic (PV) modules

and in addition to

– EN 61730 for photovoltaic module safety qualification

NOTE The integration of an existing PV module, which already complies with the standards above, into a construction product to create a BIPV module may change the electrical properties with respect to the original PV module. New evaluation of the BIPV module with respect to a basic requirement of the LVD is necessary only if an essential characteristic of the BIPV module needed to meet this basic requirement is changed with respect to the original PV module.

4.3 Building-related requirements

4.3.1 General

As construction products, BIPV modules have to be designed to comply with the wind, snow and mechanical loads as well as other requirements set out in the Eurocodes EN 1990, EN 1991, EN 1993 and EN 1999.

The specific requirements on BIPV modules, which arise from the general CPR requirements, are listed in the following chapters. Corresponding available standards are named.

The integration of photovoltaics into an existing construction product to create a BIPV module necessarily changes the properties with respect to the original construction product. New evaluation of the BIPV module with respect to a basic requirement of the CPR is necessary only if an essential characteristic of the BIPV module needed to meet this basic requirement is changed with respect to the original construction product. This standard distinguishes between BIPV module that contain at least one pane of glass and those that do not. In addition to naming the general requirements, this standard classifies BIPV modules containing glass into five different categories (depending on the intended mounting type). Specific normative references are listed for each category.

4.3.2 BIPV Modules containing glass panes

4.3.2.1 General

This sub-clause applies to BIPV modules which contain one or more glass panes. Each of these panes shall comply with the respective product standards for glass in buildings.

If the photovoltaic cells are laminated to a glass pane with an interlayer, EN 14449 for laminated glass shall apply

NOTE 1 As defined in EN ISO 12543-1, laminated glass is “an assembly consisting of one sheet of glass with one or more sheets of glass and/or plastic glazing sheet material joined together with one or more interlayers”.

If the photovoltaic cells are mounted directly in the cavity of a multiple glazing unit, prEN 1279-5 for insulating glass units shall apply.

Additional clauses from EN 13022-1 apply to BIPV modules that are used in structural sealant glazing.

Photovoltaics in buildings is subject to partial shading, which can cause thermally induced glass breakage – either directly or due to hot spots. The module manufacturer has to minimize the risk of breakage by the module design itself and/or the specification of relevant restrictions on mounting.

NOTE 2 The risk of breakage can be minimized e.g. by the use of heat-treated glass or the proper use of bypass diodes.

Table 1 — General requirements for all categories of BIPV modules containing glass panes

CPR Requirement	**Standards, guidelines, test methods**	**Comment**
1. Mechanical resistance and stability	A.2	Depending on application and national requirements
2. Safety in case of fire	EN 13501-1	Classification standard. Manufacturer to declare the fire rating. Further requirements depend on application and country.
3. Hygiene, health and the environment		
4. Safety and accessibility in use	EN 13022-1	Only applicable for BIPV modules or PV insulating glass units to be bonded adhesively which are sold separately from the framework and installed under the responsibility of the designer and assembler. National regulations may define restrictions or additional requirements.[3]
	EN 12600	For laminated safety glass only and if national regulations require the classification of pendulum body impact resistance: required for CE marking of laminated safety glass
5. Protection against noise	EN 12758	
6. Energy economy and heat retention		
7. Sustainable use of natural resources	EN 15804 CEN/TR 15941 EN 15942 EN 15978	See also Final Report of IEA-PVPS Task 12

4.3.2.2 Mounting categories

Additional requirements on PV modules containing glass panes depend on their type of mounting. This standard differentiates five categories - A to E - of mounting according to combinations of the following criteria:

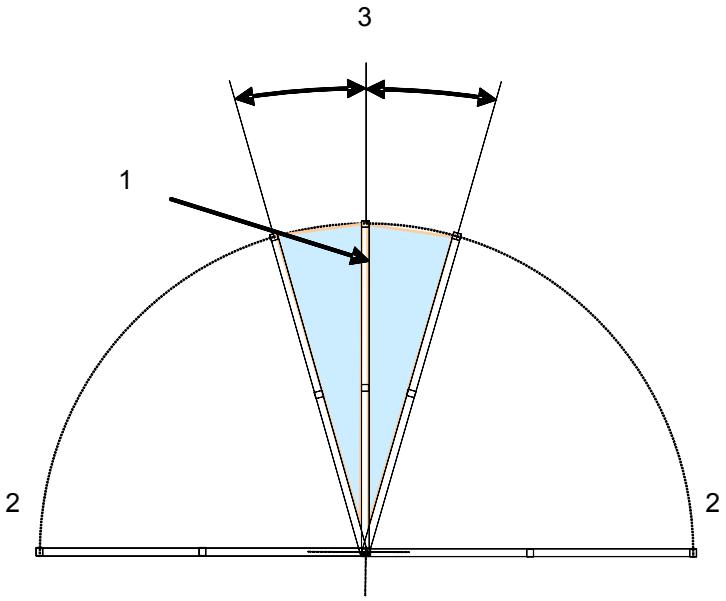
1. integrated into the building envelope: yes/no
2. accessible yes/no

[3] Structural sealant glazing systems (SSGS) or kits comprising PV modules are in the first consideration a matter of Technical Approvals which set out the requirements for the complete product to be fulfilled by the manufacturer. In the second consideration, PV modules as glass products to be sold separately and installed into or onto a framework or into or onto the building using a structural glazing technique are specified in EN 13022-1. Meeting the requirements of this standard, they are suitable for use in SSGS as defined in EN 13022-2.

3. sloped: yes/no

“Not accessible” means that another construction product still provides protection against mechanical impact, even if the PV module has been damaged or removed.

The definition of “sloped glazing” is derived from EN 13830 and prEN 12488 and illustrated below (see Figure 1).



Key

1 vertical glazing

2 angle of glazing considered sloped

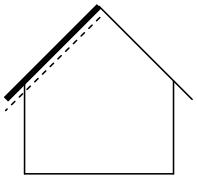
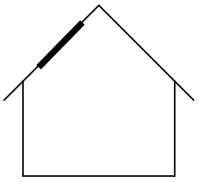
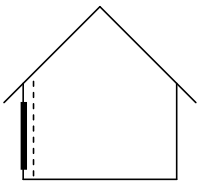
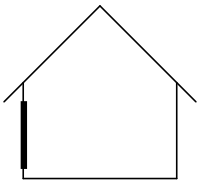
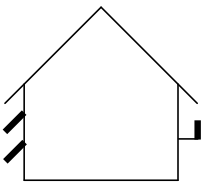
3 angle of glazing considered non-sloped ± 15° from vertical

Figure 1 — Angle of glazing considered sloped and non-sloped as per EN 13830 and prEN 12488

Stated explicitly, “non-sloped” refers to the following angles:

75° ≤ angle ≤ 90° or 90° ≤ angle ≤ 105° from horizontal.

Table 2 — Mounting categories A – E

Category A:	**Sloped, roof-integrated, not accessible from within the building**	
	The PV modules are mounted in the building envelope at an angle between 0° and 75° (see Fig. 1) with a barrier underneath preventing large pieces of glass falling onto accessible areas below	
Category B:	**Sloped, roof-integrated, accessible from within the building**	
	The PV modules are mounted in the building envelope at an angle between 0° and 75° (see Fig. 1)	
Category C:	**Non-sloped (vertically) mounted not accessible from within the building**	
	The PV modules are mounted in the building envelope at an angle between and including both 75° and 90° (see Fig. 1) with a barrier behind preventing large pieces of glass or persons falling to an adjacent lower area inside the building	
Category D:	**Non-sloped (vertically) mounted accessible from within the building**	
	The PV modules are mounted in the building envelope at an angle of between and including both 75° and 90° (see Fig. 1)	
Category E:	**Externally integrated, accessible or not accessible from within the building**	
	The PV modules are mounted onto the building and form an additional functional layer (as defined in 3.1) exterior to its envelope (e.g. balconies, balustrades, shutters, awnings, louvres, brise soleil etc.).	

4.3.2.3 Additional requirements for Category A: sloped, roof-integrated, not accessible from within the building

Table 3 — Additional requirements for BIPV modules – Category A

CPR Requirement	Standards, guidelines, test methods	Comment
1. Mechanical resistance and stability		
2. Safety in case of fire	EN 13501-2	Fire classification
3. Hygiene, health and the environment		
4. Safety and accessibility in use		
5. Protection against noise		
6. Energy economy and heat retention	EN 410 and A.3	Calculation of light and solar energy characteristics. Applicable only if underlying layer is transparent or translucent. The PV module is to be characterised in the open circuit condition.
	EN 673 or EN 674 or EN 675	Determination of thermal characteristics of glass in buildings The PV module is to be characterised in the open circuit condition.
7. Sustainable use of natural resources		

4.3.2.4 Additional requirements for Category B: Sloped, roof-integrated, accessible from within the building / Skylight

Table 4 — Additional requirements for BIPV modules – Category B

CPR Requirement	Standards, guidelines, test methods	Comment
1. Mechanical resistance and stability		
2. Safety in case of fire	EN 13501-2 EN 13501-5	Fire classification standards (applies to -2 and -5)
3. Hygiene, health and the environment		
4. Safety and accessibility in use	EN 14351-1	Apply conditions as defined in A.2 Additional national regulations for overhead glazing may apply
5. Protection against noise		
6. Energy economy and heat retention	EN 410 and A.3	Calculation of light and solar energy characteristics. The PV module is to be characterised in the open circuit condition.
	EN 673 or EN 674 or EN 675	Determination of thermal characteristics of glass in buildings. The PV module is to be characterised in the open circuit condition.
7. Sustainable use of natural resources		
NOTE If the PV module is covered by the scope of EN 14351-1 (windows, incl. roof windows, roof windows with external fire resistance and French windows) the tests and classification specified in that standard concerning CPR requirements needs to be observed.		

4.3.2.5 Additional requirements for Category C: Non-sloped (Vertically mounted), not accessible from within the building

Table 5 — Additional requirements for BIPV modules – Category C

CPR Requirement	Standards, guidelines, test methods	Comment
1. Mechanical resistance and stability		
2. Safety in case of fire	EN 13501-2	Fire classification
3. Hygiene, health and the environment		
4. Safety and accessibility in use	EN 13116 EN 12179	
5. Protection against noise		
6. Energy economy and heat retention	EN 410 and A.3.	Calculation of light and solar energy characteristics. Applicable only if interior layer is transparent or translucent. The PV module is to be characterised in the open circuit condition.
	EN ISO 12631	Calculation method for thermal resistance and thermal transmittance of facade construction. The PV module is to be characterised in the open circuit condition.
	EN 673 or EN 674 or EN 675	Determination of thermal characteristics of glass in buildings. The PV module is to be characterised in the open circuit condition.
7. Sustainable use of natural resources		
NOTE If the PV module is intended for use in a system that is covered by the scope of EN 13830 (curtain walling) the tests and classification specified in that standard concerning CPR requirements needs to be observed (see EN 50583-2:2016, 4.1.4).		

4.3.2.6 Additional requirements for Category D: Non-sloped (Vertically mounted), accessible from within the building

Table 6 — Additional requirements for Category D mounted BIPV modules

CPR Requirement	Standards, guidelines, test methods	Comment
1. Mechanical resistance and stability		
2. Safety in case of fire	EN 13501-2	Fire classification
3. Hygiene, health and the environment		
4. Safety and accessibility in use		Additional national regulations for fall-proof glazing may apply
5. Protection against noise		
6. Energy economy and heat retention	EN 410 and A.3	Calculation of light and solar energy characteristics. The PV module is to be characterised in the open circuit condition.
	EN ISO 12631	Calculation method for thermal resistance and thermal transmittance of facade construction. The PV module is to be characterised in the open circuit condition.
	EN 673 or EN 674 or EN 675	Determination of thermal characteristics of glass in buildings. The PV module is to be characterised in the open circuit condition.
7. Sustainable use of natural resources		
NOTE If the PV module is covered by the scope of EN 14351-1 (windows, incl. roof windows, roof windows with external fire resistance and French windows) the tests and classification specified in that standard concerning CPR requirements needs to be observed. If the PV module is intended for use in a system that is covered by the scope of EN 13830 (curtain walling) the tests and classification specified in that standard concerning CPR requirements needs to be observed (see EN 50583-2:2016, 4.1.5).		

4.3.2.7 Additional requirements for Category E: Externally integrated, accessible or not accessible from within the building

Table 7 — Additional requirements for Category E mounted BIPV modules

CPR Requirement	Standards, guidelines, test methods	Comment
1. Mechanical resistance and stability		
2. Safety in case of fire		
3. Hygiene, health and the environment		
4. Safety and accessibility in use		Additional national regulations for fall-proof glazing may apply
5. Protection against noise		
6. Energy economy and heat retention	EN 410	Calculation of light and solar energy characteristics. The PV module is to be characterised in the open circuit condition.
	EN 14500	Depending on application
7. Sustainable use of natural resources		

4.3.3 BIPV Modules not containing glass panes

4.3.3.1 BIPV modules based on polymer waterproofing sheet

This sub-clause addresses prefabricated BIPV modules for use in roofing that typically include a polymer waterproofing sheet as the back cover. The following building product standards are applicable for BIPV products that contain polymer waterproofing sheet:

EN 13956 for flexible plastic and rubber sheets

Table 8 — Requirements for BIPV modules based on polymer waterproofing sheet

CPR Requirement	Standards, guidelines, test methods	Comment
1. Mechanical resistance and stability		
2. Safety in case of fire	EN 13501-1	National apl. specific requirements Manufacturer to declare the fire rating.
3. Hygiene, health and the environment	EN 13956	National requirements
4. Safety and accessibility in use	EN 13956	National requirements
5. Protection against noise		
6. Energy economy and heat retention		
7. Sustainable use of natural resources	EN 15804 CEN/TR 15941 EN 15942 EN 15978	Additional information is provided in the final Report by IEA-PVPS Task 12''

4.3.3.2 BIPV modules based on metal sheet

This section addresses prefabricated BIPV modules for use in roofing that typically include a metal sheet as the back cover. One or more of the following building product standards are applicable for BIPV products that contain metal sheet as the back cover:

EN 14782 for self-supporting metal sheets

EN 14783 for fully supported metal sheets and strips

Table 9 — Requirements for BIPV modules based on metal sheet

CPR Requirement	Standards, guidelines, test methods	Comment
1. Mechanical resistance and stability		
2. Safety in case of fire	EN 13501-1	National and application- specific requirements Manufacturer to declare the fire rating.
3. Hygiene, health and the environment	EN 14782	
	EN 14783	
4. Safety and accessibility in use	EN 14782	
	EN 14783	
5. Protection against noise		
6. Energy economy and heat retention		
7. Sustainable use of natural resources	EN 15804 CEN/TR 15941 EN 15942 EN 15978	Additional information is provided in the final Report of IEA-PVPS Task 12

4.3.3.3 BIPV modules based on other materials

BIPV modules based on other materials than those defined in 4.3.3.1 and 4.3.3.2 have to comply with CPR and LVD requirements. More specific requirements can be considered in future versions of this standard.

5 Labelling

The PV module shall be labelled according to EN 50380.

6 Documentation and declaration of performance

6.1 Data sheet

The data sheet information for BIPV modules shall conform to EN 50380. In addition the data sheet information for BIPV modules shall include the information as required for CE marking according to product standards that comply with the CPR (e.g. EN 14449 or prEN 1279-5).

In addition the data sheet for PV modules that contain glass panes shall state those categories together with title or pictogram as defined in Clause 4 for which the BIPV modules are intended to be used (categories A-E).

6.2 Declaration of conformity

The declaration of conformity shall reference this standard.

6.3 Further documentation

The documentation shall be prepared by following the guidelines given in EN 61082-1 (diagrams) and EN 82079-1 (instructions for use). Instructions for storage, handling, erection, fixation, operation, maintenance, dismounting and recycling of the BIPV modules are to be stated. The information required for system documentation as specified by EN 62446 shall be provided.

The manufacturer shall provide a specification concerning permissible variations in visual appearance of the transparent module areas following the criteria stated in EN ISO 12543-6. In addition, specifications concerning *Permissible misalignment and colour variation of solar cells* are to be provided by the manufacturer.

Annex A
(normative)

Further requirements on PV modules that contain glass

A.1 General

Annex A applies only to PV modules that contain glass

Glass standards conventionally consider glass as a transparent material which is not heated strongly when exposed to the sun. The effects of the high temperatures that can be reached by a photovoltaic module shall be taken into account as follows.

A.2 Mechanical requirements

1. Structural design of insulating glass units containing a PV device:

   For calculation of the mechanical load caused by the temperature-dependent increase of the cavity volume of an insulating glass unit, the solar absorptance of the PV module is to be taken into account when determining the upper temperature limit. If no values are available a glass temperature of 75 °C shall be used as the upper limit.

2. Rigidity of laminated glass containing a PV device:

   When calculating the mechanical rigidity of a PV module, the solar absorptance and the thermal transmittance of the entire component are to be taken into account when determining the upper limit for the interlayer temperature. If no values are available an interlayer temperature of

   - 85 °C shall be used as the upper limit for PV modules that form the front part of a thermal insulation panels.
   - 80 °C shall be used as the upper limit for PV modules that forms the front component of an insulating glass unit.
   - 65 °C shall be used as the upper limit for PV modules that do not contain any kind of rear-surface thermal insulation.

   NOTE The temperature of PV modules may vary significantly if ventilation is obstructed. This can be affected strongly by the system design.

3. PV modules and post-breakage integrity

   When testing PV modules for post-breakage integrity

   - the PV module temperature shall be 65 °C ± 2 °C for PV modules that are tested for integrity under wind load. The test shall be carried out with a load corresponding to 50 % of the design wind load,
   - the PV module temperature shall be 22 °C ± 2 °C for PV modules that are tested for integrity under snow load. The test shall be carried out with a load corresponding to 100 % of the design snow load.

A.3 Energy economy requirements

PV modules and total solar energy transmittance

In addition to the procedures defined in EN 410 to determine the total solar energy transmittance (g value) of glazing materials, calculations or measurements are permitted that take the removal of energy from the system as electricity into account.

Bibliography

EN 572-9, *Glass in building — Basic soda lime silicate glass products — Part 9: Evaluation of conformity/Product standard*

EN 1096-4, *Glass in building — Coated glass — Part 4: Evaluation of conformity/Product standard*

EN 1279-1, *Glass in building — Insulating glass units — Part 1: Generalities, dimensional tolerances and rules for the system description*

EN 1279-2, *Glass in building — Insulating glass units — Part 2: Long term test method and requirements for moisture penetration*

EN 1279-3, *Glass in building — Insulating glass units — Part 3: Long term test method and requirements for gas leakage rate and for gas concentration tolerances*

EN 1279-4, *Glass in building — Insulating glass units — Part 4: Methods of test for the physical attributes of edge seals*

EN 1863-2, *Glass in building — Heat strengthened soda lime silicate glass — Part 2 Evaluation of conformity/Product standard*

EN 12150-2, *Glass in building — Thermally toughened soda lime silicate safety glass — Part 2: Evaluation of conformity/Product standard*

EN 14179-2, *Glass in building — Heat soaked thermally toughened soda lime silicate safety glass — Part 2: Evaluation of conformity/Product standard*

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