भारतीय मानक
Indian Standard

IS IEC 63092-1 : 2020

भवनों में फोटोवोल्टिक

भाग 1 भवन-एकीकृत फोटोवोल्टिक मॉड्यूल के लिए आवश्यकताएँ

Photovoltaics in Buildings

Part 1 Requirements for Building-Integrated Photovoltaic modules

ICS 27.160

भारतीय मानक ब्यूरो
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September 2022 **Price Group 10**

NATIONAL FOREWORD

This Indian Standard which is identical with IEC 63092-1 : 2020 'Photovoltaics in Buildings — Part 1 : Requirements for Building-Integrated Photovoltaic modules' issued by the International Electrotechnical Commission (IEC) will be adopted by the Bureau of Indian Standards on the recommendation of the Solar Photovoltaic Energy Systems Sectional Committee and approval of the Electrotechnical Division Council.

The text of IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain terminologies and conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following :

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker, while in Indian Standards the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 61215-1 Terrestrial photovoltaic (PV) modules — Design qualification and type approval — Part 1: Test requirements	IS 14286 (Part 1) : 2019 Terrestrial photovoltaic (PV) modules — Design qualification and type approval: Part 1 Test requirements (*second revision*)	Identical
IEC 61215-1-1 Terrestrial photovoltaic (PV) modules — Design qualification and type approval — Part 1-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules	IS 14286 (Part 1/Sec 1) : 2019 Terrestrial photovoltaic (PV) modules — Design qualification and type approval: Part 1 Test requirements, Section 1 Special requirements for testing of crystalline silicon photovoltaic (PV) modules (*second revision*)	Identical
IEC 61215-1-2 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	IS 14286 (Part 1/Sec 2) : 2019 Terrestrial photovoltaic (PV) modules — Design qualification and type approval: Part 1 Test requirements Section 2 Special requirements for testing of thin-film cadmium telluride (CdTe) based photovoltaic (PV) modules (*second revision)*	Identical
IEC 61215-1-3, 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	IS 14286 (Part 1/Sec 3): 2019 Terrestrial photovoltaic (PV) modules — Design qualification and type approval: Part 1 Test requirements Section 3 Special requirements for testing of thin-film amorphous silicon based photovoltaic (PV) modules (*second revision)*	Identical

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC 61215-1-4 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	IS 14286 (Part 1/Sec 4) : 2019 Terrestrial photovoltaic (PV) modules — Design qualification and type approval: Part 1 Test requirements Section 4 Special requirements for testing of thin-film $Cu(In,Ga)(S,Se)_2$ based photovoltaic (PV) modules (*second revision*)	Identical
IEC 61215-2 Terrestrial photovoltaic (PV) modules — Design qualification and type approval — Part 2: Test procedures	IS 14286 (Part 2) : 2019 Terrestrial photovoltaic (PV) modules — Design qualification and type approval: Part 2 Test procedures (*second revision*)	Identical
IEC 61730-1, Photovoltaic (PV) module safety qualification — Part 1: Requirements for construction	IS/IEC 61730-1 : 2016 Photovoltaic (PV) module safety qualification: Part 1 Requirements for construction (*first revision*)	Identical
IEC 61730-2, Photovoltaic (PV) module safety qualification — Part 2: Requirements for testing	IS/IEC 61730-2 : 2016 Photovoltaic (PV) module safety qualification: Part 2 Requirements for testing (*first revision*)	Identical
IEC TS 61836 Solar photovoltaic energy systems — Terms, definitions and symbols	IS 12834 : 2013 Solar photovoltaic energy systems — Terms, definitions and symbols (*first revision*)	Identical
IEC 62446-1, Photovoltaic (PV) systems — Requirements for testing, documentation and maintenance — Part 1: Grid connected systems — Documentation, commissioning tests and inspection	IS 16960 (Part 1) : 2018 photovoltaic (PV) systems — Requirements for testing, documentation and maintenance: Part 1 Grid connected systems — Documentation, commissioning tests and inspection	Identical
IEC TS 62915, Photovoltaic (PV) modules — Type approval, design and safety qualification — Retesting	IS/IEC/TS 62915 : 2018 Photovoltaic (PV) modules — Type approval, design and safety qualification — Retesting	Identical

The technical committee has reviewed the provisions of the following international standards referred in this adopted standard and decided that they are acceptable for use in conjunction with this standard

International Standard	*Title*
IEC 61082-1	Preparation of documents used in electrotechnology — Part 1 : Rules
IEC 63092-2	Photovoltaics in buildings — Part 2 : Requirements for building-integrated photovoltaic systems

International Standard	*Title*
IEC TS 63126	Guidelines for qualifying PV modules, components and materials for operation at high temperatures
IEC/IEEE 82079-1	Preparation of information for use (instructions for use) of products — Part 1: Principles and general requirements
ISO 9050	Glass in building — Determination of light transmittance, solar direct transmittance, total solar energy transmittance, ultraviolet transmittance and related glazing factors
ISO 10291	Glass in building — Determination of steady-state U values (thermal transmittance) of multiple glazing — Guarded hot plate method
ISO 10292	Glass in building — Calculation of steady-state U values (thermal transmittance) of multiple glazing
ISO 10293	Glass in building — Determination of steady-state U values (thermal transmittance) of multiple glazing — Heat flow meter method
ISO 12543-1	Glass in building — Laminated glass and laminated safety glass — Part 1: Definitions and description of component parts
ISO 12543-2	Glass in building — Laminated glass and laminated safety glass — Part 2: Laminated safety glass
ISO 12543-3	Glass in building — Laminated glass and laminated safety glass — Part 3: Laminated glass
ISO 12543-4	Glass in building — Laminated glass and laminated safety glass — Part 4: Test methods for durability
ISO 12543-5	Glass in building — Laminated glass and laminated safety glass — Part 5: Dimensions and edge finishing
ISO 12543-6	Glass in building — Laminated glass and laminated safety glass — Part 6: Appearance
ISO 15099	Thermal performance of windows, doors and shading devices — Detailed calculations
ISO 16940,	Glass in building — Glazing and airborne sound insulation — Measurement of the mechanical impedance of laminated glass
ISO 19467	Thermal performance of windows and doors — Determination of solar heat gain coefficient using solar simulator
ISO 22897	Glass in building — Glazing and airborne sound insulation — Product descriptions and determination of properties
ISO 28278-1	Glass in building — Glass products for structural sealant glazing — Part 1: Supported and unsupported monolithic and multiple glazing

International Standard	*Title*
ISO 29584	Glass in building — Pendulum impact testing and classification of safety glass
ISO 52022-1	Energy performance of buildings — Thermal, solar and daylight properties of building components and elements — Part 1: Simplified calculation method of the solar and daylight characteristics for solar protection devices combined with glazing
ISO 52022-3	Energy performance of buildings — Thermal, solar and daylight properties of building components and elements — Part 3: Detailed calculation method of the solar and daylight characteristics for solar protection devices combined with glazing

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

CONTENTS

FOREWORD

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 non-governmental 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.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
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7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
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9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 63092-1 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems, in collaboration with ISO technical committee 160: Glass in building.

This standard is based on EN 50583-1.

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

FDIS	Report on voting
82/1769/FDIS	82/1792/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 63092 series, published under the general title *Photovoltaics in buildings*, 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 "http://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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

PHOTOVOLTAICS IN BUILDINGS –

PART 1 REQUIREMENTS FOR BUILDING-INTEGRATED

PHOTOVOLTAIC MODULES

1 Scope

This part of IEC 63092 specifies BIPV (building-integrated photovoltaic) module requirements while IEC 63092-2 specifies BIPV system requirements. Both parts specify building requirements and the applicable electrotechnical requirements (both in general and specific with respect to module assembly and application category).

This document applies to photovoltaic modules used as building products. It focuses on the properties of these photovoltaic modules relevant to basic building requirements and the applicable electro-technical requirements. This document references international standards, technical reports and guidelines. For some applications, national standards (or regulations) for building products may also apply in individual countries, which are not explicitly referenced herein and for which harmonized International 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 photovoltaic modules.

This document addresses requirements on the BIPV modules in the specific ways they are intended to be mounted but not the mounting structure itself, which is within the scope of IEC 63092-2.

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 61082-1, *Preparation of documents used in electrotechnology – Part 1: Rules*

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

IEC 61215-1-1, *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, *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, *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, *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, *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*

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 62446-1, *Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance – Part 1: Grid connected systems – Documentation, commissioning tests and inspection*

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

IEC 63092-2, *Photovoltaics in buildings – Part 2: Requirements for building-integrated photovoltaic systems*

IEC TS 63126, *Guidelines for qualifying PV modules, components and materials for operation at high temperatures*

IEC/IEEE 82079-1: *Preparation of information for use (instructions for use) of products – Part 1: Principles and general requirements*

ISO 9050, *Glass in building – Determination of light transmittance, solar direct transmittance, total solar energy transmittance, ultraviolet transmittance and related glazing factors*

ISO 10291, *Glass in building – Determination of steady-state U values (thermal transmittance) of multiple glazing – Guarded hot plate method*

ISO 10292, *Glass in building – Calculation of steady-state U values (thermal transmittance) of multiple glazing*

ISO 10293, *Glass in building – Determination of steady-state U values (thermal transmittance) of multiple glazing – Heat flow meter method*

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

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ISO 12543-3, *Glass in building – Laminated glass and laminated safety glass – Part 3: Laminated glass*

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

ISO 12543-5, *Glass in building – Laminated glass and laminated safety glass – Part 5: Dimensions and edge finishing*

ISO 12543-6, *Glass in building – Laminated glass and laminated safety glass – Part 6: Appearance*

ISO 15099, *Thermal performance of windows, doors and shading devices – Detailed calculations*

ISO 16940, *Glass in building – Glazing and airborne sound insulation – Measurement of the mechanical impedance of laminated glass*

ISO 19467 *Thermal performance of windows and doors – Determination of solar heat gain coefficient using solar simulator*

ISO 22897, *Glass in building – Glazing and airborne sound insulation – Product descriptions and determination of properties*

ISO 28278-1, *Glass in building – Glass products for structural sealant glazing – Part 1: Supported and unsupported monolithic and multiple glazing*

ISO 29584, *Glass in building – Pendulum impact testing and classification of safety glass*

ISO 52022-1, *Energy performance of buildings – Thermal, solar and daylight properties of building components and elements – Part 1: Simplified calculation method of the solar and daylight characteristics for solar protection devices combined with glazing*

ISO 52022-3, *Energy performance of buildings – Thermal, solar and daylight properties of building components and elements – Part 3: Detailed calculation method of the solar and daylight characteristics for solar protection devices combined with glazing*

3 Terms and definitions

For the purposes of this document, terms and definitions given in IEC 61215-1, IEC 61215-2, IEC TS 61836, IEC 63092-2 and ISO 12543-1 (in case the module contains one or more glass sheets), together with the following, 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
building product
any product or kit which is produced and placed on the market for incorporation in a permanent manner in buildings or parts thereof and the performance of which has an effect on the performance of the buildings with respect to the following basic building requirements:

a) Mechanical resistance and durability
b) Safety in case of fire
c) Hygiene, health and the environment
d) Safety and accessibility in use
e) Protection against noise
f) Energy economy and heat retention
g) Sustainable use of natural resources

3.2
building-integrated photovoltaic module
BIPV module
photovoltaic module that provides one or more of the functions of the building envelope

Note 1 to entry: The building envelope functions shall be, depending on the application, one or more of the following:

a) Mechanical rigidity or structural integrity.

b) Primary weather impact protection: rain, snow, wind, hail.

c) Shading, daylighting, thermal insulation.

d) Fire protection.

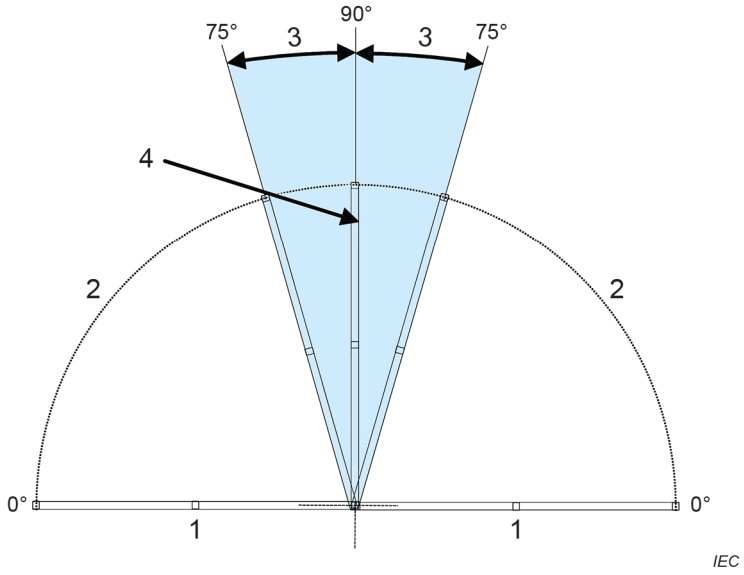
e) Noise protection.

f) Separation between indoor and outdoor environments.

g) Security, shelter or safety.

Note 2 to entry: If a BIPV module is uninstalled, it would have to be replaced by an appropriate building product in order to meet the building requirements.

3.3
non-sloping module
module installed at a tilt angle of 75° to 90° inclusive from the horizontal plane (see Figure 1), i.e. a module installed at an inclination of ±15° inclusive from the vertical plane



Key

1 horizontal module

2 angle of module considered to be sloping (including horizontal)

3 angle of module considered to be non-sloping (75° to 90° inclusive, from the horizontal plane)

4 vertical module

Figure 1 – Tilt angles of modules considered sloping and non-sloping

3.4
optically representative area of the module
selected surface area of the module that includes all the components of the module which have a significant effect on its optical properties and g value. The ratio of electrically active area (i.e. area covered by PV cells and interconnectors) to electrically inactive area within the optically representative area should not differ by more than 5 % from the ratio of the total electrically active area to the total electrically inactive area for the complete module (see Figure 2).

Note 1 to entry: The figure of 5 % was determined to result in an error of 3 % or less in the g value for BIPV modules consisting of crystalline silicon PV cells spaced over a light-transmitting medium (e.g. glass).

Note 2 to entry: The g value refers to the solar heat gain coefficient (SHGC) as defined in ISO 19467.

Note 3 to entry: If the solar cells themselves consist of opaque and transparent areas, or there are inhomogeneous layers such as ceramic frits or coloured interlayers in front of the solar cell layer, special care shall be taken in the selection of the "optically representative area" to ensure that it represents the proportions of all optically different areas of the BIPV module to within the specified tolerance.

Ratio of electrically active area to electrically inactive area for the complete module:

$$r_{\text{total,mod}} = \frac{A_{\text{cell,total}} + A_{\text{intercon,total}} + A_{\text{jb,total}}}{A_{\text{inact,total}}} \quad (1)$$

Ratio of electrically active area to electrically inactive area for the representative area of the module:

$$r_{\text{rep,mod}} = \frac{A_{\text{cell,rep}} + A_{\text{intercon,rep}}}{A_{\text{inact,rep}}} \quad (2)$$

Relation between the ratios associated to the complete module ($r_{\text{total,mod}}$) and the representative area of the module ($r_{\text{rep,mod}}$):

$$\frac{r_{\text{total,mod}} - r_{\text{rep,mod}}}{r_{\text{total,mod}}} = \pm 5\ \% \quad (3)$$

where

$r_{\text{total,mod}}$ is the ratio of electrically active area to electrically inactive area for the complete module;

$A_{\text{cell,total}}$ is the surface area covered by cells within total module area;

$A_{\text{intercon,total}}$ is the surface area covered by interconnectors within total module area;

$A_{\text{jb,total}}$ is the surface area covered by junction box, if within area of light-transmitting medium (otherwise $A_{\text{jb,total}} = 0$);

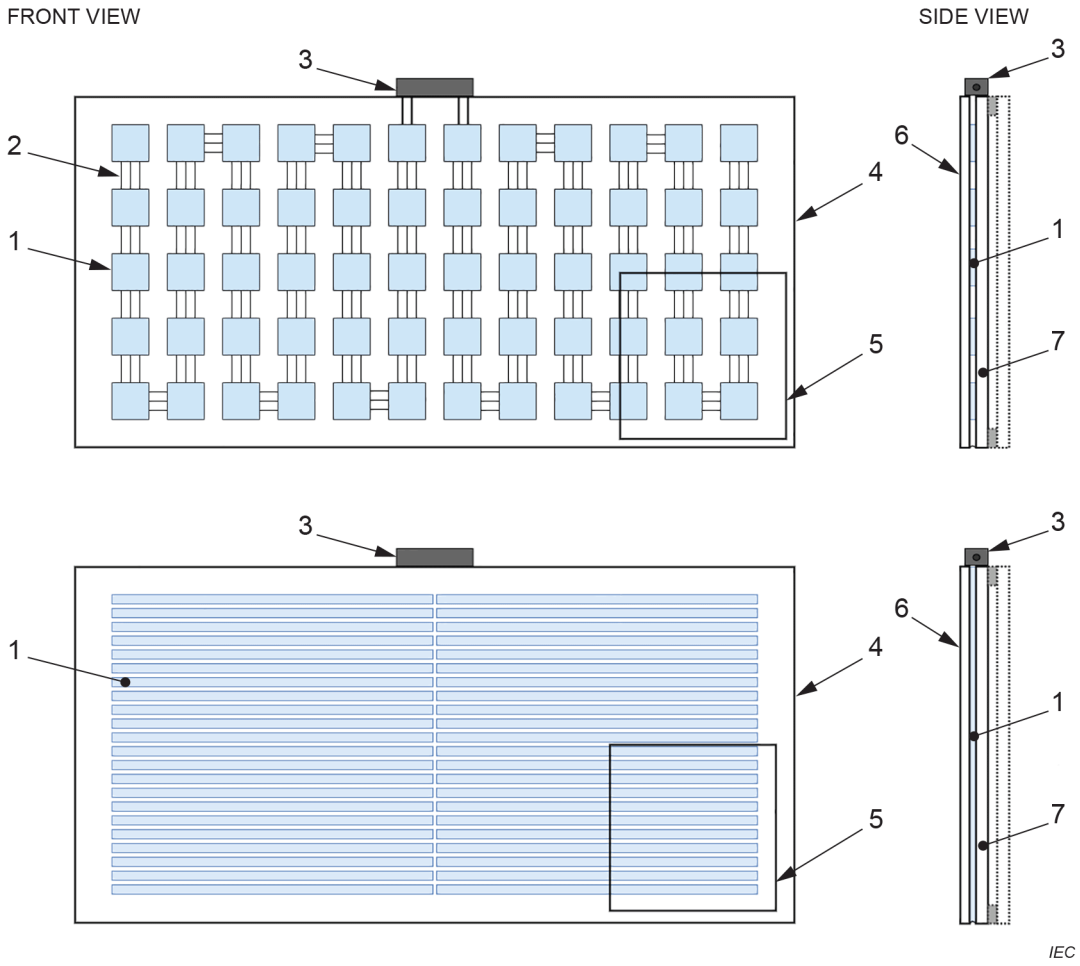
$A_{\text{inact,total}}$ is the electrically inactive surface area within total module area;

$r_{\text{rep,mod}}$ is the ratio of electrically active area to electrically inactive area for the representative area of the module;

$A_{\text{cell,rep}}$ is the surface area covered by cells within representative area;

$A_{\text{intercon,rep}}$ is the surface area covered by interconnectors within representative area;

$A_{\text{inact,rep}}$ is the electrically inactive surface area within representative area.



Key

1	photovoltaic cell or thin film	5	optically representative area of the module
2	interconnection	6	frontsheet
3	junction box	7	backsheet
4	perimeter of total module area		

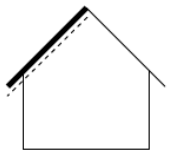
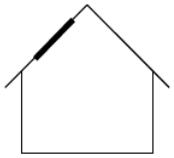
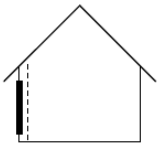
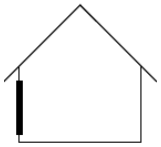
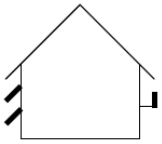
NOTE The same principles apply to modules consisting of other types of solar cell.

Figure 2 – Example of optically representative area of a crystalline silicon-based (top) and a thin-film (bottom) BIPV module for the calculation method based on spectral measurements

4 Application categories

Requirements are strongly affected by the location in the building envelope and the way the BIPV module is installed. Table 1 lists the application categories. The relevant requirements are listed in Clause 5.

Table 1 – Application categories

Category A	**Sloping, roof-integrated, not accessible from within the building** The BIPV modules are installed at a tilt angle between 0° and 75° from the horizontal plane [0°,75°), (see Figure 1), with another building product installed underneath (see Note).	
Category B	**Sloping, roof-integrated, accessible from within the building** The BIPV modules are installed at a tilt angle between 0°and 75° from the horizontal plane [0°,75°), (see Figure 1).	
Category C	**Non-sloping (vertically) envelope-integrated, not accessible from within the building** The BIPV modules are installed at a tilt angle between 75° and 90° from the horizontal plane [75°,90°], (see Figure 1) with another building product installed behind (see Note).	
Category D	**Non-sloping (vertically), envelope-integrated, accessible from within the building** The BIPV modules are installed at a tilt angle between 75° and 90° from the horizontal plane [75°,90°], (see Figure 1).	
Category E	**Externally-integrated, accessible or not accessible from within the building** The BIPV modules are installed to form an additional functional layer (as defined in 3.1) exterior to its envelope (e.g. balcony balustrades, shutters, awnings, louvers, brise soleil, etc.).	
NOTE A BIPV module is considered to be “not accessible” when another building product (represented by a dashed line in the pictograms) is present, which among other functions prevents: a) the interior surface of the module from being touched, and b) large pieces (in case of breakage) falling onto adjacent accessible areas within the building.		

5 Requirements

5.1 Electrotechnical requirements

BIPV modules shall comply with IEC TS 61215-1, IEC 61215-2, and with one of the following, according to the PV technology: IEC 61215-1-1, IEC 61215-1-2, IEC 61215-1-3 or IEC 61215-1-4 for design qualification and type approval and IEC 61730-1, IEC 61730-2 for safety qualification.

BIPV modules are often custom-made in sizes larger than test equipment can accommodate. In such a case, a representative sample (as defined under IEC 61215-1) can be used instead of a full-size sample.

BIPV modules have many variations in size, configuration and structure based on the original design. BIPV module retesting shall comply with IEC TS 62915.

5.2 Building-related requirements

5.2.1 General

As electrotechnical and building products, BIPV modules shall be designed to withstand mechanical loads (such as caused by wind and snow) as specified either in IEC 61730-1 or in national or local building codes – whichever are higher. Note that, the pass/fail criteria for IEC 61730-2 MST 34 differ significantly from building product requirements.

The specific requirements on BIPV modules, which arise from the basic requirements for buildings and their parts (see 3.1), are listed in the following clauses. Corresponding available standards are named.

The integration of photovoltaics into an existing building product to create a BIPV module necessarily changes the properties with respect to the original building product. New evaluation of the BIPV module with respect to a basic requirement for buildings and their parts is necessary only if an essential characteristic of the BIPV module needed to meet this basic requirement is changed with respect to the original building product.

This document distinguishes between BIPV modules 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 into five different categories as specified in Clause 4, Table 1 (depending on the intended application).

5.2.2 Requirements for products with at least one glass pane

5.2.2.1 General

Requirements for BIPV modules with at least one glass pane are discussed in more detail in the following clauses while Table 2 summarizes the requirements for each application category that is defined in Table 1.

5.2.2.2 Mechanical resistance and durability

In addition to the international requirements for mechanical resistance in the IEC 61215 series, IEC 61730 series and ISO 12543 series, the requirements specified under the high-temperature standard IEC TS 63126 and the provisions of Clause A.2 for assessing the shear tie connection of the encapsulant in the case of laminated BIPV modules shall apply.

The requirements specified under national or local standards or codes are also to be met. BIPV modules shall withstand the loads that are expected at the location (including position with regard to the building) of their application. Compliance of the application’s load to the BIPV module’s design load can be verified either by calculation or by testing.

5.2.2.3 Safety in case of fire

It shall be noted that fundamental requirements for fire safety are not internationally harmonised. It is therefore not possible to define general requirements for fire safety of BIPV modules, as international recognition of specific test results is not well established.

The BIPV module shall meet the fire safety requirements of the local national building code (or similar) for the building function it provides.

An example of such requirements can be found under the European Construction Product Regulation CPR 305/2011:

The buildings must be designed and built in such a way that in the event of an outbreak of fire:

a) the load-bearing capacity of the construction can be assumed for a specific period of time;

b) the generation and spread of fire and smoke within the buildings are limited;

c) the spread of fire to neighbouring buildings is limited;

d) occupants can leave the buildings or be rescued by other means;

e) the safety of rescue teams is taken into consideration.

5.2.2.4 Hygiene, health and the environment

Until an international standard is published, national or local codes or standards may apply.

5.2.2.5 Safety and accessibility in use

5.2.2.5.1 General

In addition to IEC 61730-1 and IEC 61730-2, the standards or technical specifications as described in 5.2.2.5.2 and 5.2.2.5.3 shall apply.

The BIPV module may be required to comply with applicable national, regional or local standards or codes addressing safety and accessibility in use.

5.2.2.5.2 Pendulum test

The BIPV module shall meet the impact requirements of IEC 61730-2 MST 32, and ISO 29584 together with the local national building code (or similar) for the building function it provides.

The impact testing according to ISO 29584 shall be carried out on representative samples of the BIPV end-product. Representative samples shall be operational PV modules containing all the relevant parts, but not the full-size dimensions used in the building. The area of the representative samples shall be at least 1 m × 1 m, with the same thickness and support structure around the edges as the BIPV end-product.

NOTE National regulations may define restrictions or additional requirements (e.g., calculation of glass thickness as specified by applicable building code).

It should be noted that additional testing for impact from both sides of the module may be required.

5.2.2.5.3 Structural sealant glazing

The following standard shall apply for structural sealant BIPV modules:

– ISO 28278-1

5.2.2.6 Protection against noise

Glass and glazing as part of the building skin have a role to play in noise abatement. The purpose of this requirement is to assign procedures for rating the acoustic performance of glazing and airborne sound insulation.

When a noise reduction rating is specified, the following standards shall be applied:

– ISO 16940

– ISO 22897

5.2.2.7 Energy economy and heat retention

5.2.2.7.1 General

Buildings and their heating, cooling, lighting and ventilation installations should be designed and built in such a way that the amount of energy they require in use is low, when account is taken of the occupants and of the climatic conditions of the location. Buildings should also be energy-efficient throughout their entire life cycle, using as little energy as possible during their construction and dismantling

5.2.2.7.2 Light transmittance, solar direct transmittance and total solar energy transmittance

5.2.2.7.2.1 General

The purpose of these methods is to determine light and energy transmittance of solar radiation for glazing in buildings. These characteristic data can serve as a basis for lighting, heating and ventilation calculations of rooms and can permit comparison between different types of glazing. One or more of the following methods shall be used:

NOTE Total solar energy transmittance (TSET), g value and solar heat gain coefficient (SHGC) are physically equivalent quantities.

In addition to the procedures defined in the following clauses to determine the total solar energy transmittance of glazing materials, calculations or measurements are permitted that take the removal of energy from the system as electricity into account.

5.2.2.7.2.2 Calculation method based on spectral measurements

One or more of the following standards shall apply:

– ISO 9050
– ISO 15099

The transmittance of optically differing areas of the module shall be determined separately, each according to ISO 9050. The transmittance for the whole module is then calculated as an area-weighted average of the individual transmittance values. Alternatively, the transmittance shall be measured with a large beam cross-section that covers a representative area of the module.

One or more of the following standards shall apply for solar-protection BIPV products that are intended to be combined with glazing (application category E):

– ISO 52022-1
– ISO 52022-3

5.2.2.7.2.3 Measurement method for solar heat gain coefficient using solar simulator

The following standard shall apply for doors and windows, under application category D:

– ISO 19467

NOTE 1 The measurement procedures under maximum power point (MPP) are not yet established.

For other application categories, national or local codes or standards may apply.

NOTE 2 One example of national or local codes or standards that may apply is NFRC 201

5.2.2.7.3 Thermal transmittance

5.2.2.7.3.1 General

The purpose of this test is to determine the thermal transmittance (U value) of glazing with flat and parallel surfaces (for application categories A, B, C and D). One or more of the following standards shall apply:

5.2.2.7.3.2 Guarded hot plate method

The following standard shall apply:

– ISO 10291

5.2.2.7.3.3 Calculation method

The following standard shall apply:

– ISO 10292

5.2.2.7.3.4 Heat flow meter method

The following standard shall apply:

– ISO 10293

5.2.2.8 Sustainable use of natural resources

Buildings should be designed, built and demolished in such a way that the use of natural resources is sustainable and ensure the following:

a) reuse or recyclability of the buildings, their materials and parts after demolition;
b) durability of the buildings;
c) use of environmentally compatible raw and secondary materials in the buildings.

Until an international standard is published, national or local codes or standards may apply.

NOTE Examples of national or local codes or standards that may apply include EN 15804, EN 15942, EN 15978 and CEN TR 15941

Table 2 – Summary of the building-related requirements from IEC 63092-1 for BIPV modules with at least one glass pane

<table>
<tr><th>Application category based on Table 1</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th></tr>
<tr><td>Mechanical resistance and durability</td><td colspan="5">IEC 61215-1
IEC 61215-1-1 (if crystalline silicon), IEC 61215-1-2 (if CdTe),
IEC 61215-1-3 (if amorphous silicon), IEC 61215-1-4 (if Cu(In,Ga)(S,Se)$_2$
IEC 61215-2
IEC 61730-1, IEC 61730-2
ISO 12543-2 (if laminated safety glass), ISO 12543-3 (if laminated glass)
ISO 12543-4, ISO 12543-5
IEC TS 63126 (if operating under high temperatures)
Annex A</td></tr>
<tr><td>Safety in case of fire</td><td colspan="5">No requirements are specified</td></tr>
<tr><td>Hygiene, health and the environment</td><td colspan="5">No requirements are specified</td></tr>
<tr><td>Safety and accessibility in use</td><td colspan="5">IEC 61730-1, IEC 61730-2
ISO 28278-1 (if structural sealant glazing)
ISO 29584</td></tr>
<tr><td>Protection against noise</td><td colspan="5">ISO 16940, ISO 22897</td></tr>
<tr><td rowspan="3">Energy economy and heat retention</td><td colspan="5">ISO 9050 and/or ISO 15099</td></tr>
<tr><td colspan="4">ISO 10291 and/or ISO 10292 and/or ISO 10293</td><td></td></tr>
<tr><td colspan="3"></td><td>ISO 19467</td><td>ISO 52022-1
ISO 52022-3</td></tr>
<tr><td>Sustainable use of natural resources</td><td colspan="5">No requirements are specified</td></tr>
</table>

Additionally, national or local codes or standards may apply.

5.2.3 Requirements for products without glass panes

5.2.3.1 BIPV modules based on polymer waterproofing sheet

5.2.3.1.1 General

This subclause addresses BIPV modules for use in building applications that typically include a polymer waterproofing sheet while Table 3 summarizes the requirements for each application category that is defined in Table 1. The following building product standards are applicable for BIPV modules that contain polymer waterproofing sheet:

5.2.3.1.2 Mechanical resistance and durabilty

The requirements identical to 5.2.2.2 are specified.

NOTE One example of a national or local code or standard that may apply is:

– EN 13956: *Flexible sheet for waterproofing – Plastic and rubber sheets for roof waterproofing. Definitions and characteristics*.

5.2.3.1.3 Safety in case of fire

Similarly to the products with glass panes, it is not possible to define specific requirements for fire safety of PV modules, as international recognition of specific test results is not well established. The general principles documented in 5.2.2.3 apply here also.

Fire test requirements are to be included as national differences in this standard.

5.2.3.1.4 Hygiene, health and the environment

Until an international standard is published, national or local codes or standards may apply.

NOTE One example of a national or local code or standard that may apply is:

– EN 13956: *Flexible sheet for waterproofing – Plastic and rubber sheets for roof waterproofing. Definitions and characteristics*.

5.2.3.1.5 Safety and accessibility in use

The general principles documented in 5.2.2.5 apply here also. For modules without glass panes, the requirements of 5.2.2.5.1 and 5.2.2.5.2 do not apply. Until an international standard is published, national or local codes or standards may apply.

NOTE One example of a national or local code or standard that may apply is:

– EN 13956: *Flexible sheets for waterproofing – Plastic and rubber sheets for roof waterproofing – Definitions and characteristics*.

5.2.3.1.6 Protection against noise

No requirements are specified. Until an international standard is published, national or local codes or standards may apply.

5.2.3.1.7 Energy economy and heat retention

The general principles documented in 5.2.2.7 apply here also. No requirements are specified. Until an international standard is published, national or local codes or standards may apply.

5.2.3.1.8 Sustainable use of natural resources

The requirements identical to 5.2.2.8 are specified.

5.2.3.2 BIPV modules based on metal sheet

5.2.3.2.1 General

This subclause addresses prefabricated BIPV modules for use in building applications that typically include a metal sheet as the back cover while Table 3 summarizes the requirements for each application category that is defined under Table 1. One or more of the following building product standards are applicable for BIPV modules that contain metal sheet as the back cover:

5.2.3.2.2 Mechanical resistance and durability

The requirements identical to 5.2.2.2 are specified.

NOTE Examples of further requirements may be found under national or local codes or standards such as:

– 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*.

5.2.3.2.3 Safety in case of fire

Similarly to the products with glass panes, it is not possible to define specific requirements for fire safety of PV modules as international recognition of specific test results is not well established. The general principles documented in 5.2.2.3 apply here also.

Fire test requirements are to be included as national differences in this standard.

5.2.3.2.4 Hygiene, health and the environment

Until an international standard is published, national or local codes or standards may apply.

NOTE Examples of national or local codes or standards that may apply include:

– 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.*

5.2.3.2.5 Safety and accessibility in use

The general principles documented in 5.2.2.5 apply here also. For modules without glass panes, the requirements of 5.2.2.5.1 and 5.2.2.5.2 do not apply. Until an international standard is published, national or local codes or standards may apply.

NOTE Examples of national or local codes or standards that may apply include:

– 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.*

5.2.3.2.6 Protection against noise

No requirements are specified. Until an international standard is published, national or local codes or standards may apply.

5.2.3.2.7 Energy economy and heat retention

The general principles documented in 5.2.2.7 apply here also. No specific requirements. Until an international standard is published, national or local codes or standards may apply

5.2.3.2.8 Sustainable use of natural resources

The requirements identical to 5.2.2.8 are specified.

Table 3 – Summary of the building-related requirements from IEC 63092-1 for BIPV modules based on polymer waterproofing sheet or metal sheet

Application category based on Table 1	A	B	C	D	E
Mechanical resistance and durabilty	IEC 61215-1 IEC 61215-1-1 (if crystalline silicon), IEC 61215-1-2 (if CdTe), [2] IEC 61215-1-3 (if amorphous silicon), IEC 61215-1-4 (if Cu(In,Ga)(S,Se)) IEC 61215-2 IEC 61730-1, IEC 61730-2 IEC TS 63126 (if operating under high temperatures)				
Safety in case in fire	No requirements are specified				
Hygiene, health and the environment	No requirements are specified				
Safety and accessibility in use	IEC 61730-1, IEC 61730-2				
Protection against noise	No requirements are specified				
Energy economy and heat retention	No requirements are specified				
Sustainable use of natural resources	No requirements are specified				

Additionally, national or local codes or standards may apply.

5.2.3.3 Requirements for products based on other materials

BIPV modules based on other materials than those defined in 5.2.2, 5.2.3.1 and 5.2.3.2 have to comply with general requirements specified in 5.1 and 5.2. More specific requirements can be considered in future versions of this document.

6 Labelling

The BIPV module shall be labelled according to IEC 61215-1 and IEC 61730-1 or labelled to facilitate traceability to the label information as required by IEC 61215-1 and IEC 61730-1.

NOTE Traceability to the label information may be facilitated e.g. by use of a QR code.

7 Documentation and declaration of performance

7.1 Data sheet

The data sheet information for BIPV modules shall conform to IEC 61730-1 and IEC 61215-1.

The data sheet shall also include the information for international, regional or local product standards by building-related application according to Table 1, e.g. thermal transmittance (as per 5.2.2.7.3).

In addition, the data sheet shall state those application categories together with title or pictogram as defined in Clause 4 for which the BIPV modules are intended to be used (categories A to E in Table 1).

A copy of this report shall be kept by the manufacturer for reference purposes.

7.2 Further documentation

The documentation shall be prepared by following the guidelines given in IEC 61082-1 (diagrams) and IEC/IEEE 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 IEC 62446-1 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 ISO 12543-6. In addition, specifications concerning permissible misalignment and colour variation of solar cells are to be provided by the manufacturer.

8 Modifications (re-test guideline)

Changes in material selection, components and manufacturing process can impact the qualification of the modified product. Materials in direct contact with each other shall be tested in all applicable combinations unless equality with a previously tested and qualified combination can be proven.

Detailed retesting requirements are defined in IEC TS 62915. The recommended test sequences have been selected to identify adverse changes to the modified product.

The number of samples to be included in the retesting program and the pass/fail criteria are to be taken from the relevant clauses of this document.

Annex A
(normative)

Building-related requirements on BIPV modules with at least one glass pane

A.1 General

Annex A applies only to BIPV modules that contain at least one glass pane.

Glass standards conventionally consider glass as a transparent material which is not heated strongly when exposed to the sun. The effect of high temperatures which can be reached in BIPV modules is a complex topic and shall be taken into account as follows.

The BIPV module may be required to comply with national, regional or local standards or codes for design.

The temperature values given below should not be considered representative of all temperatures that can be reached in all conceivable buildings and locations. The intention of this annex is to provide temperature values for calculations related to mechanical requirements when no representative values are available.

A.2 Mechanical requirements

A.2.1 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 BIPV 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.

A.2.2 Rigidity of laminated glass containing a PV device:

When calculating the mechanical rigidity of a BIPV 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:

a) 85 °C shall be used as the upper limit for BIPV modules that form the front part of a thermal insulation panel;

b) 80 °C shall be used as the upper limit for BIPV modules that forms the front component of an insulating glass unit;

c) 65 °C shall be used as the upper limit for BIPV modules that do not contain any kind of rear-surface thermal insulation.

NOTE 1 The temperature of BIPV modules and thus of their interlayers may vary significantly, e.g. if the interlayer thickness is varied or a low emissivity coating is applied on the surface of the insulating glass unit that faces the unit's sealed cavity or ventilation is obstructed. This can be affected strongly by the system design.

NOTE 2 The temperature of 85 °C stated is not the highest temperature that a photovoltaic panel could experience during operation. However, the climatic load is the superposition of simultaneous thermal, wind and snow loads on the photovoltaic panel. The load combination, which in most cases leads to the highest load on the glass, results from the superposition of high thermal loads at high temperature induced by high irradiation in combination with high wind loads. The high wind loads result from high-speed wind which cools the PV panel. Thus, the temperature is lower than without wind and it is not necessary for the default temperature to be the highest possible.

A.2.3 BIPV modules and post-breakage integrity

When testing BIPV modules for post-breakage integrity:

a) the BIPV module temperature shall be 65 °C ± 2 °C for BIPV 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,

b) the BIPV module temperature shall be 22 °C ± 2 °C for BIPV 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.

Bibliography

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

CPR 305/2011, *Construction Products Regulation, European Union*

EN 13956, *Flexible sheets for waterproofing – Plastic and rubber sheets for roof water-proofing – Definitions and characteristics*

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*

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 50583-1, *Photovoltaics in buildings – BIPV modules*

NFRC 201, *Procedure for Interim Standard Test Method for Measuring the Solar Heat Gain Coefficient of Fenestration Systems Using Calorimetry Hot Box Methods*

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