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Glass in building — Laminated solar photovoltaic glass for use in buildings

Verre dans la construction — Verre feuilleté photovoltaïque pour utilisation dans les bâtiments

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 160, *Glass in building*, Subcommittee SC 1, *Product considerations*.

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Glass in building — Laminated solar photovoltaic glass for use in buildings

1 Scope

This document specifies requirements of appearance, durability and safety, test methods and designation for laminated solar photovoltaic (PV) glass for use in buildings.

This document is applicable to building-integrated photovoltaics (BIPV). Building attached PV (BAPV) may refer to this document.

This document is limited to building material, not including electrical performance.

This document needs to be combined with IEC standards (all electrical performances are covered by IEC 61215, IEC 61646 and IEC 61730).

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.

ISO 3290-1, *Rolling bearings — Balls — Part 1: Steel balls*

ISO 12543-2:2011, *Glass in building — Laminated glass and laminated safety glass — Part 2: Laminated safety glass*

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

ISO 12543-6:2011, *Glass in building — Laminated glass and laminated safety glass — Part 6: Appearance*

ISO/TS 29584, *Glass in building — Pendulum impact testing and classification of safety glass*

IEC 61215:2005, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval*

IEC 61646:2008, *Thin-film terrestrial photovoltaic (PV) modules — Design qualification and type approval*

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

EN 12150-1:2015, *Glass in building — Thermally toughened soda lime silicate safety glass — Part 1: Definition and description*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12543-1, ISO 12543-2, ISO 12543-3, ISO 12543-4, ISO 12543-5, ISO 12543-6, IEC/TS 61836 and 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
laminated solar PV glass**

laminated glass that integrates the function of photovoltaic power generation

Note 1 to entry: The term “laminated solar PV glass” covers both laminated glass (see ISO 12543-3) and laminated safety glass (see ISO 12543-2).

**3.2
interlayer**

one or more layers of material acting as an adhesive and separator between either plies of glass or between plies of glass and electrical components subject to be embedded by the interlayer

Note 1 to entry: Different interlayer materials may be combined within one PV composition.

EXAMPLE Electrical components such as solar cells, interconnectors, diodes, cables.

**3.3
termination**

component that extracts power from *laminated solar PV glass* (3.1)

**3.4
insulating strip**

material that is used for the insulating treatment of electric-circuit connection parts

**3.5
building-integrated photovoltaics
BIPV**

photovoltaic materials that are used to replace conventional building materials in parts of the building envelope

EXAMPLE The building envelope would comprise the roof, skylights, or facades.

**3.6
building-attached photovoltaics
BAPV**

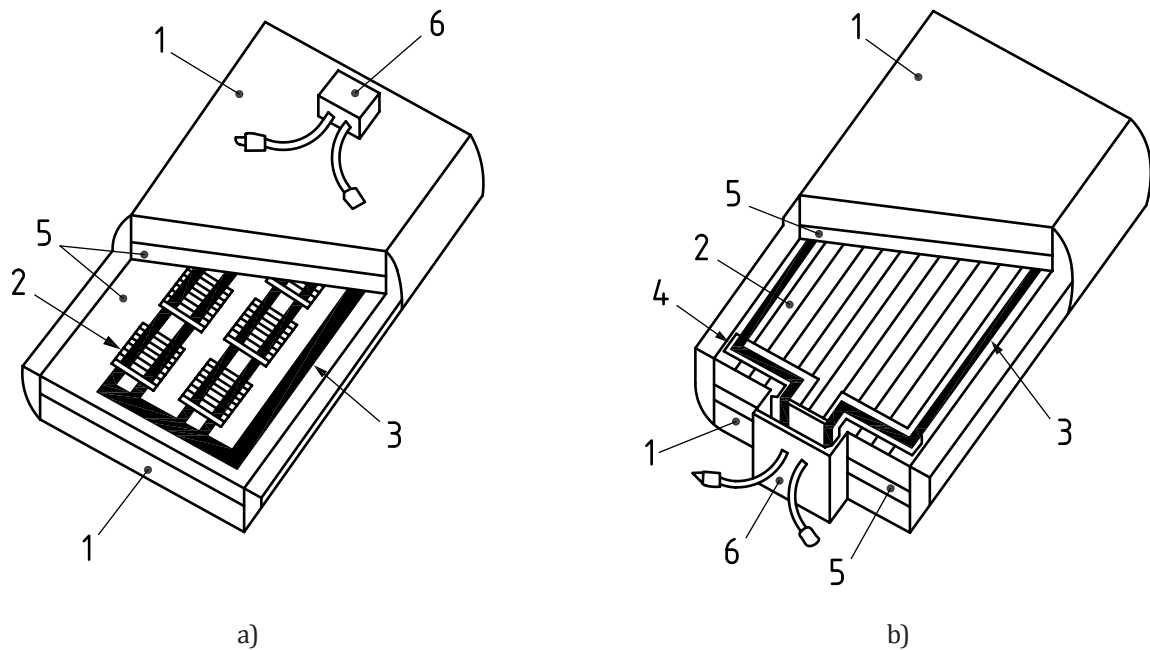
photovoltaic materials that are not used to replace conventional building materials in parts of the building but simply attached to the building

4 Description of components

4.1 General

Laminated solar PV glass shall be manufactured from the combinations of one or more sheets of glass, solar cell, interlayers, interconnector and termination. [Figure 1](#) shows examples of laminated solar PV glass for use in buildings.

NOTE Drawings are not to scale. The description of components in this clause is not exhaustive. Not all components need to be present.

**Key**

- 1 glass
- 2 solar cell (a: crystal silicon solar cell; b: thin-film solar cell)
- 3 interconnector
- 4 insulating strip
- 5 interlayer
- 6 termination

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Figure 1 — Example configurations of laminated solar PV glass in buildings

The glass, interlayer and other component materials are subject to standardization. If materials are not subject to standardization, they should be subject to the manufacturer's specification. These specifications are usually subject to the manufacturer's own quality procedure for factory production control or quality assurance system.

4.2 Types of glass

The type of glass used in laminated solar PV glass may be (see ISO 16293-1) as follows:

- float glass;
- patterned glass.

The glass may also be as follows:

- clear, tinted or coated;
- transparent, translucent or opaque;
- annealed, heat strengthened, tempered or chemically strengthened;
- surface-treated (e.g. by sandblast or acid etched).

The layer of glass that faces the sunlight directly shall be transparent.

NOTE Glass compositions and types are the subject of product standards.

4.3 Typical type of solar cells

Typical type of solar cells used in laminated glass may be as follows:

- crystal silicon solar cell;
- thin-film solar cell.

Typical types of thin film solar cell include but are not limited to the following:

- amorphous silicon (a-Si) or microcrystalline silicon (uc-Si);
- copper indium gallium selenide (CIGS), or copper zinc tin sulfide (CZTS);
- cadmium telluride (CdTe);
- dye-sensitized solar cell (DSSC or DSC);
- organic solar cell.

NOTE The terms, a-Si, uc-Si, CIGS, CZTS, CdTe, DSSC and DSC, are commonly used in the photovoltaic industry.

4.4 Interlayer

Typical type of interlayers are as follows:

- polyvinyl butyral (PVB);
- ethylene vinyl acetate (EVA);
- ionomer;
- silicone;
- liquid resin;
- olefin.

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4.5 Interconnector

Materials with suitable conductivity of electricity and suitable weldability or solderability, typical type of interconnector, such as copper and aluminium, should be selected and used.

4.6 Insulating strip

Polyethylene terephthalate (PET) and other materials with suitable electrical insulation should be selected and used to provide the sole insulation between a live part and an accessible metal part or between uninsulated live parts not of the same potential.

The strip should be of adequate thickness and of a material appropriate for the application, as given in IEC 61730-1.

4.7 Termination

Terminal consists of junction box (see IEC 62790), cable, connector and other parts.

5 Requirements

5.1 General

The requirements of laminated solar PV glass shall be in accordance with those listed in [Table 1](#).

Table 1 — Technical requirements and test methods

Item	Requirement	Test method
Appearance and dimensions	Appearance	7.1
	Dimensions and edge finishing	—
Durability	High-temperature test	7.2
	Damp heat test	7.3
	Radiation test	7.4
	Thermal cycling test	7.5
	Humidity freeze test	7.6
	Measurement of nominal operating cell temperature (NOCT)	7.7
	Hot-spot endurance test	7.8
Safety	Impact test	ISO/TS 29584
	Ball drop test	7.9
	Insulation test	7.10
	Wet leakage current test	7.11
	Robustness of terminations test	7.12

For curved or oversized laminated solar PV glass, the appearance, dimensions and technical requirements should be agreed with the manufacturer.

5.2 Appearance

5.2.1 Major visual defects

The following are considered to be major visual defects and shall not be permitted:

- broken, cracked, or torn external surfaces, including front glass, back glass, and terminations;
- bent or misaligned external surfaces, including superstrates, substrates, frames and junction boxes to the extent that the installation and/or operation of the module would be impaired;
- voids in, or visible corrosion of visible surfaces, extending over more than 10 % of any cell area;
- visible corrosion of output connections, interconnections and busbars;
- bubbles or delamination forming a continuous path between any part of the electrical circuit and the edge of the pane, or which exhibits significant growth during the testing and will, if testing is continued, reach such a condition;
- haze and cloudiness in the main area;
- creases and streaks introduced into interlayer in the main area;
- evidence of any molten, burned or broken solar cell, diode or active PV component;