
**Glass in building — Retesting
requirements for laminated solar
photovoltaic glass for use in buildings**

*Verre dans la construction — Exigences relatives aux contre-essais
pour le 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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This document was prepared by Technical Committee ISO/TC 160, *Glass in building*, Subcommittee SC 1, *Product considerations*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Glass in building — Retesting requirements for laminated solar photovoltaic glass for use in buildings

1 Scope

This document specifies requirements for retesting laminated solar photovoltaic (PV) glass for use in buildings.

This document applies to laminated solar PV glass.

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

ISO/TS 18178:2018, *Glass in building — Laminated solar photovoltaic glass for use in buildings*

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

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 Retesting criteria

4.1 Glass modifications

For glass modification, retesting shall be performed in accordance with [Table 1](#).

Table 1 — Parameters, changes and retesting items for glass

Parameters	Changes	Retesting item
Thickness	Decrease: >20 %	1) Appearance 2) Dimensions and edge finishing 3) High-temperature test 4) Hot-spot endurance test 5) Ball drop test 6) Impact test
	a) Increase, or b) Decrease: ≤20 %	Does not require retesting
Varieties	Toughened glass change to non-toughened glass	1) Impact test 2) ball drop test
	Enamelled glass change to non-enamelled glass or coated glass	1) Radiation test 2) High-temperature test 3) Thermal cycling test (200 cycles) 4) Damp heat test 5) Humidity freeze test
	Ordinary glass change to lower iron glass or patterned glass ^a	1) Radiation test 2) High-temperature test 3) Thermal cycling test (200 cycles) 4) Damp heat test 5) Humidity freeze test
	a) Non-toughened glass change to toughened glass, or b) Non-enamelled glass change to enamelled glass, or c) Lower iron glass or patterned glass change to ordinary glass	Does not require retesting

^a The light transmission of the glass is higher than the uncertainty of the measured glass value.

4.2 Solar cell modifications

4.2.1 Crystalline silicon solar cells

For modifications to crystalline silicon solar cells, retesting shall be performed in accordance with [Table 2](#).

Table 2 — Parameters, changes and retesting items for crystalline silicon solar cells

Parameters	Changes	Retesting items
Thickness	Decrease: $\geq 10\%$	1) Appearance 2) Hot-spot endurance test 3) Impact test
	a) Increase, or b) Decrease: $< 10\%$	Does not require retesting
Size	Increase: $\geq 10\%$	1) Appearance 2) Thermal cycling test (200 cycles) 3) Hot-spot endurance test 4) Impact test
	a) Decrease, or b) Increase: $< 10\%$	Does not require retesting
Cell surface	Treatment	1) Appearance 2) Hot-spot endurance test 3) Damp heat test 4) High-temperature test
Density ^a	Increase: $\geq 20\%$ and $< 50\%$	1) Appearance 2) Hot-spot endurance test
	Decrease or increase: $< 20\%$	Does not require retesting
	Increase: $\geq 50\%$	All testing items ^b
Cell type	Changes between monocrystalline silicon and polycrystalline silicon	All testing items ^b
^a Percentage of solar cells per unit area. ^b Under this condition, the module shall be considered as a new product and subjected to all the testing items in accordance with ISO/TS 18178.		

4.2.2 Thin-film solar cells

For modifications to thin-film solar cells, retesting shall be performed in accordance with [Table 3](#).

Table 3 — Parameters, changes and retesting items for thin-film solar cells

Parameters	Changes	Retesting items
Substrate material	Thickness decrease	1) Appearance 2) Ball drop test 3) Impact test 4) Damp heat test 5) High-temperature test 6) Humidity freeze test
	Thickness increase	Does not require retesting
	Material type	All testing items ^a
Thin-film material	Material type	All testing items ^a
^a Under this condition, the module shall be considered as a new product and subjected to all the testing items in accordance with ISO/TS 18178.		

4.3 Interlayer modifications

For interlayer modifications, retesting shall be performed in accordance with [Table 4](#).

Table 4 — Parameters, changes and retesting items for interlayer

Parameters	Changes	Retesting items
Thickness	Decrease: $\geq 0,38$ mm	1) Appearance 2) High temperature test 3) Damp heat test 4) Radiation test 5) Thermal cycling test (200 cycles) 6) Humidity freeze test 7) Insulation test 8) Wet leakage current test 9) Ball drop test 10) Impact test
	a) Increase, or b) Decrease: $< 0,38$ mm	Does not require retesting
Material	The chemical composition of the interlayer changes such as polyolefin elastomer (POE) and polyvinyl butyral (PVB) and vice versa.	All testing items ^a
^a Under this condition, the module shall be considered as a new product and subjected to all the testing items in accordance with ISO/TS 18178.		

4.4 Interconnector modifications

For interconnector modification, retesting shall be performed in accordance with [Table 5](#).

Table 5 — Parameters, changes and retesting items for interconnector

Parameters	Changes	Retesting items
Thickness	Decrease: $\geq 10\%$	1) Appearance 2) Thermal cycling test (200 cycles) 3) Humidity freeze test 4) High temperature test
	a) Increase, or b) Decrease: $< 10\%$	Does not require retesting
Width	Decrease: $\geq 20\%$	1) Appearance; 2) Thermal cycling test (200 cycles) 3) Humidity freeze test
	a) Increase, or b) Decrease: $< 20\%$	Does not require retesting
Material	Chemical composition material change	1) Appearance 2) Insulation test 3) Wet leakage current test 4) Thermal cycling test (200 cycles) 5) Damp heat test 6) Hot-spot endurance test
Connection method	a) Series and parallel connection exchange, or b) Weld and glue vice versa, or c) Change in position from front to back or side and vice versa	1) Appearance 2) Insulation test 3) Wet leakage current test 4) Hot-spot endurance test

4.5 Insulating strip modifications

For modifications to insulating strips, retesting shall be performed in accordance with [Table 6](#).

Table 6 — Parameters, change and retesting items for insulating strip

Parameters	Changes	Retesting items
Thickness	Decrease: $\geq 20\%$	1) Appearance 2) Thermal cycling test (200 cycles) 3) Humidity freeze test 4) Insulation test 5) Wet leakage current test
	a) Increase, or b) Decrease: $< 20\%$	Does not require retesting
Material	Material change	1) Appearance 2) Radiation test 3) Thermal cycling test (200 cycles) 4) Humidity freeze test 5) Insulation test 6) Wet leakage current test 7) Hot spot endurance test 8) Damp heat test

4.6 Termination modifications

For termination modification, retesting shall be performed in accordance with [Table 7](#).

Table 7 — Parameters, changes and retesting items for termination

Parameters	Changes	Retesting items
Design	Structure changes affecting sealing (including dimension, position, number of JB)	1) Damp heat test 2) Insulation test 3) Wet leakage current test 4) Robustness of terminations test
	Structure changes not affecting sealing	Does not require retesting
Material	Degradation of material electrical insulation performance ^a	1) Damp heat test 2) Insulation test 3) Wet leakage current test 4) Robustness of terminations test 5) Humidity freeze test
	Improvement of material electrical insulation performance ^a	Does not require retesting
Potting material	Potting material change (different type of material)	1) Damp heat test 2) Insulation test 3) Wet leakage current test 4) Robustness of terminations test 5) Humidity freeze test 6) Thermal cycling test (200 cycles)

^a The material electrical insulation performance can be evaluated by measurement.

5 Testing requirements

5.1 Appearance

The test method shall be performed according to the test method given in ISO/TS 18178:2018, 7.2, and the test result shall be in accordance with ISO/TS 18178:2018, 5.2.

5.2 Dimensions and edge finishing

The test method shall be performed according to the test method given in ISO 12543-5, and the test result shall be in accordance with ISO/TS 18178:2018, 5.3.

5.3 High temperature test

The test method shall be performed according to the test method given in ISO/TS 18178:2018, 7.3, and the test result requirement shall be in accordance with ISO/TS 18178:2018, 5.4.

5.4 Damp heat test

The test method shall be performed according to the test method given ISO/TS 18178:2018, 7.4, and the test result requirement shall be in accordance with ISO/TS 18178:2018, 5.5.

5.5 Radiation test

The test method shall be performed according to the test method given in ISO/TS 18178:2018, 7.5, and the test result shall be in accordance with ISO/TS 18178:2018, 5.6.

5.6 Thermal cycling test

The test method shall be performed according to the test method given in ISO/TS 18178:2018, 7.6, and the test result shall be in accordance with ISO/TS 18178:2018, 5.7.

5.7 Humidity freeze test

The test method shall be performed according to the test method given in ISO/TS 18178:2018, 7.7, and the test result shall be in accordance with ISO/TS 18178:2018, 5.8.

5.8 Hot-spot endurance test

The test method shall be performed according to the test method given in ISO/TS 18178:2018, 7.9, and the test result shall be in accordance with ISO/TS 18178:2018, 5.10.

5.9 Impact test

The test method shall be performed according to the test method given in ISO 29584, and the test result shall be in accordance with ISO/TS 18178:2018, 5.11.

5.10 Ball drop test

The test method shall be performed according to the test method given in ISO/TS 18178:2018, 7.10, and the test result shall be in accordance with ISO/TS 18178:2018, 5.12.

5.11 Insulation test

The test method shall be performed according to the test method given in ISO/TS 18178:2018, 7.11, and the test result shall be in accordance with ISO/TS 18178:2018, 5.13.