INTERNATIONAL STANDARD

ISO 20492-4

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Glass in buildings — Insulating glass —

Part 4: Methods of test for the physical attributes of edge seals

Verre dans la construction — Verre isolant —

Partie 4: Méthodes d'essai pour les caractéristiques physiques des joints d'assemblage

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 20492-4 was prepared by Technical Committee ISO/TC 160, *Glass in building*, Subcommittee SC 1, *Product considerations*.

ISO 20492 consists of the following parts, under the general title *Glass in buildings — Insulating glass*:

— *Part 1: Durability of edge seals by climate tests*

— *Part 2: Chemical fogging tests*

— *Part 3: Gas concentration and gas leakage*

— *Part 4: Methods of test for the physical attributes of edge seals*

Introduction

This International Standard consists of a series of procedures for testing the performance of pre-assembled, permanently sealed insulating glass units or insulating glass units with capillary tubes that have been intentionally left open. This International Standard is intended to help ensure that

— energy savings are made, as the U value and solar factor (solar heat gain coefficient) do not change significantly;

— health is preserved, because sound reduction and vision do not change significantly;

— safety is provided because mechanical resistance does not change significantly.

This International Standard also covers additional characteristics that are important to the trade, and marking of the product (i.e. CE marking or other regulatory groups).

There are distinct markets to consider for insulating glass. Within each market there are technical differences with respect to rebate sizes, vision lines and methods of application; two approaches are included in this International Standard. Approach 1 addresses requirements for markets such as North America. Approach 2 addresses requirements for markets such as Europe. Each approach includes separate test methods and specifications pertaining to minimum requirements for durability of edge seals by climate tests.

This International Standard does not cover physical requirements of sealed glass insulating units such as appearance, thermo-physical properties, heat and light transmission, and glass displacement.

The main intended uses of the insulating glass units are installations in buildings and constructions such as in windows, doors, curtain walling, skylights, roofs and partitions where protection against direct ultraviolet radiation exists at the edges.

The use of insulating glass in cases where there is no protection against direct ultraviolet radiation at the edges, such as structural glazing systems, can be suitable. However, it can be necessary to review factors such as sealant longevity when exposed to long-term ultraviolet light and the structural properties of the sealant for these applications.

NOTE 1 For more information on the requirements for structural sealant glazing applications, reference can be made to ASTM C1369, ASTM C1249 and ASTM C1265 and CEN technical specifications.

NOTE 2 IG units whose function is artistic only are not part of this International Standard.

The test methods in this International Standard are intended to provide a means for testing the performance of the sealing system and construction of sealed insulating glass units.

Sealed insulating glass units tested in accordance with these methods are not intended for long-term immersion in water.

The options for testing apply only to sealed insulating glass units that are constructed with glass.

In certain cases such as insulating glass units containing spandrel glass or absorptive coatings, these methods might not be applicable, as these products can experience field temperatures that exceed the temperature limitations of the sealant.

Glass in buildings — Insulating glass —

Part 4:
Methods of test for the physical attributes of edge seals

1 Scope

This part of ISO 20492 specifies methods for testing the edge seal strength, and partially testing the moisture and gas permeation through sealants, of glass insulating units. Other parts of ISO 20492 designate two approaches to the standardization of insulating glass units: approach 1 is intended for use in markets such as North America; and approach 2 is intended for use in markets such as Europe.

The methods in this part of ISO 20492 are applicable only to approach 2, as defined and used in the other parts of ISO 20492.

In cases where there is no protection against direct ultraviolet radiation at the edges, such as structural sealant glazing systems, it is necessary that additional European technical specifications be followed. See References [4] and [5].

2 Normative references

The following referenced documents are indispensable for the application 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 20492-1, *Glass in building — Insulating glass — Part 1: Durability of edge seals by climate tests*

ISO 20492-3, *Glass in building — Insulating glass — Part 3: Gas concentration and gas leakage*

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

EN 1096 (all parts), *Glass in building — Coated glass*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 20492-1 and the following apply.

3.1.1
moisture vapour transmission rate
steady moisture vapour flow in unit time through unit area of a body, normal to specific parallel surfaces, under specific conditions of temperature and humidity at each surface

3.1.2
standard room conditions
ambient temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) % relative humidity

3.2 Symbols

For the purpose of this document, the symbols given in ISO 20492-1 and the following apply.

ε extension of bond expressed as a percent

σ stress applied to the bond during extension

θ moisture vapour transmission rate

ΔP_{H_2O} difference in water vapour pressure across a membrane

4 Requirements

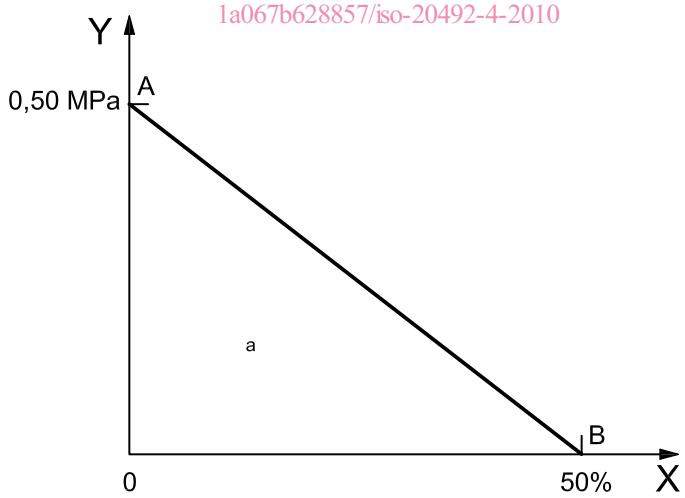
4.1 Edge seal strength

All edge seals shall have sufficient adhesive and cohesive strength to allow the extension of seals such that any rupture of the seal occurs outside the area 0AB of Figure 1.

If, during the strength test of the glass-sealant-glass joint, as seen from the side view, loss of adhesion or cohesion extends through the whole depth of the sealant within the area 0AB of Figure 1, then the sealant test specimen has failed (see Figure 2). The principle of light transmission through the defect can be applied to determine pass or failure.

Breakage of the glass during testing does not constitute failure, providing that a sufficient number of joints is tested in order that a successful average result can be obtained.

For comparisons of the seal strength required for substituting sealants, see Annex B.



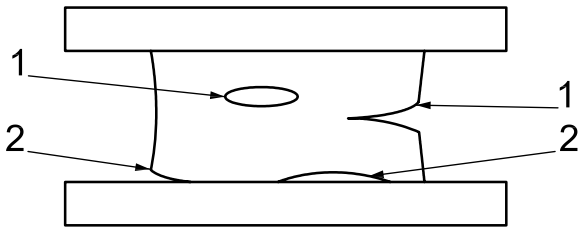
Key

X strain in the sealant, ε

Y stress in the sealant, σ

[a] No breakage is allowed before and after ageing in area 0AB.

Figure 1 — Stress/strain triangle



Key

1 loss of cohesion

2 loss of adhesion

Figure 2 — Illustration of the extension of loss of adhesion or cohesion through the whole depth

4.2 Compliance with the definition of insulating glass units

4.2.1 General

A test report shall be available of the concerned insulating glass outer sealant according to Clause 6 (which summarizes the test report in which the edge seal strength is recorded) with a moisture penetration test report in accordance with ISO 20492-1 and, in case of gas-filled units, also with a gas leakage rate report in accordance with ISO 20492-3, and fulfils the requirement to demonstrate the conformity with the definition of insulating glass units.

In the case of sealing the insulating glass unit with a coating that is not intended to be stripped in accordance with EN 1096 (all parts), a test report in accordance with Annex D shall be made available for inclusion in with the other test reports.

NOTE Although only clear float glass is referred to in this part of ISO 10492, it is the responsibility of the insulating glass manufacturer to ensure that the edge sealant is capable of bonding to all glasses that are used. The requirements for the use of coated glasses in accordance with EN 1096 (all parts) are detailed in Annex D.

4.2.2 Possibility to substitute the sealant

4.2.2.1 Limits of application

The possibility of substituting for the sealant is applicable only in the case of insulating glass units with a hollow metal spacer. For other systems, no experience is available for setting up the substitution rules.

4.2.2.2 Air-filled insulating glass units

Available test reports in accordance with Clause 6 allow for the substitution of the sealant without repeated moisture penetration testing in accordance with ISO 20492-1 in the following cases.

a) For units with an I value below 0,1, the substituting sealant

- shall be applicable with the same production equipment,
- has been previously applied in insulating glass units that have been demonstrated to comply with ISO 20492-1; the demonstrated compliance may have been obtained separately using units of different construction and, therefore, the test report numbers may vary,
- has a moisture vapour transmission rate that is not more than 20 % higher than that of the initial sealant,

— has a stress/strain curve comparison that satisfies the requirement in Annex B,

— shall have the relevant parts of the factory production control (periodic test, mixing ratio, hardness test, etc.) carried out.

b) For units with an I value between 0,1 and 0,2, the list under a) applies however with the exception that the moisture vapour transmission rate through membrane of the substitute sealant shall be the same or lower than the initial sealant.

4.2.2.3 Gas-filled insulating glass units

Available test reports in accordance with Clause 6 allow the substitution of the sealant without repeated gas loss rate testing according to ISO 20492-3 in the following cases.

a) For units with a gas loss rate, L_i, below 0,8 % a^{-1}, the substituting sealant

— is allowed for limiting the moisture vapour penetration in accordance with 4.2.2.2,

— has been previously applied in insulating glass units that have been demonstrated to comply with ISO 20492-3; the demonstrated compliance may have been obtained separately using units of different construction and, therefore, the test report numbers may vary,

— has a gas permeation that is not more than 20 % higher than that of the initial sealant.

For units with a gas loss rate, L_i, between 0,8 % a^{-1} and 1,0 % a^{-1}, the list under a) applies, however with the exception that the gas permeation of the substitute sealant shall be the same or lower than the initial sealant.

4.2.3 Possibility of substitute the coated glass, coatings not intended to be removed

Available test reports in accordance with Annex D allow for the substitution of the coated glasses in accordance with EN 1096 (all parts) when the coating is not intended to be stripped from the area where the insulating glass is sealed without repeated moisture penetration testing according to ISO 20492-1 and, in case of gas-filled units, without repeated gas loss rate testing in accordance with ISO 20492-3, when the provisions set out in Annex D are followed.

5 Test methods

5.1 Adhesion

5.1.1 Principle

The test consists of preparing a number of glass-sealant-glass joints, some of which are unaged and some are subjecting to ageing regimes as outlined in 5.1.3 before testing under tensile load.

The test specimen shapes and bond preparations shall be as specified in Annex A. For insulating glass units with systems that cannot apply Annex A, the test specimen shall be 50 mm cut from the edge seal of an insulating glass unit. The shape of the samples shall be as similar as possible. Their cross-sections shall have a cross-section as near as possible to the test specimen described in Annex A. The number of joints is seven per exposure condition.

After manufacturing, ageing where relevant and conditioning for 24 h to 48 h at standard room conditions, the test specimens shall be measured accurately for width, depth and height prior to being placed in an extensiometer with an accuracy equal to or better than 2 %.

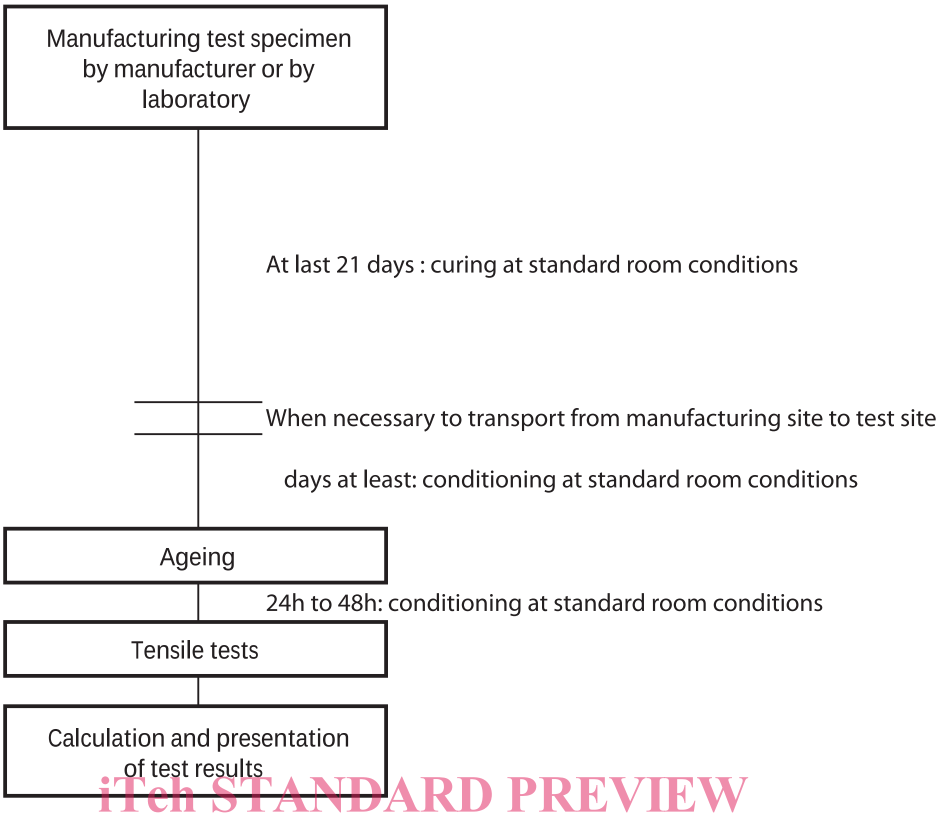


Figure 3 — Schematic presentation of test order for adhesion — Flow from top to bottom

The speed of separation is in case of polymer-based edge sealants (5 ± 0,25) mm/min, and in case of metallic edge seals (12,5 ± 0,5) mm/min. See Figure 3 for the schematic presentation of the order of the preparation and tests.

Where the glass continuously breaks, a bond stiffener can be bonded to the glass immediately prior to testing but after ageing. Stiffening can be accomplished by the addition of a second piece of glass or other material bonded, for example, with a cyanoacrylate adhesive.

5.1.2 Calculation of stress and expression of results

The stresses are calculated from the mean of the contact areas between the sealant and the glass in one test specimen. In case of metal seal, the contact area is fixed on 100 mm^2 (see Figure A.2).

The results are expressed as the average values of the stress and strain when the stress/strain curves cross the line AB of Figure 1. The highest and lowest values are ignored so that the average values are calculated on the five remaining measured stress and strain values.

5.1.3 Procedures

5.1.3.1 Initial cure test

After initial cure (see Annex A) and conditioning at standard room conditions of at least seven days, seven test specimens not subjected to any ageing regime are subjected to tensile load.

5.1.3.2 Heat exposure

After initial cure and conditioning at standard room conditions of at least seven days, the seven test specimens for heat ageing shall be aged in a closed oven at (60 ± 2) °C for (168 ± 5) h. Where the sealant shows plastic flow at 60 °C, the spacers shall be retained between the two glass pieces to prevent bond deformation.

5.1.3.3 Water immersion

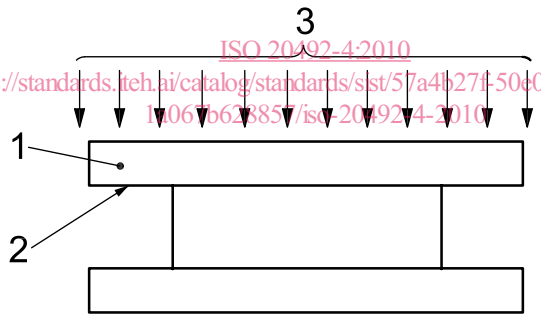
After initial cure and conditioning at standard room conditions of at least seven days, all seven test specimens for water immersion shall be immersed in 1 l to 2 l of distilled or deionized water for (168 ± 5) h, at standard room condition. Fresh new water shall be used for each test. The conductance of the fresh water shall be equal to or less than 30 µS.

5.1.3.4 UV exposure

After initial cure and conditioning at standard room conditions of at least seven days, seven test specimens for UV exposure shall be subject (96 ± 4) h to UV irradiation, which shall be perpendicular to the glass at an intensity in the UVA range in accordance with ISO 9050 of (40 ± 5) W/m^2. Refer to Figure 3 for the radiation orientation and to Annex F for an example of a UV radiation source.

The height of the UV source shall be adjusted to ensure all joint assemblies are subjected to the minimum intensity.

The irradiation intensity shall be measured at the beginning and end of each test. When the minimum irradiation can no longer be achieved, a new UV source shall be installed.



Key

1 clear float glass
2 tested surface, which can be coated
3 ultraviolet radiation

Figure 4 — Orientation of the surface being tested to the ultraviolet radiation

5.2 Moisture vapour transmission rate

5.2.1 General

The information on the moisture vapour transmission rate is requested only when sealant comparisons are made for the purpose of change.

5.2.2 Principle

The moisture vapour transmission rate, θ, when determined, shall be measured on a 2 mm thick film as outlined in 5.2.3.