INTERNATIONAL STANDARD

ISO 20492-3

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Glass in buildings — Insulating glass —

Part 3:
Gas concentration and gas leakage

Verre dans la construction — Verre isolant —

Partie 3: Concentration de gaz et fuite de gaz

Reference number
ISO 20492-3:2010(E)

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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 20492-3 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 3:
Gas concentration and gas leakage

1 Scope

This part of ISO 20492 specifies two methods of test for insulating glass units, including a determination of the gas leakage rate and a determination of gas concentration tolerances. The two methods designated as approach 1, which is intended for use in markets such as North America, and approach 2, which is intended for use in markets such as Europe.

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 16293-1, *Glass in building — Basic soda lime silicate glass products — Part 1: Definitions and general physical and mechanical properties*

ISO 20492-1, *Glass in building — Insulating glass —Part 1: Durability of edge seals by climate tests*

ISO 20492-4, *Glass in building — Insulating glass —Part 4: Methods of test for the physical attributes of edge seals*

EN 1279-6:2002, *Glass in building — Insulating glass units — Part 6: Factory production control and periodic tests*

ASTM C1036, *Standard Specification for Flat Glass*

3 Terms and definitions

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

3.1
standard laboratory conditions
ambient temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %

3.2
controlled limit environment conditions
environment temperature of 10 °C with a dew point temperature of –5 °C, giving a relative humidity of 32,8 %

3.3
accuracy
precision of the test method within confidence limits of 99 %

3.4
sealed insulating glass unit
pre-assembled unit, comprising lites (panes) of glass that are sealed at the edges and separated by dehydrated space(s), intended for vision areas of buildings

NOTE The unit is normally used for windows, window walls, picture windows, sliding doors, patio doors, or other types of fenestration.

3.5
gas-filled insulating glass units
sealed insulating glass unit in which the cavity contains gas(es) in addition to air, usually for improving thermal and/or sound insulation

3.6
reference standard mixtures
gas mixtures that contain known percentages of argon, oxygen and nitrogen that are required for calibration purposes

NOTE Where gases other than argon are used the reference samples shall contain those gases. The concentrations of each component in the reference samples should encompass the expected concentration range of the corresponding component in the tested samples. The suitable standard mixtures can be obtained with a certificate of analysis of each mixture from a reputable commercial supplier.

3.7
gas concentration
c_i
volume of gas i in the cavity

NOTE Gas concentration is expressed in units of volume percentage.

3.8
nominal gas concentration
$c_{i,\mathrm{o}}$
nominal volume of gas i in the cavity

NOTE 1 The nominal gas concentration is used as the basis for testing sound insulation and/or calculating or testing thermal insulation to fix R_W and the U value, respectively.

NOTE 2 Nominal gas concentration is expressed in units of volume percentage.

3.9
final gas concentration
$c_{i,\mathrm{f}}$
estimated final volume of gas i in the cavity

NOTE 1 The final gas concentration is expressed in units of volume percentage.

NOTE 2 See Annex B.

3.10
gas leakage rate
L_i
volume of gas i leaking from a gas-filled unit per year

NOTE The gas leakage rate is expressed in units of volume percentage per year.

3.11
U value for publication
U_p
thermal transmittance value to be published, normally determined from the gas concentration $c_{i,o}$

NOTE See ISO 10292 and Annex B.

3.12
sound insulation measure for publication
$R_{w,p}(C/C_{tr})$
weighted sound reduction index that is published, normally determined with the gas concentration

4 Requirements

4.1 Approach 1

If the specimen is filled with argon, the average minimum fill of eight argon-filled specimens shall be 90 % when tested in accordance with 5.1.

4.2 Approach 2

4.2.1 Gas leakage rate

The gas leakage rate, L_i, expressed as a percent per year, for gases with concentrations higher than 15 %, and also for air, measured in accordance with 5.2 shall be as given in Equation (1):

$$L_i < 1{,}00 \tag{1}$$

For most insulating glass units, measured L_i values are much higher than actual L_i values would be after 10 years natural ageing. Therefore, the limiting value should not be used for calculating the gas concentration during the lifetime of the unit. See Annex C.

In the case of sealants based on polysulfide, polyurethane, silicone or polyisobutylene, determining the gas leakage rate of argon, Ar, may replace the measurement of the gas leakage rate for sulfurhexafluoride, SF_6, and air.

4.2.2 Tolerances on gas concentration

Tolerances on gas concentration shall be determined in accordance with EN 1279-6:2002, Annex A.3.

4.2.3 Dew-point and moisture-penetration indices

Dew-point and moisture penetration shall be determined in accordance with ISO 20492-1.

4.2.4 Edge-seal strength

Edge-seal strength shall be determined in accordance with ISO 20492-4.

4.2.5 Additional requirements for gases other than argon, sulfurhexafluoride and air

These requirements shall be determined in accordance with Annex B.

5 Principle

5.1 Approach 1

Argon, nitrogen and oxygen are physically separated by gas chromatography and compared to corresponding components separated under similar conditions from a reference standard mixture or a mixture of known similar composition.

5.2 Approach 2

The gas leakage rate at 20 °C is measured after subjecting the test specimen to a climate as specified in ISO 20492-1 with the following modifications.

— The number of cycles is reduced to 28.

— The time at a constant temperature of 58 °C is reduced to 4 weeks.

For measuring the gas leakage rate, the unit is placed in a gastight container and, after a given time, the amount of gas that has leaked from the unit is measured. After this measurement, the gas concentration in the unit is analysed and the gas leakage rate calculated.

6 Apparatus

6.1 Approach 1

6.1.1 Gas chromatograph

The gas chromatograph is comprised of a gas sampling valve with a capacity of 100 µL to 250 µL, an adsorption column that is capable of separating argon from other gases, a detector and an integrator. Chromatograms shall be reproducible so that successive runs of a reference standard agree on each component peak area within ±0,1 %.

NOTE An example of a detector is a thermal conductivity detector (TCD).

6.2 Approach 2

6.2.1 Climate exposure

The climate exposure should be as specified in ISO 20492-1.

6.2.2 Container for gas leakage rate measurement

A controlled temperature container shall be used for measuring the gas leakage rate. It shall be hermetically sealable, and capable of surrounding the test specimen while inducing as little stress as possible on the specimen. The residual volume in the container shall be as small as possible yet still allow the exposure of the sealed edge zones of the specimen to the circulation of purging gas.

The quantity of ambient air penetrating into the container from outside or the quantity of each constituent leaking from the container shall be measured in a blank test using a solid glass body of approximately the same dimensions as the test specimens.

The container shall be deemed to have an adequate degree of tightness if the quantity of gas measured during the test does not exceed 10 % of the mass of gas leaking from the test specimen.

The container shall have fittings for introducing specific gases and for taking gas specimens.

For test specimens with at least one outer pane made of organic material, it shall be ensured that the gas diffusion through this (these) pane(s) is included in the measurement.

6.2.3 Gas analysis equipment

Gas analysis equipment should be capable of the following:

a) analysis of the gaseous constituents essential to the insulation function of the glass unit, for concentrations of 50×10^{-6};

b) determination of percentages by volume of gas of up to 100 % within ±3 % (relative).

These tasks shall not necessarily be performed using the same equipment.

6.2.4 Gas sampling device

A gas sampling device used for taking gas specimens from the glass unit, ensuring that the result is not distorted by ingress of air, segregation phenomena, etc.

7 Reagents and materials

7.1 Approach 1

7.1.1 Helium carrier gas cylinder, analytical grade with a purity of 99,9 %.

7.1.2 Compressed air cylinder, for valve actuation.

7.1.3 Liquid CO_2 or N_2 cylinder, with dip tube, or **refrigeration system**, for cooling the column oven if using a column that requires sub-ambient temperatures for operation.

7.1.4 10 ml **gas-tight syringe(s)**, with closure valve and side port needle(s).

7.2 Approach 2

Reagents shall be chosen as needed to meet the requirements in 6.2.3.

8 Test specimens

8.1 Approach 1

Each test specimen shall measure (355 ± 6) mm by (505 ± 6) mm, and shall be composed of two or three panes of clear, tinted or coated annealed, heat-strengthened, tempered or laminated glass.

The double-glazed test specimens shall be fabricated with at least one pane of clear, uncoated glass. The triple glazed test specimens shall be fabricated with at least one outer pane of clear, uncoated glass. The other outer pane shall be fabricated with a glass that allows easy viewing of the frost point.

The glass and airspace thicknesses for qualification under this part of ISO 20492 are 4 mm glass with 12 mm airspace or 5 mm glass with 6 mm airspace.

Glass and/or airspace thickness(es) may be increased e.g. using 6 mm glass with 12 mm airspace. This can result in a more rigorous test.

For triple pane units, 4 mm glass with 6 mm airspaces shall be used.

Tolerance of glass thickness shall be in accordance with ASTM C1036.

Airspace tolerance(s) shall be ±0,8 mm.

A minimum of eight specimens shall be submitted for testing. Extra specimens should be considered in case of breakage.

Triple-pane units where the intermediate airspace divider is a plastic film shall be acceptable.

Each specimen shall be permanently and legibly marked with the designation of the manufacturer, the date of fabrication (month or quarter and year) and orientation intended in the field (for units constructed with coated glass).

During all stages of exposure and storage, hold the units in a vertical position with equal support to all panes and no compression loading.

Select units for testing at random except for units damaged in transit. Do not test damaged units.

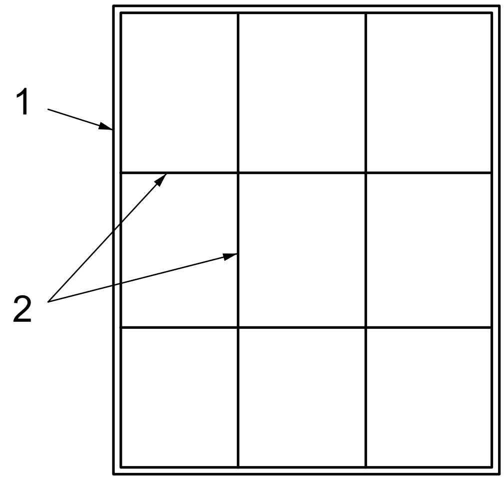
The test specimens representing units that are gas filled shall be fabricated using the same hole sealing and gas filling techniques as those used for manufacturing. For example, if a gas-filling plug is used in manufacturing then it shall be used in the test units.

It is not allowed to test the specimens representing units that include tubes.

Test specimens representing units that include muntins shall be fabricated with muntins dividing the sample into nine equal areas (3 by 3).

NOTE See Figure 1.

It is recommended that the test specimens be sealed a minimum of four weeks after the date of manufacture before testing begins to allow for stabilization. This is at the discretion of the manufacturer.



Key

1 insulation glass unit

2 muntin bars

Figure 1 — Test specimen with muntin bars