SLOVENSKI STANDARD
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Steklo v gradbeništvu - Izolacijsko steklo - 3. del: Dolgoročna preskusna metoda ter zahteve za stopnjo uhajanja plina in tolerance koncentracije plina

Glass in building - Insulating glass units - Part 3: Long term test method and requirements for gas leakage rate and for gas concentration tolerances

Glas im Bauwesen - Mehrscheiben-Isolierglas - Teil 3: Langzeitprüfverfahren und Anforderungen bezüglich Gasverlustrate und Grenzabweichungen für die Gaskonzentration

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Verre dans la construction - Vitrage isolant préfabriqué scellé - Partie 3 : Méthode d'essai à long terme pour le débit de fuite et prescriptions pour les tolérances de concentration en gaz

Ta slovenski standard je istoveten z: **EN 1279-3:2018**

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EUROPEAN STANDARD

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Glass in building - Insulating glass units - Part 3: Long term test method and requirements for gas leakage rate and for gas concentration tolerances

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European foreword

This document (EN 1279-3:2018) has been prepared by Technical Committee CEN/TC 129 “Glass in building”, the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2019 and conflicting national standards shall be withdrawn at the latest by January 2019.

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

This document supersedes EN 1279-3:2002.

The main changes compared to the previous edition EN 1279-3:2002 are:

a) the standard has been fully technically and editorially revised;

b) the scope has been changed;

c) Terms and definitions and symbols have been split into two clauses;

d) requirement for gas leakage rate has been significantly changed;

e) the test method of this standard is also applicable to triple glazing units;

f) gas leakage rate can be determined after ageing a minimum two and a maximum four test specimens. Durability of gas and interaction with IGU components has been added to requirements;

g) precision of the test method has been moved to A.4.8 and updated following a new inter-laboratory test performed in 2009;

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h) "Test report" has been revised adding a full description of the test specimen;

i) “Requirements for other gases” has been changed and moved to EN 1279-5:2018, Annex B: “Effect of gas filling on U and Rw”.

j) “Gas leakage rate by gas chromatography” is now Annex A;

k) exchange criteria for gases are given in EN 1279-1:2018, Annex D.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This document is part of the series EN 1279 “Glass in building - Insulating glass units” which consists of the following parts:

— *Part 1: Generalities, system description, rules for substitution, tolerances and visual quality;*

— *Part 2: Long term test method and requirements for moisture penetration;*

— *Part 3: Long term test method and requirements for gas leakage rate and for gas concentration tolerances;*

— *Part 4: Methods of test for the physical attributes of edge seal components and inserts;*

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— *Part 5: Product standard;*

— *Part 6: Factory production control and periodic tests.*

These parts are inextricably bound up with each other.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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1 Scope

This European Standard describes the test method for the determination of gas leakage rate and specifies the requirements for limit values for gas leakage rate and gas concentration for gas filled insulating glass units made

a) in accordance with EN 1279-1:2018 and manufactured to EN 1279-6:2018, or

b) for the purpose to demonstrate that components (e.g. edge seals or spacers) will allow the insulating glass unit to conform to the requirements given in EN 1279-1:2018, Clause 6.

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.

EN 673, *Glass in building - Determination of thermal transmittance (U value) - Calculation method*

EN 1279-1:2018, *Glass in building - Insulating glass units - Part 1: Generalities, system description, rules for substitution, tolerances and visual quality*

EN 1279-2:2018, *Glass in building - Insulating glass units - Part 2: Long term test method and requirements for moisture penetration*

EN 1279-6:2018, *Glass in building - Insulating glass units - Part 6: Factory production control and periodic tests*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1279-1:2018 apply.

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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

4 Symbols and abbreviations

Symbol	Characteristic	Unit
c_i	concentration of gas i determined in accordance with 6.3.4	%
$c_{i,o}$	nominal value for a system of insulating glass and gas *i* which is the basis for testing sound insulation and/or calculating or testing thermal insulation to fix the respective R_w and *U*-value	%
m_i	mass of gas that has leaked from a gas-filled unit in a given time	µg/h
L_i	gas leakage rate	%·a^{-1}
$L_{i,max}$	maximum gas leakage rate from all tested specimens	%·a^{-1}
$L_{i,av}$	average gas leakage rate for all tested specimens	%·a^{-1}
P	absolute atmospheric pressure at which the unit was sealed	hPa

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Symbol	Characteristic	Unit
P_0	atmospheric pressure at which ρ_0 was determined	hPa
T	temperature at which unit was sealed	K
T_0	temperature at which ρ_0 was determined	K
V_{int}	internal volume of the test specimen according to 6.3.1	in mm^3
$\rho_{0,i}$	density of gas i at temperature T_0 and pressure P_0	in $\mu g/mm^3$

5 Requirements

5.1 Gas leakage rate

The gas leakage rate *L*i for IGU containing gas(es) in concentrations higher than 15 % by volume per gas are measured as described in Clause 6 and shall be determined on an average of at least two specimens and maximum 4 specimens.

NOTE The number of specimens to be tested is decided by the manufacturer.

$L_{i,av} \leq 1,0$ in % a^{-1}

With an absolute limit of all individual $L_{i,max} \leq 1,20$ in % a^{-1}

Individual values shall be rounded to the second decimal place. Average value shall be rounded to one decimal place.

EXAMPLE 1 Measurements of only two specimens:

a) 0,89 and 0,91 = > average 0,9, passed; no further measurement

b) 0,91 and 1,09 = > average 1,0, passed; no further measurement

c) 0,82 and 1,22 = > average 1,0, failed (1,22) ; no further measurement

d) 1,10 and 1,08 = > average 1,1 failed; further measurements optional: see option A or B

e) 0,98 and 1,15 = > average 1,1 failed; further measurements optional: see option A or B

Optional further measurements:

Option A:

— If with the 3rd specimen the mean value is ≤ 1,0: passed

— If with the 3rd specimen the mean value stays > 1,0 but the value of the 3rd specimen is ≤ 1,20, test the 4th specimen and if with the 4th specimen the mean value is ≤ 1,0: passed.

— If the mean value of 4 specimens remain > 1,0: failed

Option B:

Measure *L*i of further 2 specimens and if average value of the 4 tested specimens is less than 1,0 and no individual value > 1,20: passed

EXAMPLE 2 Measurements of 4 specimens

Measure directly 4 specimens and determine *L*i,av and *L*i,max and compare with requirements given.

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For most insulating glass units, measured *L*i values are much higher than actual gas leakage values after 10 years of natural ageing. Therefore, the limiting value shall not be used for calculating the gas concentration during the lifetime of the IGU. See also Annex B.

5.2 Tolerances on gas concentration

Gas concentration before and after the test procedure given in 6.3, shall not be lower than 5 % absolute below the nominal value used to calculate the U-value declared by the IGU manufacturer.

5.3 Durability of the gas and interaction with IGU components

For the purposes of gas filling, only inert gases should be used like Ar, Kr, Xe. The use of any other gas will require chemical compatibility tests to be carried out.

6 Test method

6.1 Principle of testing

The gas leakage rate at 20 °C is measured after subjecting the test specimens to a climate exposure as specified in EN 1279-2:2018 with the following modifications:

— in step 1 the number of cycles is 28; and

— in step 2 the time at a constant temperature of 58 °C is 4 weeks.

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

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6.2 Apparatus

6.2.1 Climate exposure equipment

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Test apparatus for the climate exposure shall be as specified in EN 1279-2:2018.

6.2.2 Container for gas leakage rate measurement

A container with temperature control shall be used for measuring the gas leakage rate, which shall be hermetically sealable, and capable of receiving the specimen. Under the test conditions as little stress as possible shall be induced and the residual volume in the container shall be as small as possible. The sealed edges of the test specimens shall be exposed to the circulating purging gas (see Annex A).

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 measured quantity of gas during the blank measurement 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 samples.

6.2.3 Gas analysis equipment

Gas analysis equipment shall be used which is capable of:

— analysis of the gaseous constituents essential to the insulation function of the glass unit, for concentrations of $50 \cdot 10^{-6}$;

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

These tasks need not be performed using the same equipment.

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6.2.4 Gas sampling device

A device shall be used for taking gas samples from the tested IGU specimens, ensuring that the result is not distorted by ingress of air, segregation phenomena, or similar. The gas samples shall be representative for the whole gas volume.

6.2.5 Preparation of test specimens

The test specimens shall be representative of the system description (see EN 1279-1:2018, Annex A) and shall consist of two panes of 4 mm glass in accordance with EN 1279-1:2018, 5.2. If 4 mm glass is not available, the thickness as near as possible to 4 mm shall be used. The length shall be (502 ± 2) mm and the width (352 ± 2) mm. The cavity width shall be nominal 12 mm, or if not manufactured, a cavity width as near as possible to 12 mm.

Specimens of triple glazed units may also be tested. Length, width and cavity width should fulfil the above mentioned descriptions. The gas loss rates of the individual cavities may be different. Therefore, only an average value can be given. There is no specific requirement on individual cavities.

The panes of the test specimen shall be flat when the unit is sealed. During sealing, the ambient temperature, T is measured in °C and recorded in K, and the absolute pressure, P in hPa, shall be measured and recorded. The test specimens shall be manufactured in such a way that the gas concentration shall not be lower than 5 % absolute of the declared value ci,o, for each gas when gas mixtures are used.

6.2.6 Number of test specimens

At least six test specimens shall be prepared of which at least two shall be tested as described in 6.3.3 after climate exposure.

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6.3 Procedure

6.3.1 Determination of internal volume V_{int} of a test specimen

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Measure the clear distance between opposite spacers, d1 and d2, to the nearest 1 mm, e.g. by means of a gauge graduated in millimetres. Determine the clear distance between the inner pane surfaces, d3, by measuring the distance between the inner pane surfaces at mid-length on the four edges of the test specimen, to the nearest 0,1 mm, and calculate the mean. The internal volume, V_{int} in mm^3, is obtained in accordance with Formula (1):

$$V_{int} = d1 \cdot d2 \cdot d3 \quad (1)$$

6.3.2 Climate exposure

The climate exposure as specified in 6.1 shall be carried out on a minimum of two test specimens and up to four test specimens as determined by the manufacturer, not sooner than one week after preparation of the test specimens. On completion of the climate exposure, the test specimens are stored to achieve stabilization, with free circulation of air around the edges at (23 ± 2) °C and (50 ± 5) % relative humidity, for at least two weeks, and no longer than six months, up to the time of measuring the gas leakage rate as described in 6.3.4.

NOTE If the specimens are stored vertically, the free circulation of air around the edges can be realized by using two blocks at least 20 mm high, each covering not more than 30 mm of the edge.

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6.3.3 Measuring the gas leakage

Measure the gas leakage of at least two test specimens at (20 ± 1) °C after the climate exposure, leaving the test specimen in the container for as long as it takes for the mass of gas that has leaked from the specimen to be determined quantitatively, in µg/h, using the gas analysis equipment described in 6.2 .The water or air temperature in the ambient of the IGU shall be measured and recorded to ± 0,1 °C.

The measurement of the gas leakage has to be repeated until sufficient constancy of the values has been achieved. Sufficient constancy is reached when the standard deviation over the last four measurements, which in the case of natural gases such as the components of air are made with at least one day between them, is less than 0,25 µg/h, and with at least one measurement being higher than the one immediately preceding it (see Annex A). It has to be ensured that for determination of gas concentrations peaks of argon and oxygen are totally separated by base line. It is not allowed to calculate argon or oxygen concentration with the help of the nitrogen concentration.

6.3.4 Analysis of gas

Determine directly or indirectly the volume fraction in percent of the gaseous constituents essential to the insulation function of the unit, using a gas analysis equipment with an accuracy for the determined gases as described in 6.2.3.

Take a gas sample for this analysis from the cavity of the tested IGU specimen after the last measurement of the gas leakage rate.

6.4 Evaluation

Calculate the gas leakage rate, Li, of all measured test specimens in accordance with Formula (2).

$$L_{\mathrm{i}} = 87,6 \cdot 10^{6} \frac{m_{\mathrm{i}}}{c_{\mathrm{i}} \cdot V_{\mathrm{int}} \cdot \rho_{\mathrm{o,i}}} \cdot \frac{T}{T_{\mathrm{o}}} \cdot \frac{P_{\mathrm{o}}}{P} \quad \text{in \%.a}^{-1} \tag{2}$$

$\rho_{0,i}$ shall be given at To = 293 K (20 °C) and Po = 1 000 hPa.

At these standard conditions values from EN 673 shall be used, i.e.:

$\rho_{0,air}$ = 1,227; $\rho_{0,Ar}$ = 1,762; $\rho_{0,Kr}$ = 3,690; $\rho_{0,Xe}$ = 5,897 .

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