SLOVENSKI STANDARD
SIST EN 1279-2:2004

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Steklo v gradbeništvu - Izolacijski stekleni elementi - 2. del: Preskus tipa na izolacijskih steklenih elementih, polnjenih z zrakom

Glass in building - Insulating glass units - Part 2: Long term test method and requirements for moisture penetration

Glas im Bauwesen - Mehrscheiben-Isolierglas - Teil 2: Langzeitprüfverfahren und Anforderungen bezüglich Feuchtigkeitsaufnahme

Verre dans la construction - Vitrage isolant préfabriqué scellé - Partie 2: Méthode d'essai de longue durée et exigences en matiere de pénétration d'humidité

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ICS:

81.040.20	Steklo v gradbeništvu	Glass in building

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EUROPEAN STANDARD

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 1279-2:2002) has been prepared by Technical Committee CEN/TC 129 "Glass in building", the secretariat of which is held by IBN.

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of an identical text or by endorsement, at the latest by May 2003, and conflicting national standards shall be withdrawn at the latest by May 2003.

The described testing is part of type evaluation of insulating glass units.

This European Standard "*Glass in Building - Insulating glass units*" consists of the following Parts:

– *Part 1: Generalities, dimensional tolerances and rules for the system description.*

– *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 seals.*

– *Part 5: Evaluation of Conformity.*

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

The annexes A to D are normative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies requirements for moisture penetration and the long term test method for insulating glass units and ensures by means of an adequate evaluation of conformity to this standard that over time:

– energy savings are made because the *U*-value and solar factor 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.

It covers additional characteristics that are of importance for trade. Marking conditions are included.

For glass products with electrical wiring or connections for e.g. alarm or heating purposes, this standard covers only wiring subject for electrical potential difference to earth less than 50 V a.c. or less than 75 V d.c.

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

NOTE 1 In cases where there is no protection against direct ultraviolet radiation at the edges, such as structural sealant glazing systems, additional European technical specifications should be followed.

NOTE 2 Units where the nature is only artistic are not part of this standard.

This Part of this standard, which is inextricably bound up with the other Parts of this standard, covers the moisture penetration by testing as one means of verifying whether a product made in accordance with its system description conforms with the relevant aspect of the definition on insulating glass units.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated by amendment or revision. For undated references, the latest edition of the publication referred to applies (including amendments).

EN 572-1, *Glass in Building - Basic soda lime silicate glass products - Part 1: Definitions and general physical and mechanical properties.*

EN 572-2, *Glass in Building - Basic soda lime silicate glass products - Part 2: Float glass.*

prEN 1279-1:1998, *Glass in Building - Insulating glass units - Part 1: Generalities, dimensional tolerances and rules for the system description.*

EN 1279-3, *Glass in Building - Insulating glass units - Part 3: Long term test method and requirements for gas leakage rate and for gas concentration tolerances.*

EN 1279-4, *Glass in Building - Insulating glass units - Part 4: Methods of test for the physical attributes of edge seals.*

ISO 760, *Determination of water - Karl Fischer method (General method).*

3 Terms and definitions, abbreviations and symbols

3.1 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in prEN 1279-1:1998 together with the following apply.

3.1.1
standard laboratory conditions
ambient temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %

3.1.2
standard moisture adsorption capacity
capacity of a desiccant material to adsorb a quantity of moisture under controlled limit environment conditions

3.1.3
controlled limit environment conditions
environment temperature 10 °C with a dew point temperature of - 5 °C, giving a relative humidity of 32,8 %

3.1.4
moisture penetration index
amount of drying capacity consumed after standardised ageing conditions

3.1.5
accuracy
precision of the test method itself within confidence limits of 99 %

3.2 Abbreviations

r.h. relative humidity

3.3 Symbols

I Moisture penetration index (can be expressed in decimal or in percentage terms);

I_{av} Average value of the moisture penetration indices I, obtained over five measurements;

m_o Mass of dish when empty, clean and dry;

m_c Mass of dish plus desiccant plus water adsorbed from r.h. of 32 % air;

m_f Mass of dish plus desiccant plus water initially adsorbed plus water adsorbed when subjected to the climate conditions in the cabinet;

m_i Mass of dish plus desiccant plus water initially adsorbed;

m_r Mass of dish plus desiccant plus water adsorbed in equilibrium with a defined reference level of relative humidity of air, or dish plus dried desiccant at high temperatures;

M_m Mass of desiccant in mixtures with non-desiccant material;

M_t Total mass of desiccant when, for the purpose of testing, in a mixture with non-desiccant material, the non-desiccant material is replaced by the same volume of desiccant;

R Ratio between the masses of desiccant M_m and M_t ;

T_C Standard moisture adsorption capacity of desiccant;

$T_{C,av}$ Average standard moisture adsorption capacity of desiccant T_C obtained over two measurements;

T_f Final moisture content of desiccant;

$T_{f,u}$ Uncorrected final moisture content of desiccant;

T_i Initial moisture content of desiccant;

$T_{i,av}$ Average initial moisture content of desiccant T_i obtained over four measurements;

$T_{i,u}$ Uncorrected initial moisture content of desiccant;

Θ Temperature of test specimens in test cabinet;

Θ_c Temperature of the central test specimen in test cabinet during constant temperature phase;

Θ_h High temperature of the central test specimen in the test cabinet during the high humidity/temperature cycling phase;

Θ_l Low temperature of the central test specimen in the test cabinet during the high humidity/temperature cycling phase;

Θ_s Temperature of the central test specimen in the test cabinet as the cycle moves between high temperature and low temperature and vice versa.

4 Requirements

4.1 Moisture penetration index

Insulating glass units shall fulfil their functions during an economically reasonable working life. Therefore the following values are verified on test specimens submitted to the climate test described in this Part of the standard:

The average moisture penetration index I_{av} over the five test specimen shall not exceed 0,20.

Although breakage of the glass does not constitute failure, the average moisture penetration index I_{av} shall be the average over not less than, and no more than, five units. Spare units shall be used instead of the broken test specimens.

The unit with the highest moisture penetration index shall have an index value I not exceeding 0,25.

4.2 Edge seal strength

For the requirements on edge seal strength, refer to EN 1279-4.

4.3 Gas leakage rate

When the system description includes gas-filled insulating glass units, for additional testing and requirements on gas leakage rate, refer to EN 1279-3.

5 Method of test

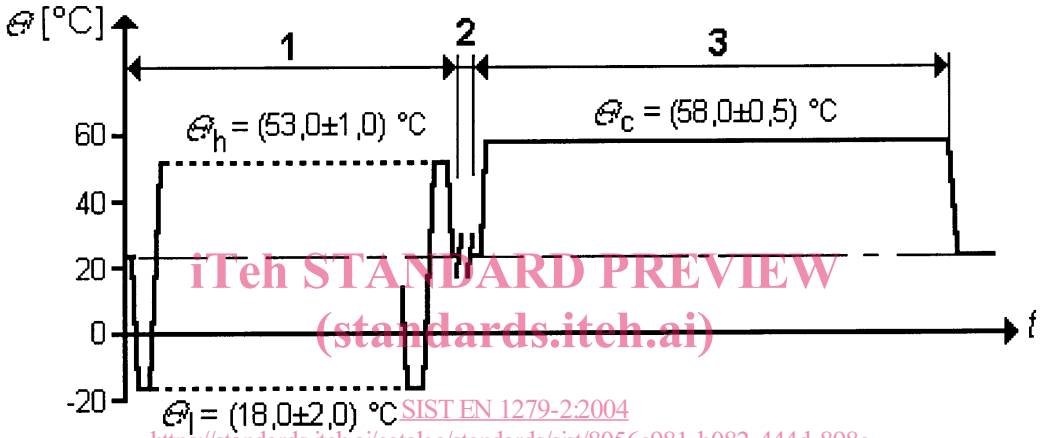
5.1 Principle

Sets of insulating glass units are exposed to a climate test. The initial and final dew point and the initial and final moisture content, as applicable, are measured and the moisture penetration index is calculated.

5.2 Climate conditions in cabinet

The high humidity/temperature test procedure consists of two parts. The climate condition in the cabinet comprises as a first part 56 temperature cycles of 12 h from -18 °C to +53 °C with slopes of 14 °C/h, followed by a second part comprising constant temperature of +58 °C for seven weeks. High humidity shall be as described.

The exact specifications of the temperature, humidity and time, and their tolerances, are given in Figures 1 and 2.



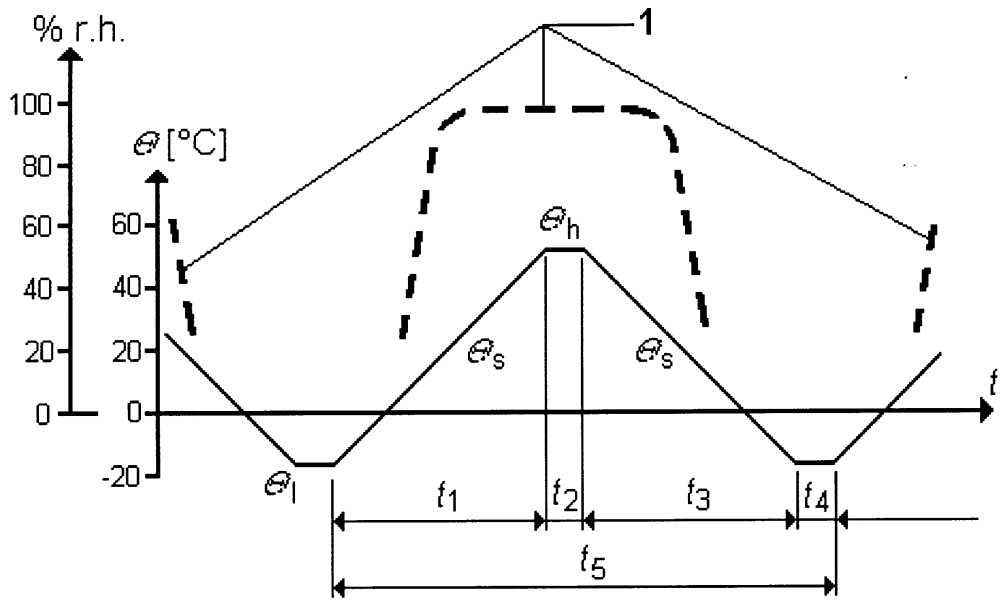
Key

1 56 temperature cycles of 12 h (is four weeks)

2 Interval of 2 h to 4 h for moving test pieces from one cabinet to a second cabinet when two cabinets are used

3 (1176 ± 4) h (seven weeks) constant temperature and a relative humidity of r.h. ≥ 95 %. Condensation on test specimen is allowed

Figure 1 — Overview of climate conditions in cabinet. ϑ is the glass temperature of the centrally located test specimen - Temperature cycles start with the cooling part



Key

1 Relative humidity during temperature cycle. Top value of r.h. ≥ 95 %. During the cold part of the cycle, the high humidity is interrupted. Condensation on test specimen from time to time is allowed.

– Time intervals: t_1 = 5 h, t_2 = 1 h, t_3 = 5 h, t_4 = 1 h, t_5 = total cycle time 12 h ;

– Tolerance on time intervals: less than 1 min;

– Temperatures of the centrally located test specimen during cycle:

  – Θ_h = (53,0 ± 1,0) °C (high temperature);

  – Θ_l = (-18,0 ± 1,0) °C (low temperature);

  – Θ_s = (14 ± 2) °C/h (slopes).

Figure 2 — Temperature/time and humidity/time relations in cycling stage

NOTE The two parts of the process can be carried out in a single cabinet or in two separate cabinets. If two cabinets are used allow up to 4 h for moving the test specimens from one to the other for the second period.

The indicated temperatures and temperature tolerances in Figures 1 and 2 are valid for the glass of that unit which is centrally located in the cabinet(s). The temperature of that centrally located test specimen shall be recorded continuously. Also the relative humidity and air temperature, measured at the most suitable location in the test cabinet(s) shall be recorded continuously. Any deviations in temperature and in relative humidity will be noted in the test report.

The glass temperatures of the other test specimens in the cabinet shall be:

– during cycling: • high temperature $\Theta = (\Theta_h \pm 1{,}0)$ °C;

• low temperature $\Theta = (\Theta_l \pm 2{,}0)$ °C;

- slopes $\Theta = (\Theta_S \pm 2{,}0)$ °C/h;

– during constant temperature: $\Theta = (\Theta_C \pm 0{,}5)$ °C.

In order to maximize uniform climate conditions throughout the cabinet(s), the distance between the vertically placed test specimens shall not be less than 15 mm.

5.3 Number, description and selection of the test specimens

A set of insulating glass units consists of 15 test pieces. The test specimens shall be representative of the system description (see prEN 1279-1) and shall consist of two panes of 4 mm clear float glass in accordance with EN 572-1 and EN 572-2. The length shall be (502 ± 2) mm and the width (352 ± 2) mm. The gap shall be 12 mm, or if not manufactured, a gap as near to 12 mm as possible. The cavity is preferably air filled, but other gases may also be used. Construction details of the edges and corners shall correspond to the edge and corner details in units supplied to the market.

When the system description contains curved insulating glass units with a bending radius equal to or less than 1 m, the test pieces shall be curved as described in prEN 1279-1.

When the system provides a mixture of desiccant with a non-desiccant material, incapable of resisting 1 000 °C, the Karl Fischer method shall be used for determining the moisture contents (after verifying the method for applicability), or the non-desiccant material shall be replaced by the same volume of desiccant.

When the system provides a mixture of desiccant with a non-desiccant material, incapable of withstanding 220 °C, the non-desiccant material shall be replaced by the same volume of desiccant.

Following reception, condition 15 test specimens for two weeks minimum at standard laboratory conditions. The initial dew point temperatures of the test specimens, measured in accordance with 6.1, shall be within a range of 10 K from the maximum dew point temperature as stated in, or to be derived from, information in the manufacturer's product/type description. Dew point temperatures less than -60 °C should be considered as -60 °C.

Rank the test specimens in order of dew point value, commencing with the highest dew point value as number 1 and ending with the lowest dew point as number 15. Number units with dew point values below -60 °C at random. Select the units as indicated in Table 1.

Table 1 — Designation of insulating glass units in climate tests

Unit number	**Designate units for:**
7, 8, 9 and 10	Measurement of initial moisture content of desiccant (T_i)
4, 5, 6,11 and 12	Climate testing and measurement of final moisture content of desiccant (T_f)
2, 3, 13 and 14	Spare units to replace broken units for measurement of final moisture content of desiccant (T_f) (after climate testing)
1 and 15	Rejection or measurement of standard moisture adsorption capacity of desiccant (T_C) as required

5.4 Procedure

When starting the climate test, measure the initial moisture content (T_i) of the desiccant (if any) on the four selected test specimens, in accordance with 6.2. Submit the five selected test specimens to the climate conditions, in accordance with 5.2. For units without desiccant, measure the initial dew point temperature of the test specimens in accordance with 6.1. This dew point temperature enables an equivalent value for T_i to be found in accordance with 6.2.3.

NOTE 1 For reasons of time saving and cost aspects of this test, the manufacturer or his agent may decide whether the spare units shall be submitted to climate conditions from the beginning, or only when a unit under climate conditions breaks.

NOTE 2 In order to be able to determine the requirement for the periodic test on moisture penetration, it is recommended that parallel with this procedure the periodic moisture penetration test in accordance with EN 1279-6 is carried out.

Store the units for a minimum of two weeks under standard laboratory conditions.

Measure the final moisture content (T_f) of the desiccant (if any) of the five test specimens in accordance with 6.2. When the amount of desiccant in the test unit differs from the units placed on the market, the final moisture content T_f shall be corrected by the multiplier

$$k = \frac{Q_{desiccant\_as\_per\_system\_description}}{Q_{desiccant\_unit\_in\_test}} \qquad (1)$$

where

Q is amount of desiccant in weight or in volume.

NOTE 3 When there are technical reasons that the quantity of desiccant in the test pieces cannot be representative of the system description, the test can be performed with a different quantity, however test results have to be corrected in order to obtain a true *I*-value.

For units without desiccant, measure the final dew point temperature of the test specimens in accordance with 6.1. This dew point temperature enables an equivalent value for T_f to be found in accordance with 6.2.4.

Establish the standard moisture adsorption capacity (T_c) according to annex D. If necessary, measure the standard moisture adsorption capacity of the desiccant on the rejected units in accordance with 6.2. In the case of units without desiccant, find T_c in accordance with 6.2.4.

Calculate the average initial moisture content of the desiccant from the following equation:

$$T_{1,av} = \sum_{n=1}^{4} \frac{T_{i,n}}{4} \qquad (2)$$

When applicable, calculate the average standard moisture adsorption capacity of desiccant from the following equation:

$$T_{c,av} = \sum_{n=1}^{2} \frac{T_{c,n}}{2} \qquad (3)$$

Calculate the moisture penetration index, in fractions or in percentage, of each of the five selected or designated test specimens subjected to the climate conditions, from the following equation:

$$I = \frac{T_f - T_{i,av}}{T_{c,av} - T_{i,av}} \quad \text{or} \quad I = 100\frac{T_f - T_{i,av}}{T_{c,av} - T_{i,av}} \quad \text{in \%} \qquad (4)$$