



# SLOVENSKI STANDARD

## SIST EN 1279-4:2004

01-september-2004

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### **Steklo v stavbah - Izolacijski stekleni elementi - 4. del: Preskusne metode za fizikalne lastnosti robnih tesnil**

Glass in building - Insulating glass units - Part 4: Methods of test for the physical attributes of edge seals

Glas im Bauwesen - Mehrscheiben-Isolierglas - Teil 4: Verfahren zur Prüfung der physikalischen Eigenschaften des Randverbundes

Verre dans la construction - Vitrage isolant préfabriqué scellé - Partie 4 : Méthodes d'essai de propriétés physique des produits de scellement

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**Ta slovenski standard je istoveten z: EN 1279-4:2002**

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 1279-4**

July 2002

ICS 81.040.20

English version

## Glass in building - Insulating glass units - Part 4: Methods of test for the physical attributes of edge seals

Verre dans la construction - Vitrage isolant préfabriqué  
scellé - Partie 4: Méthodes d'essai des propriétés  
physiques des produits de scellement

Glas im Bauwesen - Mehrscheiben-Isolierglas - Teil 4:  
Prüfmethoden der physikalischen Eigenschaften des  
Randverbundes

This European Standard was approved by CEN on 5 March 2002.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

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.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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## Foreword

This document EN 1279-4:2002 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 January 2003, and conflicting national standards shall be withdrawn at the latest by January 2003.

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

This Part of the standard does not stand alone, it is part of one standard:

- prEN 1279-1, Glass in building - Insulating glass units - Part 1: Generalities, dimensional tolerances and rules for the system description.
- prEN 1279-2, Glass in building - Insulating glass units - Part 2: Long term test method and requirements on moisture vapour penetration.
- prEN 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.
- prEN 1279-5, Glass in building - Insulating glass units - Part 5: Evaluation of conformity.
- EN 1279-6, Glass in building - Insulating glass units - Part 6: Factory production control and periodic tests.

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The annexes A, B, C and D are normative. The annexes E and F are informative.

This standard includes a Bibliography.

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 is the product standard for insulating glass units, which defines 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.

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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. See Bibliography [4] and [5].

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

This European Standard, which is inextricably bound up with the other Parts of the standard, covers evaluation of the edge seal strength, and partial evaluation of moisture and gas permeation through sealants, by testing and/or report examination as means of verifying whether a product made in accordance with its system description, and its variations in accordance with prEN 1279-1, conforms with the relevant aspects of the definition of 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 in it by amendment or revision. For undated references, the latest edition of the publication referred to applies (including amendments).

EN 410, *Glass in building - Determination of luminous and solar characteristics of glazing.*

EN 1096, *Glass in building - Coated glass.*

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

prEN 1279-2, *Glass in building - Insulating glass units - Part 2: Long term test method and requirements on moisture vapour penetration.*

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

### 3 Terms, definitions and symbols

#### 3.1 Terms and definitions

For the purposes of this European Standard, the terms and definitions of prEN 1279-1, prEN 1279-2, prEN 1279-3 and EN 1279-6 apply as well as the following terms and definitions.

##### 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  $(23 \pm 2)$  °C and a relative humidity of  $(50 \pm 5)$  % r.h

#### 3.2 Symbols

$\varepsilon$	Extension of bond expressed as a percent
$\sigma$	Stress applied to the bond during extension
$\Delta P_{H_2O}$	Difference in water vapour pressure across a membrane

### 4 Requirements

#### 4.1 Edge seal strength

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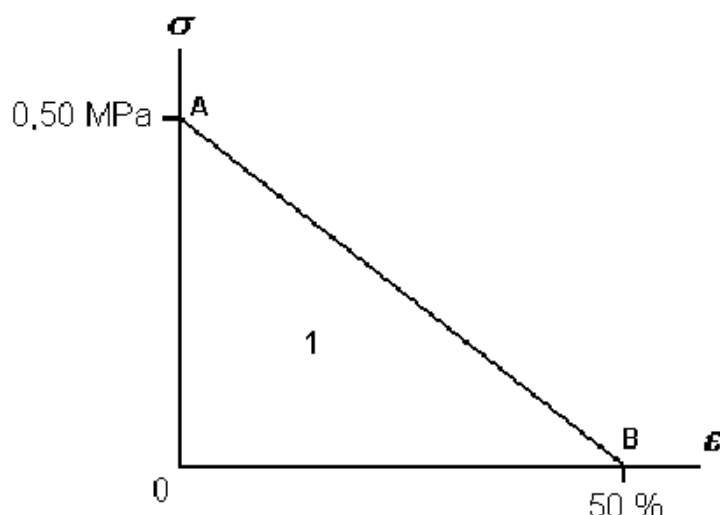
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All edge seals shall have sufficient adhesive and cohesive strength to allow the joints as specified to be extended such that any failure occurs outside the area OAB of Figure 1.

If during the strength test of the glass-sealant-glass joint, seen from the side view, loss of adhesion or cohesion extends through the whole depth of the sealant within the area OAB 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 sufficient successful joints are tested in order that the average result can be obtained.

For comparisons of seal strength, needed for substituting sealants, refer to annex B.



**Key** 1 Area OAB. In that area, no breakage allowed before and after ageing  
 $\sigma$  Stress in the sealant  
 $\varepsilon$  Strain in the sealant

**Figure 1 - Stress/strain triangle**



**Key** 1 Loss of cohesion  
 2 Loss of adhesion

**Figure 2 - Illustration of loss of adhesion or cohesion extends through the whole depth**

## 4.2 Conformity with the definition of insulating glass units

### 4.2.1 General

There shall be available a test report of the concerned insulating glass outer sealant according to clause 6 of this EN 1279-4:2002 (which summarizes the test report in which the edge seal strength is recorded) with a moisture penetration test report according to prEN 1279-2 and in case of gas-filled units also with a gas leakage rate report according to prEN 1279-3, and fulfills the requirement to demonstrate the conformity with the definition of insulating glass units. Refer to prEN 1279-1.

In case of sealing the insulating glass unit also on a coating (in accordance with EN 1096) not intended to be stripped, a test report according to annex D of this EN 1279-4:2002 shall be made available for inclusion in the assembling of the other test reports. Refer to prEN 1279-1.



NOTE Although only clear float glass is referred to in the standard, it is the responsibility of the insulating glass manufacturer to ensure that the edge sealant is capable of bonding to all used glasses listed in prEN 1279-1. The requirements for the use of coated glasses in accordance with EN 1096, are detailed in annex D.

## 4.2.2 Possibility to substitute the sealant

### 4.2.2.1 Limits of application

This possibility is applicable only in the case of insulating glass units with hollow metal spacer. For other systems, no experience is available for the setting up of substitution rules. Refer also to prEN 1279-1.

### 4.2.2.2 Air filled insulating glass units

Available test reports according to clause 6 of this EN 1279-4:2002 allows for the substitution of the sealant without repeated moisture penetration testing according to prEN 1279-2, when the substituting sealant:

(a) for units with an I value below 0,1:

- shall be applicable with the same production equipment;
- has been previously applied in insulating glass units which have been demonstrated to comply with prEN 1279-2. The demonstrated compliance may have been obtained separately using units of different construction and therefore the test report numbers may vary;
- and the moisture vapour transmission rate of the sealant is not more than 20 % higher than that of the initial sealant;
- and the stress/strain curve comparison satisfies the requirement in annex B;
- and the relevant Parts of EN 1279-6 (periodic test, mixing ratio, hardness test, etcetera) shall be carried out.

(b) for units with an I value between 0,1 and 0,2: the list under a) applies however with the following deviation:

- 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 according to clause 6 of this EN 1279-4:2002 allows to substitute the sealant without repeated gas loss rate testing according to prEN 1279-3, when the substituting sealant:

(a) for units with a gas loss rate  $L_i$  below  $0,8 \% \cdot a^{-1}$ :

- is allowed for limiting the moisture vapour penetration in accordance with 4.2.2.2;
- has been previously applied in insulating glass units which have been demonstrated to comply with prEN 1279-3. The demonstrated compliance may have been obtained

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- separately using units of different construction and therefore the test report numbers may vary;
- and the gas permeation of the sealant is not more than 20 % higher than that of the initial sealant.
- (b) for units with a gas loss rate  $L_i$  between  $0,8 \% \cdot a^{-1}$  and  $1,0 \% \cdot a^{-1}$ : the list under a) applies however with the following deviation:
- and 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 according to annex D of this EN 1279-4:2002 allow for the substitution of the coated glasses (coated glass in accordance with EN 1096), coating not intended to be stripped from the area where the insulating glass will be sealed without repeated moisture penetration testing according to prEN 1279-2, and in case of gas-filled units without repeated gas loss rate testing according to prEN 1279-3, when the provisions set out in the annex D are followed. Refer also to prEN 1279-1.

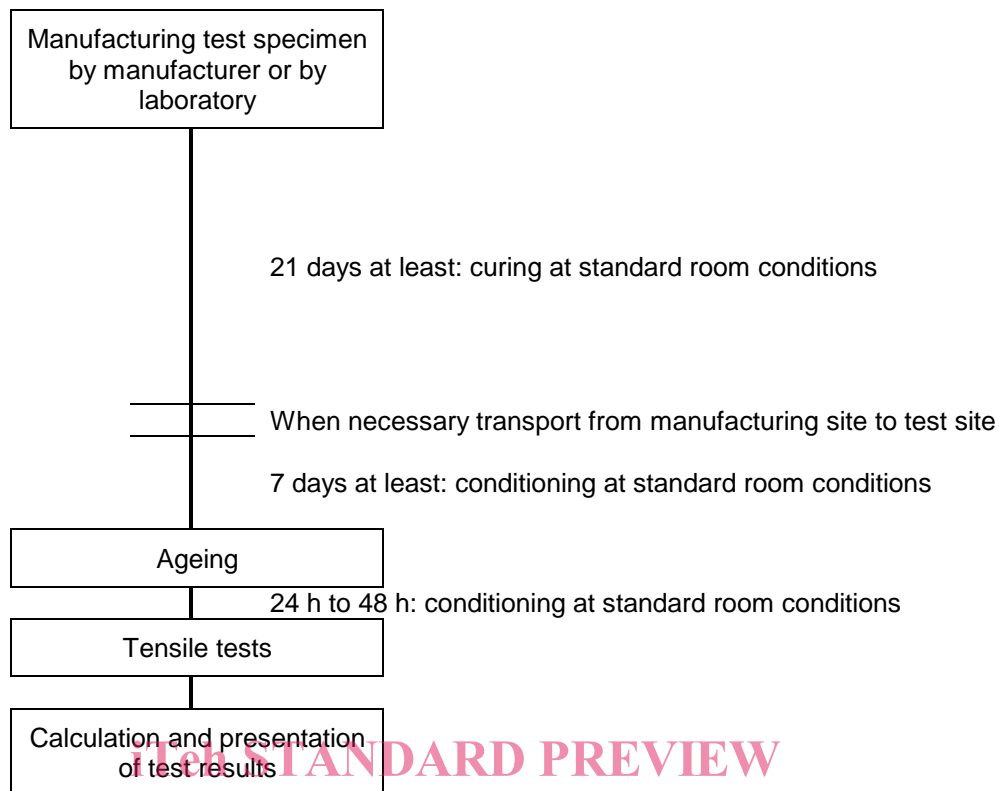
**5 Test methods****5.1 Adhesion****5.1.1 Principle**

The test consists of preparing a number of glass-sealant-glass joints and subjecting them to ageing regimes as outlined in 5.1.2 of this EN 1279-4:2002.

- heat exposure,
- water immersion,
- UV exposure,

as well as to no ageing (initial test) before testing under tensile load.

The test specimen shapes and bond preparations shall be as given in normative annex A. For insulating glass units with systems which 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 are seven per exposure condition.



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

After manufacturing, ageing where relevant, and conditioning during 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 extensometer with an accuracy equal to or lower than 2 %.

The speed of separation is in case of polymer based edge sealants  $(5 \pm 0,25)$  mm/min, and in case of metallic edge seals  $(12,5 \pm 0,5)$  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 addition of a second piece of glass or other material bonded e.g. with a cyano acrylate 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<sup>2</sup> (see Figure A.2).

The results are expressed in 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.

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**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  $(60 \pm 2)$  °C for  $(168 \pm 5)$  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 one litre to two litres distilled or deionised water for  $(168 \pm 5)$  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  $(96 \pm 4)$  h to UV irradiation which shall be perpendicular to the glass at an intensity in the UVA range in accordance with EN 410 of  $(40 \pm 5)$  W/m<sup>2</sup>. 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 subject 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.