



# SLOVENSKI STANDARD

## SIST EN 1096-3:2001

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**Steklo v stavbah - Steklo z nanosi - 3. del: Zahteve in preskusne metode za nanose razredov C in D**

Glass in building - Coated glass - Part 3: Requirements and test methods for class C and D coatings

Glas im Bauwesen - Beschichtetes Glas - Teil 3: Anforderungen an und Prüfverfahren für Beschichtungen der Klassen C und D

Verre dans la construction - Verre à couche - Partie 3: Exigences et méthodes d'essai pour les couches de classes C et D

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 1096-3**

January 2001

ICS 81.040.20

English version

## Glass in building - Coated glass - Part 3: Requirements and test methods for class C and D coatings

Verre dans la construction - Verre à couche - Partie 3:  
Exigences et méthodes d'essai pour les couches de  
classes C et D

Glas im Bauwesen - Beschichtetes Glas - Teil 3:  
Anforderungen an und Prüfverfahren für Beschichtungen  
der Klassen C und D

This European Standard was approved by CEN on 24 December 2000.

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, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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## Foreword

This European Standard 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of an identical text or by endorsement, at the latest by July 2001, and conflicting national standards shall be withdrawn at the latest by July 2001.

This part of the European Standard does not stand alone, it is a part of one standard:

Part 1: Definitions and classification

Part 2: Requirements and test methods for class A, B and S coatings

Part 3: Requirements and test methods for class C and D coatings

Part 4: Evaluation of conformity

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, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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## 1 Scope

This European Standard specifies requirements and a test method related to resistance to solar radiation for coated glass for use in buildings.

This test is aimed at evaluating if the exposure to solar radiation over an extended period of time produces any appreciable change in light transmittance and solar transmittance of the coated glass as well as a reduction of the infrared reflectance in the case of low emissivity coatings.

This European Standard applies to Class C and D coatings as defined in EN 1096-1 and used in insulating glass units.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. The 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 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.*

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

EN 1096-1, *Glass in Building - Coated glass - Part 1: Definitions and classification.*

prEN 1279, *Glass in Building - Insulating glass units.*

prEN 1279-2 :1996, *Glass in Building - Insulating glass units - Part 2: Long term test method and requirements for moisture penetration.*

EN 12150-1, *Glass in Building - Thermally toughened soda lime silicate safety glass - Part 1: Definitions and description.*

ISO 9060, *Solar energy - Specification and classification of instruments for measuring hemispherical solar and direct solar radiation.*

## 3 Terms and definitions

For the purposes of this European Standard the following terms and definitions apply.

### 3.1

#### **coated annealed glass**

a coated glass which has an annealed glass substrate.

### 3.2

#### **toughened or heat strengthened coated glass**

a coated glass which has to be toughened or heat strengthened to meet its final spectrophotometric properties.

### 3.3

#### **coated toughened or heat strengthened glass**

a coated glass which has a toughened or heat strengthened glass substrate.

## 4 Requirements

The coated glass complying with this European Standard shall meet the requirements given in Table 1 as they relate to the characteristic resistance to solar radiation.

**Table 1 - Requirements**

Test piece	Visual inspection	Spectrophotometric measurements
Exposed test specimens	No additional defects on the coating are seen as compared to the unexposed double glass test specimens	no requirements
Exposed single coated glass test piece	No requirements	the transmittance values at 550 nm and 900 nm shall differ from the corresponding values of the unexposed single coated glass sample by no more than +/- 0,03.  For a glass claimed to have a low emissivity coating, the reflectance at 8 $\mu\text{m}$ shall decrease by no more than 0,02.

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## 5 Samples, test pieces and test specimens

### 5.1 Test pieces

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#### 5.1.1 Coated annealed glass

A sample of 1000 mm x 500 mm is needed. Two square test pieces of minimum size 250 mm x 250 mm shall be cut from the sample.

#### 5.1.2 Toughened or heat strengthened coated glass

As the test piece cannot be cut from the test sample, a special procedure has to be employed to obtain the test piece (see annex A).

#### 5.1.3 Coated toughened or heat strengthened glass

Use coated annealed glass samples for testing this type of coated glass.

### 5.2 Preparation of test specimens

Two insulating glass units shall be manufactured as test specimens. The insulating glass units shall consist of one of the test pieces, a 12 mm airspace and a piece of 4 mm clear float glass (in compliance with EN 572-1 and EN 572-2). The dew point of the test specimens shall not be higher than  $-25^{\circ}\text{C}$ , when measured at  $(23 \pm 5)^{\circ}\text{C}$ , according to prEN 1279. The dew point is ensured when the insulating glass unit is manufactured in accordance with the prEN 1279 series.

The edge area of the test specimens shall be covered with a reflecting aluminium foil  $(40 \pm 5)$  mm wide as a means of protection for the sealant components.

## 6 Initial evaluation of test pieces

The external surfaces of the test pieces shall be cleaned with a soft tissue using demineralised water, having a conductivity lower than 30  $\mu\text{S}$ . Drying shall also be done with a soft tissue. If necessary this cleaning procedure can be repeated.

The test pieces shall be subjected to a visual inspection under an artificial sky according to EN 1096-1 at a distance of 600 mm. The examination shall be in both transmission and reflection. The test pieces shall be defect free, i.e. no visible scratches or pinholes shall be allowed.

## 7 Test methods for exposure to simulated solar radiation

Annex B gives criteria to demonstrate equivalence of coatings, i.e. an indications of whether or not the coated glass needs to be tested.

### 7.1 Radiation source

Radiation sources shall be used which emit radiation with a spectral distribution similar to the spectral solar global distribution as given in EN 410 and with percentages of UVB and UVA as given in Table 2. Such a spectral distribution can be obtained using different kinds of lamps (examples of test apparatus are given in annex C).

**Table 2 - Spectral characteristics of the lamps used for the test**

Radiation	Range of wavelength (nm)	Percentage of total energy (%)
ultraviolet range UVB	280 to 315	1 to 4
ultraviolet range UVA	315 to 380	3 to 9
visible and infrared range	> 380	balance

### 7.2 Test conditions

The total irradiance level measured on the surface of the test pieces (surface facing the test lamps) shall be  $(900 \pm 100) \text{ W/m}^2$ .

NOTE Calibrated pyranometers with characteristics as reported in ISO 9060 and with a spectral sensitivity in the 305 nm to 2800 nm range should be used for the determination of the total irradiance level. Using these detectors, the measured irradiance level on the surface of the test pieces should be  $(730 \pm 80) \text{ W/m}^2$ .

The exposure time for the radiation test shall be:

- $(1000 \pm 24) \text{ h}$  in the case of test apparatus given in C.1;
- $(2000 \pm 24) \text{ h}$  in the case of test apparatus given in C.2.

The test specimen shall be placed with the coating orientated towards the radiation source. When tested, the coating shall be on surface 3. However, when the coating is only to be used on surface 2, then it shall be tested on surface 2.

Figures C.1a) (planar array) or C.1b) (circular array) show the arrangement of the test specimens and the reference glass piece.

The reference glass piece has a thermocouple placed on its surface facing the test lamps. The temperature of the reference glass piece shall be  $(56 \pm 3) \text{ }^\circ\text{C}$ .



### 7.3 Reference glass piece

An opaque thermally toughened soda lime silicate safety glass (according to EN 12150-1) shall be used as a reference glass piece. It will be manufactured from a piece of float glass, up to 10 mm thickness, according to EN 572-1 and EN 572-2 with an enamelled black frit on the surface facing the array of lamps.

The reference glass piece shall have the following properties:

- dimensions not less than 250 mm;
- solar direct absorption  $\alpha_e \geq 0,92$  measured according to EN 410 with radiation of normal incidence onto the surface of the reference glass piece facing the test lamps;
- normal emissivity  $\varepsilon_n \geq 0,84$  at  $(23 \pm 5)$  °C of both outer surfaces of the reference glass piece, measured according to EN 673 with radiation of nearly normal incidence;
- thermal conductance between the two outer surfaces  $\Lambda \geq 100 \text{ W}/(\text{m}^2 \cdot \text{K})$ .

### 7.4 Test procedure

The test procedure shall include the following steps:

- initial visual inspection of the two test pieces according to clause 6;
- checking for the appearance of humidity between the panes;
- exposure of one test piece under simulated solar radiation, and storage of the second test piece in a dark room at a temperature of  $(23 \pm 5)$  °C;
- final visual inspection of the exposed and unexposed test pieces according to 8.1;
- checking for the appearance of humidity between the panes;
- opening of both test pieces and preparation of a test portion according to 8.2;
- spectrophotometric measurements.

## 8 Final evaluation of exposed test pieces

### 8.1 Visual inspection

The exposed test specimens shall be subjected to the same cleaning and the visual inspection procedure as for the initial test pieces see clause 6.

The requirements are given in Table 1.

### 8.2 Spectrophotometric measurements

This is undertaken on the coated test piece obtained by opening the test specimen.

#### 8.2.1 Coated annealed glass

A measurement sample shall be cut from the centre of the coated glass obtained from both the exposed and unexposed test specimens. The measurement sample shall be obtained without touching the coating.

The actual size of the measurement sample shall be dependent on the type of equipment being used for the measurement.