



SLOVENSKI STANDARD

SIST EN 1096-3:2012

01-marec-2012

Nadomešča:
SIST EN 1096-3:2001

Steklo v gradbeništvu - 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 C et D

Ta slovenski standard je istoveten z: EN 1096-3:2012

ICS:

81.040.20 Steklo v gradbeništvu Glass in building

SIST EN 1096-3:2012 **en,fr,de**

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SIST EN 1096-3:2012

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EUROPEAN STANDARD

EN 1096-3

NORME EUROPÉENNE

EUROPÄISCHE NORM

January 2012

ICS 81.040.20

Supersedes EN 1096-3:2001

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 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 3 December 2011.

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Foreword

This document (EN 1096-3:2012) 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of an identical text or by endorsement, at the latest by July 2012, and conflicting national standards shall be withdrawn at the latest by July 2012.

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

This document supersedes EN 1096-3:2001.

The main changes compared to the previous edition are:

- reference to the future EN 1096-5, *Test method and classification for the Self-cleaning performances of coated glass surfaces*;
- the introduction of a method to deal with toughenable / heat strengthenable and to be toughened / to be heat strengthened coated glass, see Annex A.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

EN 1096-3:2012 (E)**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

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.

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 1096-1:2012, *Glass in Building — Coated glass — Part 1: Definitions and classification*

EN 1279 (all parts), *Glass in Building — Insulating glass units*

EN 1279-2:2002, *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*

EN 12898, *Glass in building — Determination of emissivity*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1096-1 apply.

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 µm shall decrease by no more than 0,02.

5 Samples, test pieces and test specimens

5.1 Test pieces

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.

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5.1.2 Toughened or heat strengthened coated glass

For the thermally treated coated glass, defined in EN 1096-1:2012, 3.1.8 to 3.1.11, as the test pieces cannot be cut from test samples, a special procedure has to be employed to obtain the test pieces (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, 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°C, when measured at (23 ± 5) °C, according to EN 1279-2:2002, Annex A, or equivalent. The dew point is ensured when the insulating glass unit is manufactured in accordance with the EN 1279 series.

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

6 Initial evaluation of the 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 µS. Drying shall also be done with a soft tissue. If necessary this cleaning procedure can be repeated.

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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

NOTE Annex B gives criteria to demonstrate equivalence of coatings, i.e. an indication 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

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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.1 a) (planar array) or C.1 b) (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 enamelled 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 of 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 $\alpha_e \geq 0,92$ determined according to EN 410 with radiation of normal incidence onto the surface of the reference glass piece facing the test lamps;
- normal emissivity $\epsilon_n \geq 0,84$ at $(23 \pm 5) ^\circ\text{C}$ of both outer surfaces of the reference glass piece, measured according to EN 12898 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 $(23 \pm 5) ^\circ\text{C}$;
- 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

8.2.1 General

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

EN 1096-3:2012 (E)**8.2.2 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.

The spectrophotometric measurements on the single coated glass measurement sample shall be performed immediately after opening the test specimen.

The transmittance of the measurement sample shall be determined with radiation at normal incidence of the following wavelengths:

- 550 nm (representative wavelength for light and solar transmittance);
- 900 nm (representative wavelength for solar transmittance).

For glasses claiming to have a low emissivity coating a measurement of the reflectance shall be made at 8 μm with radiation of nearly normal incidence.

The requirements are given in Table 1.

8.2.3 Toughened or heat strengthened coated glass

As measurement samples cannot be cut from the test pieces a special procedure has to be employed to make the measurements (see Annex A).

9 Test report

The test report shall state the following information:

- reference to this European Standard,
- identification of the manufacturer,
- identification of the coating (class and commercial name),
- identification of the coated glass (annealed, toughened or heat strengthened),
- description of test equipment and radiation source,
- temperature of the reference glass piece,
- results of the initial inspection,
- results of the final inspection,
- for toughened/heat-strengthened coated glass details of the method used to determine the spectrophotometric properties,
- result of the test,
- comments (if any),
- test date.

NOTE An example of summary of test report is given in Annex D.

Annex A (normative)

Special procedures for thermally treated coated glass

A.1 General

This annex applies to the following coated glass types:

- to be toughened;
- toughenable;
- to be heat strengthened;
- heat strengthenable.

A.2 Spectrophotometric measurements

A.2.1 Samples and test pieces for spectrophotometric measurements

For the measurement of the emissivity according to EN 12898, and the radiation properties according to EN 410, small test specimens, not larger than 80 mm x 80 mm, are required.

The manufacture of such small samples of thermally treated coated glass is not always possible on a normal production machine. For thermally toughened glass with a coating, the glass cannot be cut after toughening because it fragments into small particles. However, the tempering process influences the properties of the coating, which develops its final properties only after the tempering process.

NOTE Heat strengthened glass can be measured via island fragments (see A.2.2.3).

A.2.2 Procedures

A.2.2.1 General

Any of the following procedures is suitable for producing test specimens, provided the test specimens are representative of production. It is the responsibility of the manufacturer to select the procedure to be used.

A.2.2.2 Procedure A

Test specimens of approximately 80 mm x 80 mm are manufactured in a laboratory oven (prototype production). The laboratory production parameters shall be traceable to the parameters used in the production line.

NOTE Attention should be given to the relationship of the temperature, time and heat flow to the surface of the coating.

A.2.2.3 Procedure B

The production of test specimens is carried out using the normal series production facility, not as thermally toughened glass, but as heat strengthened glass (the heating process is the same, but the cooling process is