SLOVENSKI STANDARD
SIST EN 1096-5:2016

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Steklo v gradbeništvu - Steklo z nanosi - 5. del: Metode preskušanja in klasifikacija za samočistilne lastnosti površine stekla z nanosom

Glass in building - Coated glass - Part 5 - Test method and classification for the self-cleaning performances of coated glass surfaces

Glas im Bauwesen - Beschichtetes Glas - Teil 5: Prüfverfahren und Klasseneinteilung für das Selbstreinigungsverhalten von beschichteten Glasoberflächen

Verre dans la construction - Verre à couche - Partie 5: Méthode d'essai et classification des performances autonettoyantes des surfaces de verre à couche

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European foreword

This document (EN 1096-5:2016) 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of an identical text or by endorsement, at the latest by July 2016, and conflicting national standards shall be withdrawn at the latest by July 2016.

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 part of the standard is published to allow the test methodology to be used.

As stated in the scope, at the present time, the test procedure does not specifically address the durability of the coating's self-cleaning functionality. Work is on-going to develop applicable testing.

EN 1096, *Glass in building — Coated glass*, is composed of the following parts:

— *Part 1: Definitions and classification;*

— *Part 2: Requirements and test methods for A, B and S coatings;*

— *Part 3: Requirements and test methods for C and D coatings;*

— *Part 4: Evaluation of conformity/Product standard;*

— *Part 5: Test method and classification for the self-cleaning performances of coated glass surfaces.*

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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard defines a test method to establish the self-cleaning performances for coatings on glass which utilize sun, rain or a combination of sun and rain to enhance the cleanliness of the glass.

The European Standard applies to class A coated glass as defined in EN 1096-1 and EN 1096-2 for use in outdoor building applications. The test is designed to be applicable for coatings on glass which use hydrophilic or photocatalytic active functionalities to enhance the cleanliness of the glass.

The test procedure does not specifically address the durability of the coating's self-cleaning functionality.

2 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

EN ISO 4892-3:2013, *Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps (ISO 4892-3:2013)*

3 Terms and definitions

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

3.1
glass substrate
basic glass, special basic glass, chemically strengthened basic glass, thermally treated basic and special basic glass, laminated glass or laminated safety glass

3.2
coating
one or more thin solid layers of inorganic materials applied onto the surface of a glass substrate by various methods of deposition

Note 1 to entry: Methods of deposition are described in EN 1096–1.

3.3
glass with dual coating
glass substrates to which coatings have been applied on both sides

Note 1 to entry: The second coating should not necessarily be a self-cleaning coating.

3.4
coated glass
glass substrate to which has been applied a coating, in order to modify one or more of its properties

3.5
self-cleaning coating
coating on glass substrates allowing obtaining or maintaining in time a cleaner surface as compared to untreated glass

3.6
hydrophilic coating
coating allowing maintaining a water contact angle of less than 20°

3.7
photocatalytic coating
coating containing a substance that performs one or more functions based on oxidation and reduction reactions under photo irradiation, inducing decomposition and removal of contaminants

3.8
secondary coating
coating deposited on the opposite side of a self-cleaning coating, in case of dual coatings

3.9
haze
wide angle scattering of light expressed as the percentage of the total transmitted light which, in passing through the glass, deviates from the incident beam by more than 2,5°

4 Symbols and abbreviations

For the purpose of this document, the following symbols and abbreviations apply.

RH	Relative humidity
S_{global}	Global standard deviation
T_t	Total light transmittance
T_d	Diffuse light transmittance
H	Haze
$\overline{\Delta H_{Global}}$	Mean global change of haze
$H_{initial}$	Haze after initial preparation of the sample (cleaning / activation)
$H_{cycle1dirt}$	Haze after cycle 1 dirt application
$H_{cycle1sun}$	Haze after cycle 1 UV exposure
$H_{cycle1rain}$	Haze after cycle 1 water spray
$H_{cycle2dirt}$	Haze after cycle 2 dirt application
$H_{cycle2sun}$	Haze after cycle 2 UV exposure
$H_{cycle2rain} = H_{final}$	Haze after cycle 2 water spray
$\Delta H = H_{final} - H_{initial}$	Haze variation between initial cleaning stage and end of cycle 2

5 Principle of the test

Standardized glass samples shall be submitted to a spray of a standardized dirt mixture, followed by a simulation of natural weathering action by applying UV irradiation (to simulate sun) and water spray (to simulate rain). This cycle shall be repeated twice to ensure better stability of results.

The haze shall be measured at initial preparation (after cleaning) and final stage (at the end of the second cycle).

The evaluation criteria shall be the haze variation (ΔH) between the sample after initial preparation ($H_{initial}$) and the sample at the final stage of the test (H_{final}), see Formula (1).

$$\Delta H = H_{final} - H_{initial} \quad (1)$$

NOTE The incident light on glass samples with dirt deposit is diffused scattered and the effect in transmission is seen as reduction of contrast of objects observed through the glass.

It is strongly recommended to measure haze at each step of the test (as explained in Clause 10) in order to check that there is no deviation of the test.

The test and all handling of the product to be tested shall be performed in a clean environment, i.e. exempt from any source of contamination (organics, silicones, dust) which could modify the surface, affect the functionality, the test conditions or the haze measurements. An example of contamination checking procedure is given in Annex C.

6 Instrumentation

6.1 UVA-Illumination chamber

A UV illumination chamber[1)] shall be equipped with UVA-340 lamps, such as described in EN ISO 4892-3:2013, Table 1 ("type 1" lamps).

A closed chamber is recommended.

The irradiation power shall be set to 0,68 $W \cdot m^{-2} \cdot nm^{-1}$ at 340 nm on the surface of the samples, which is the maximal irradiance of solar light according to CIE 85 Table 4. The irradiation level shall be maintained constant and uniformly distributed such as to ensure a same level of irradiation on all the samples.

NOTE The irradiation level can be monitored with a radiometer. The intensity of the lamp can be controlled continuously and adjusted to balance aging of the lamps.

Relative Humidity (RH) shall be maintained between 15 % and 50 % inside the chamber during the irradiation period. The air temperature in the illumination chamber shall remain between 25°C and 40°C. The UVA cabinet shall be placed in a well-ventilated area and its vents shall be fully opened, to ensure that the temperature inside the cabinet remains in the indicated values. The temperature and RH shall be monitored and given in the test report. The cabinet shall be clean and exempt of any contamination source, especially silicone source, see Annex C.

6.2 Sample support

For the spraying steps, the sample shall be installed on a support, with an inclination of 10° from vertical. The description of the support is given in Annex A.

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1) Equipment UV2000 or UVCon from Atlas or QUV from QPannel have been used during the Round Robin tests and found to be suitable. This equipment is an example of a suitable product available commercially. This information is given for the convenience of users of this European Standard and does not constitute an endorsement by CEN of this product.

6.3 Spraying nozzle

The spraying nozzle[2)] shall be fixed horizontally and aligned with the centre of the haze measurement area on the glass samples. The distance between the nozzle tip and the glass sample shall be 300 mm, as described in Annex A. The nozzle shall be a full cone airless nozzle with a large spray angle (120°).

6.4 Dirt mixture pressure tank

The dirt mixture shall be placed in a dedicated pressure vessel equipped with a mechanical stirrer. The turning velocity of the stirrer shall be adapted to avoid particles precipitation. Pressure vessel and mechanical stirrer shall be made of inert material resistant to acid corrosion and shall not contain any silicone contamination source[3)]. Attention shall be paid to ensure sufficient height of liquid (at least 5 cm) in the container in order to avoid air bubbles in the pulverization system, which could affect final results.

The section of container may be lowered by using a narrower container inside the pressure tank to reduce the necessary solution volume.

6.5 Water pressure tank

The same precautions against air bubbles as described in 6.4. shall be taken.

The water pressure tank may be a simple clean pressurized tank.

6.6 Timer for spray

The time of pulverization of the dirt mixture shall be measured in order to control the volume sprayed.

It is recommended to use an automatic timer (such as a solenoid valve) to obtain better precision on pulverization time, thus on sprayed volumes.

6.7 Furnace used to dry the glasses

The temperature set to dry the glasses shall be (60 ± 2) °C on the glass surface. Before starting the test, furnace shall be calibrated by placing the same amount of glasses that will normally be used for the test inside the furnace. A thermocouple shall be affixed on the glass surface to check the conformity to the target temperature.

The duration of the drying stage shall be counted after stabilization of the glass surface temperature. The time for the glass surface to reach the (60 ± 2) °C shall not be included in the drying time.

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2) The nozzle SSD-VKL-1-120°-1.4571 from Spraying Systems Germany has been used during the Round Robin tests and found to be suitable. This nozzle is an example of a suitable product available commercially. This information is given for the convenience of users of this European Standard and does not constitute an endorsement by CEN of this product.

3) Commercial equipment 83S-211-AT SS pressure tank with direct rotary agitation from ITW-Binks has been used for Round Robin tests and found to be suitable. This pressure tank is an example of a suitable product available commercially. This information is given for the convenience of users of this European Standard and does not constitute an endorsement by CEN of this product.

7 Preparation of the glass samples

7.1 General

The test shall be performed on monolithic samples of the products.

Dual coating shall be tested according to one of the following options:

— an equivalent glass, with only the self-cleaning coating on one side, shall be tested; or

— the secondary coating shall be removed by polishing, providing it does not damage the self-cleaning coating on the opposite side; or

— the use an of an adapted protection of secondary coating shall be provided (e.g. protective film with electrostatic or low adhesive charge, or laminated glass assembly), in order to protect the secondary coating during the spraying of the dirt mixture . This protective film shall be removed after the spray, and the secondary coating side shall be cleaned before haze measurements.

Insulating glass units (IGU) shall not be used.

NOTE 1 Assembly in IGU can distort the haze measurements.

The test shall be performed on glass with a light transmittance ≥ 10 %.

NOTE 2 For tinted glass and absorbing layers (self-cleaning or dual coatings) the light absorption may affect the precision of haze measurements.

7.2 Tested sample

A minimum of 6 samples shall be tested for a given self-cleaning coating. The chosen number of samples shall be indicated as “*n*”.

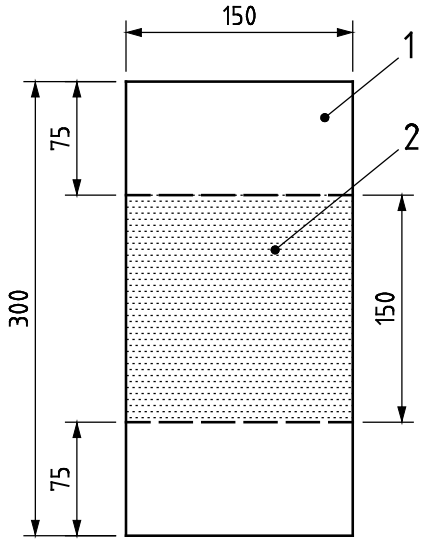
In case the product to be tested has to be toughened to become active, the test shall be performed on toughened samples. In case the product can be used annealed or toughened, both types shall be tested, with a minimum of 6 annealed samples and 6 toughened samples.

The size of the samples shall be 150 mm x 300 mm.

The central zone shall be analysed and the sample shall be positioned vertically, as described in Figure 1.

The sample shall be engraved with references on the upper left corner of the opposite side from the side to be tested i.e. non coated side.

All dimensions are in mm



Key

1 sample

2 test zone on the sample

Figure 1 — Description of test sample

7.3 Control sample

A minimum of 6 control samples shall be tested along with the self-cleaning products to be tested. Control samples shall have a behaviour known in advance.

A commercial product can be used. The use of clear float glass as control sample should be avoided, due to the sensibility of its surface to its history.

Control samples shall fulfil these criteria:

— stability of performances and homogeneity;

— availability;

— low visible absorption;

— low initial haze.

EXAMPLE Examples of references samples are:

— silica sheets;

— float glass coated with a given oxide layer, resistant to corrosion (such as silica or photocatalytic coating);

— commercially available photocatalytic self-cleaning glass.

If control samples do not give the expected results a new test shall be performed, ensuring that all test conditions are respected.