SLOVENSKI STANDARD
oSIST prEN 17940:2023

01-marec-2023

Steklo v gradbeništvu - Vmesna folija za izdelavo laminiranega stekla - Standard za proizvod

Glass in Building - Folio Interlayers for the Manufacturing of Laminated Glass - Product standard

Glas im Bauwesen - Folien-Zwischenlagen für die Herstellung von Verbundglas - Produktnorm

Verre dans la construction - Films intercalaires pour la fabrication du verre feuilleté - Norme de produit

Ta slovenski standard je istoveten z: **prEN 17940**

ICS:

81.040.20	Steklo v gradbeništvu	Glass in building

oSIST prEN 17940:2023 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 17940

January 2023

ICS 81.040.20

English Version

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 129.

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

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Ref. No. prEN 17940:2023 E

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European foreword

This document (prEN 17940:2023) has been prepared by Technical Committee CEN/TC 129 “Glass in building”, the secretariat of which is held by NBN.

This document is currently submitted to the CEN Enquiry.

1 Scope

This document specifies the composition, tolerances and characteristics, i.e. mechanical, acoustic, optical, and thermal properties, of folio interlayers for the manufacturing of laminated glass and laminated safety glass for use in buildings and construction works and it defines their general quality criteria.

This document does not apply to interlayers for laminated glass which are achieved by pouring the interlayer material in liquid state on or between the plies of glass or plastic glazing sheet material followed by drying or chemical or ultraviolet curing.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 410:2011, *Glass in building — Determination of luminous and solar characteristics of glazing*

EN 16613:2019, *Glass in building — Laminated glass and laminated safety glass — Determination of interlayer viscoelastic properties*

EN ISO 489:2022, *Plastics — Determination of refractive index*

EN ISO 1183-1:2019, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method (ISO 1183-1:2019, Corrected version 2019-05)*

EN ISO 1716:2018, *Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value) (ISO 1716:2018)*

EN ISO 11357-4:2021, *Plastics — Differential scanning calorimetry (DSC) — Part 4: Determination of specific heat capacity (ISO 11357-4:2021)*

EN ISO 12543-1:2021, *Glass in building — Laminated glass and laminated safety glass — Part 1: Vocabulary and description of component parts (ISO 12543-1:2021)*

EN ISO 12543-2:2021, *Glass in building — Laminated glass and laminated safety glass — Part 2: Laminated safety glass (ISO 12543-2:2021)*

EN ISO 12543-3:2021, *Glass in building — Laminated glass and laminated safety glass — Part 3: Laminated glass (ISO 12543-3:2021)*

EN ISO 12543-4:2021, *Glass in building — Laminated glass and laminated safety glass — Part 4: Test methods for durability (ISO 12543-4:2021)*

EN ISO 12543-6:2021, *Glass in building — Laminated glass and laminated safety glass — Part 6: Appearance (ISO 12543-6:2021)*

EN ISO 22007-4:2017, *Plastics — Determination of thermal conductivity and thermal diffusivity — Part 4: Laser flash method (ISO 22007-4:2017)*

ISO 527-3:2018, *Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets*

ISO 11359-2:2021, *Plastics — Thermomechanical analysis (TMA) — Part 2: Determination of coefficient of linear thermal expansion and glass transition temperature*

ASTM D1003:2021, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*

ASTM E313:2020, *Standard Practice for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12543-1:2021 and EN ISO 12543-6:2021 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 General

The folio manufacturer is responsible for the preparation and maintenance of a product description. The folios may be described either in full, i.e. chemical composition, or by a manufacturer's code. Further guidance on documentation is given in Annex A.

Clause 5 covers the properties which are measured on the folio supplied, Clause 6 covers the folio properties which are determined on laminated glass incorporating the folio to be assessed.

Some folios reach their final properties only after the lamination process. This must be considered in the evaluation of the interlayer properties to this standard.

5 Properties of folios before processing

5.1 Dimensions

5.1.1 Length and width

The nominal length and width of the folio shall be provided by the folio manufacturer. The actual length and width of the folio product supplied shall not be less than the nominal length and width.

The oversize in width should be agreed upon by the laminated glass producer and folio manufacturer and can vary with nature of the lamination process.

5.1.2 Thickness

The actual thickness *d* shall be the average of three measurements, taken to 0,01 mm at the edges and the centre of the folio interlayer. The measurement shall be performed my means of an instrument of the calliper micrometre type at a temperature of (23 ± 3) °C. The measurement shall be taken having applied a pressure to the interlayer of not more than 60 N/m^2 for 5 s to10 s.

NOTE 1 The relative ambient humidity does not have a significant influence on the result of the thickness measurement.

The nominal thickness of the folio shall be provided by the folio manufacturer. The actual thickness of the folio supplied, rounded to the nearest 0,01 mm, shall not vary from the nominal thickness by more than the tolerances shown in Table 1.

Table 1 — Tolerances on nominal thickness

Nominal thickness mm	Tolerances mm
$d \leq 1$	±0,05
$1 < d \leq 2$	±0,07
$d > 2$	±0,1

Product specific thickness tolerances should be available from the folio interlayer manufacturer.

NOTE 2 For the final laminated glass, clause 4.1.2.1 of EN ISO 12543-5:2021 also applies.

5.2 Appearance

5.2.1 General

The folio manufacturer shall have a process in place to control foreign particles and/or contaminations that can lead to defects in the laminated glass.

5.2.2 Methods of observation and measurement

5.2.2.1 General

In order to check the appearance of the interlayer supplied a representative folio sample of at least 1 m² size is inspected with the naked eye and under normal diffused lighting conditions, (natural daylight or simulated daylight, between 300 lx and 600 lx at the folio) from a distance of 1 m. The direction of observation is normal, i.e. at right angles, to the folio. When inspected to this observation method, holes, creases and unintentional streaks are not allowed.

5.2.2.2 Spot faults

The largest dimension (diameter or length) of these faults is measured with a micrometre with graduations in tenths of a millimetre. The number and dimensions of the spot faults are noted. Table 2 gives the allowable number of faults.

Table 2 —Acceptance levels of spot faults

Dimension of spot faults mm	Average per 20 m²
≤ 0,5	Any number
> 0,5 and ≤ 1,0	3
> 1,0 and ≤ 3,0	0,6
> 3,0	0,05

NOTE The word average indicates a cumulative average over at least 2 000 m² of foil.

5.2.2.3 Linear/extended faults

The sample is inspected to the observation method described in 5.2.2 and the presence of visually disturbing faults is noted.

The allowable number of faults is an average 0,05 faults in 20 m^2 of foil, related to at least 2 000 m^2.

5.3 Mechanical Properties

The viscoelastic properties of the folio or folio product family shall be determined according to EN 16613:2019 for use in calculations of laminated glass load resistance.

If no determination to EN 16613:2019 is available from the folio manufacturer, a value of 0,01 MPa for the folio shear modulus can be used for use in calculations of laminated glass load resistance.

In absence of further information of the folio manufacturer, the Poisson's ratio of the folio can be taken as 0,49 for isotropic folios.

5.4 Safety in the case of fire (cf. Reaction to fire EN 13501-1)

The calorific value of a single composition per folio or folio product family shall be tested according to EN ISO 1716.

This can be used by the laminated glass producer, in part, to determine the classification of reaction to fire of the laminated glass to EN 13501-1.

NOTE The availability of such test report does not imply the necessity for classification of the laminated glass, nor an opinion on the suitability or relevance of EN 13501-1 for such classification.

5.5 Thermal and other physical properties

The density, coefficient of thermal expansion, the thermal conductivity and the specific heat of the folio shall be assessed using the standards given in Table 3.

Table 3 — Test methods to determine the material properties

Material property	Test method
Density	EN ISO 1183-1:2019, procedure A
Refractive index	EN ISO 489:2022
Haze	ASTM D1003:2021
Yellowness	ASTM E313:2020
Thermal expansion coefficient	ISO 11359-2:2021
Thermal conductivity	EN ISO 22007-4:2017
Specific heat capacity	EN ISO 11357-4:2021
Calorific value (gross heat of combustion)	EN ISO 1716:2018
Tensile strength at 23 °C	ISO 527-3:2018

In absence of further information from the folio producer, the values given in Table 4 can be used to calculate the properties of laminated glass:

Table 4 — Conventional values of material properties

Property	Unit	Material	Value
Density	kg/dm³	PVB	1,07
		EVA	0,95
		Ionomer	0,97
Thermal expansion coefficient	1/K	PVB	$1{,}7 \cdot 10^{-4}$
		EVA	$1{,}6 \cdot 10^{-4}$ (25 °C) $1{,}36 \cdot 10^{-3}$ (75 °C)
		Ionomer	$1{,}3 \cdot 10^{-4}$
Thermal conductivity	W/(m·K)	PVB	0,18
		EVA	0,2 to 0,3
		Ionomer	0,25
Specific heat capacity	J/kg·K	PVB	2 000
		EVA	2 300
		Ionomer	1 800 (at 20 °C) 2 400 (at 60 °C)
Calorific value	MJ/kg	PVB	31
		EVA	40
		Ionomer	40

6 Properties of processed folios

6.1 General

For some folios, e.g. EVA, the degree of crosslinking can have an influence of the properties of the processed product. It can be determined according to ISO 10147:2011 or EN 62788-1-6:2017. The necessary degree of crosslinking should be considered when defining the processing conditions.

6.2 Adhesion

The mechanical behaviour of a laminated glass assembly is a result of the inherent mechanical or viscoelastic properties of the folio, and the adhesion of the folio to the other components of the assembly.

The inherent mechanical properties are set by the composition of the folio and are further specified in 5.3.

The folio manufacturer shall have a procedure in place to control the intrinsic adhesion of the folio.

The folio manufacturer can base this procedure on any of the methods applicable on laminated glass in EN 14449:2005, Annex C or use an appropriate method that is executed on the folio product, e.g. a peel test according to EN 28510-1:2014 (90°) or EN ISO 8510-2:2010 (180°)

The folio manufacturer shall specify the adhesion level of the folio to glass including the tolerance and link this information to the test method used to determine the adhesion.