SLOVENSKI STANDARD

SIST EN 14449:2005

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Steklo v gradbeništvu – Lepljeno steklo in lepljeno varnostno steklo – Ovrednotenje skladnosti/standard za izdelek

Glass in building - Laminated glass and laminated safety glass - Evaluation of conformity/Product standard

Glas im Bauwesen - Verbundglas und Verbund-Sicherheitsglas - Konformitätsbewertung/Produktnorm

Verre dans la construction - Verre feuilleté et verre feuilleté de sécurité - Evaluation de la conformité

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Glass in building - Laminated glass and laminated safety glass - Evaluation of conformity/Product standard

Verre dans la construction - Verre feuilleté et verre feuilleté de sécurité - Evaluation de la conformité/Norme de produit

Glas im Bauwesen - Verbundglas und Verbund-Sicherheitsglas - Konformitätsbewertung/Produktnorm

This European Standard was approved by CEN on 3 March 2005.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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Contents

Foreword

This European Standard (EN 14449:2005) has been prepared by Technical Committee CEN/TC 129 “Glass in building”, the secretariat of which is held by IBN/BIN.

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of an identical text or by endorsement, at the latest by October 2005, and conflicting national standards shall be withdrawn at the latest by January 2007.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

No existing European Standard is superseded.

This European Standard stands alone.

This European Standard contains other aspects of importance of trade.

This European 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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard covers the evaluation of conformity and the factory production control of laminated glass and laminated safety glass for use in buildings.

NOTE 1 This also includes requirements subject to regulation.

NOTE 2 For glass products with electrical wiring or connections for, e.g. alarm or heating purposes, other directives, e.g. Low Voltage Directive, may apply.

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 356, *Glass in building - Security glazing - Testing and classification of resistance against manual attack*

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 673, *Glass in building – Determination of thermal transmittance (U value) – Calculation method*

EN 1063, *Glass in building - Security glazing - Testing and classification of resistance against bullet attack*

EN 1748-1-1, *Glass in building - Special basic products - Borosilicate glasses - Part 1-1: Definition and general physical and mechanical properties*

EN 1748-2-1, *Glass in building - Special basic products - Glass ceramics - Part 2-1: Definition and general physical and mechanical properties*

EN 1863-1, *Glass in building - Heat strengthened soda lime silicate glass - Part 1: Definition and description*

EN 12150-1, *Glass in building - Thermally toughened soda lime silicate safety glass - Part 1: Definition and description*

EN 12337-1, *Glass in building - Chemically strengthened soda lime silicate glass – Part 1: Definition and description*

EN 12600, *Glass in building - Pendulum test - Impact test method and classification for flat glass*

EN 12758, *Glass in building - Glazing and airborne sound insulation - Product descriptions and determination of properties*

EN 12898, *Glass in building - Determination of the emissivity*

EN 13024-1, *Glass in building - Thermally toughened borosilicate safety glass - Part 1: Definition and description*

EN 13501-1, *Fire classification of construction products and building elements - Part 1: Classification using test data from reaction to fire tests*

EN 13501-2, *Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services*

prEN 13501-5, *Fire classification of construction products and building elements - Part 5: Classification using test data from external fire exposure to roof tests*

EN 13541, *Glass in building - Security glazing - Testing and classification of resistance against explosion pressure*

EN 14178-1, *Glass in building – Basic alkaline earth silicate glass products - Part 1: Float glass*

prEN 14179-1, *Glass in building - Heat soaked thermally toughened soda lime silicate safety glass – Part 1: Definition and description*

prEN 14321-1, *Glass in building – Thermally toughened alkaline earth silicate safety glass - Part 1: Definition and description*

EN ISO 12543-1:1998, *Glass in building – Laminated glass and laminated safety glass - Part 1: Definitions and description of component parts (ISO 12543-1:1998)*

EN ISO 12543-2:1998, *Glass in building – Laminated glass and laminated safety glass - Part 2: Laminated safety glass (ISO 12543-2:1998)*

EN ISO 12543-3:1998, *Glass in building – Laminated glass and laminated safety glass - Part 3: Laminated glass (ISO 12543-3:1998)*

EN ISO 12543-4:1998, *Glass in building – Laminated glass and laminated safety glass - Part 4: Test methods for durability (ISO 12543-4:1998)*

EN ISO 12543-5:1998, *Glass in building – Laminated glass and laminated safety glass - Part 5: Dimensions and edge finishing (ISO 12543-5:1998)*

EN ISO 12543-6:1998, *Glass in building – Laminated glass and laminated safety glass - Part 6: Appearance (ISO 12543-6:1998)*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN ISO 12543:1998 Parts 1, 2, 3, 4, 5 and 6 and the following apply.

3.1 initial type testing
determination of the performance of a product (characteristic, durability), on the basis of either actual tests or other procedures (such as conventional, standardised, tabulated or general accepted values, standardised or recognised calculation methods, test reports when made available, …), in accordance with this European Standard that demonstrates compliance with this European Standard

3.2 test report
document that covers the results of tests undertaken on a representative sample of the product from production or on a prototype design of the product

3.3 product description
document that details the relevant parameters, e.g. process conditions, structure, etc., for defining a product that complies with the standard. It includes specific reference(s) to characteristics that are modified by the production process

3.4 significant change
variation in performance beyond the permitted tolerance for the characteristic

4 Requirements

4.1 Product description

For conformity purposes, the laminated/laminated safety glass manufacturer[1] is responsible for the preparation and maintenance of a product description. This description shall describe the product and/or product families.

Disclosure of the product description shall be at the discretion of the laminated/laminated safety glass manufacturer or his agent except in the case of regulatory requirements.

The description shall contain at least a normative part. The description may also contain an informative part, when the manufacturer foresees further development of the product.

The normative part of the description shall contain the following minimum information:

- A reference to EN ISO 12543 Parts 1 to 6 and all other standards with which the manufacturer claims compliance;
- Component parts:
  - Glass types and thicknesses (see 4.3.1.2),
  - Plastics glazing sheet materials types and thicknesses,
  - Interlayer types and thicknesses;
- The order of stacking of the components;
- Lamination process, e.g. folio, cast-in-place, etc.;
- Coatings if present and their position relative to an interlayer.

The interlayers may be listed either in full, i.e. chemical composition, or by a manufacturer's code.

The definition of product families shall be consistent with the normative part of the product description.

The substitution of materials and/or components shall maintain the conformity with the product description. The substituting materials and/or components can be added to the product family and also the product description when compliance has been demonstrated.

4.2 Conformity with the definition of laminated glass and laminated safety glass

4.2.1 General

Products shall conform with the manufacturer’s product description and fulfil the definition and requirements of laminated glass or laminated safety glass (see 4.2.2 and 4.2.3).

4.2.2 Conformity with definition of laminated glass

Products shall fulfil the definition and requirements for laminated glass as defined in EN ISO 12543-3.

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[1] The terms ‘manufacturer’ and ‘producer’ are understood as being synonyms (see CPD working document NB-CPD/02/019 – issued 24 April 2002 – page 1)

4.2.3 Conformity with definition of laminated safety glass

Products shall fulfil the definition and requirements for laminated safety glass as defined in EN ISO 12543-2.

4.3 Determination of the characteristic's performances

4.3.1 Characteristics of laminated glass and laminated safety glass

4.3.1.1 General

The characteristics of laminated glass and laminated safety glass are those of the glass panes used as components (see 4.3.1.2).

4.3.1.2 Characteristics of the glass panes used as components for the production of laminated and laminated safety glass

The glass types given in Table 1 can be used for the manufacture of laminated glass and laminated safety glass.

Table 1 - Glass types used as components for the production of laminated glass and laminated safety glass

Glass type	Reference
Basic soda lime silicate glass products	EN 572-1
Special basic glass products:	
- Borosilicate glasses	EN 1748-1-1
- Glass ceramics	EN 1748-2-1
Heat strengthened soda lime silicate glass	EN 1863-1
Thermally toughened soda lime silicate safety glass	EN 12150-1
Chemically strengthened soda lime silicate glass	EN 12337-1
Thermally toughened borosilicate safety glass	EN 13024-1
Alkaline earth silicate glass products	EN 14178-1
Heat soaked thermally toughened soda lime silicate safety glass	prEN 14179-1
Thermally toughened alkaline earth silicate safety glass	prEN 14321-1
NOTE For coated glass see EN 1096-4. Some characteristics of coated glass are similar to those of glass substrates.	

The characteristics of the glass components are listed in Table 2 and the values can be found in the appropriate product standards, e.g.; EN 572-1, EN 1748-1-1, etc.

For the characteristics listed in Table 2, for the glass pane types, generally accepted values or calculated values shall be used.

Table 2 - Example of characteristics for glass components

Characteristic	Symbol	Unit
Generally accepted values:		
- density	ρ	kg/m³
- hardness	$HK_{0,1/20}$	GPa
- Young's modulus	E	Pa
- Poisson's ratio	μ	Dimensionless
- Characteristic bending strength	$f_{g,k}$	Pa
- Resistance against sudden temperature changes and temperature differentials		K
- Specific heat capacity	c	J/(kg.K)
- Coefficient of linear expansion	α	K^{-1}
- Thermal conductivity (for *U*-value)	λ	W/(m.K)
- Mean refractive index to visible radiation	n	Dimensionless
- Emissivity	ε	Dimensionless
Measured values:		
- light transmittance	τ_v	Dimensionless
- solar direct transmittance	τ_e	Dimensionless
Calculated values:		
- total energy transmittance	g	Dimensionless

Since the majority of the characteristics of Table 2 are not changed significantly by the laminating process they shall be used for laminated/laminated safety glass.

4.3.2 Determination of characteristics of laminated glass and laminated safety glass

If the laminated glass and/or laminated safety glass manufacturer wishes to claim that any performance characteristic is independent of the production equipment used then the factory production control system shall be in accordance with this European Standard including his specific process control conditions.

4.3.2.1 Safety in the case of fire - Resistance to fire

Fire resistance shall be determined and classified in accordance with EN 13501-2.

NOTE EN 357 may be used as a classification reference specific to fire resistant glazed elements.

4.3.2.2 Safety in the case of fire - Reaction to fire

Reaction to fire shall be determined and classified in accordance with EN 13501-1.

4.3.2.3 Safety in the case of fire - External fire behaviour

Where the manufacturer wishes to declare external fire performance (e.g. when subject to regulatory requirements), the product shall be tested and classified in accordance with prEN 13501-5.

NOTE Compliance with this requirement is not possible until a version of prEN 13501-5 later than 2002 becomes available.

4.3.2.4 Safety in use - Bullet resistance: shatter properties and resistance to attack

Bullet resistance shall be determined and classified in accordance with EN 1063.

4.3.2.5 Safety in use - Explosion resistance: impact behaviour and resistance to impact

Explosion resistance shall be determined and classified in accordance with EN 13541.

4.3.2.6 Safety in use - Burglar resistance: shatter properties and resistance to attack

Burglar resistance shall be determined and classified in accordance with EN 356.

4.3.2.7 Safety in use - Pendulum body impact resistance: shatter properties (safe breakablity) and resistance to impact

Pendulum body impact resistance shall be determined and classified in accordance with EN 12600.

NOTE Laminated glass conforming with EN ISO 14543-3 (No EN 12600 classification) will be declared NPD.

4.3.2.8 Safety in use - Mechanical resistance: Resistance against sudden temperature changes and temperature differentials

The resistance against sudden temperature changes and temperature differentials is a generally accepted value. That value is given in the standards (see Table 1) for the appropriate glass substrate.

4.3.2.9 Safety in use - Mechanical resistance: Resistance against wind, snow, permanent load and/or imposed loads of the glass unit

The ordered assemblies of laminated glass or laminated safety glass (thickness and types of glass components or plastic glazing sheet materials – interlayers) shall ensure the resistance against wind, snow, permanent load, and other mechanical, (quasi-) static action, which shall be checked in accordance with design standards[2].

As long as on the concerned construction or building site no part of the design standards is applicable for the design then the current method of determining mechanical resistance in the country of destination shall be applied.

The manufactured or supplied thickness of laminated glass or laminated safety glass shall conform to the ordered thickness.

4.3.2.10 Protection against noise - Direct airborne sound reduction

The sound reduction indexes shall be determined in accordance with EN 12758.

4.3.2.11 Energy conservation and heat retention - Thermal properties

The thermal transmittance value (*U*-value) shall be determined by calculation in accordance with EN 673 with:

[2] prEN 13474 series is currently being prepared.

— emissivity ε: the declared value of the manufacturer. If the information is not available, the emissivity shall be determined in accordance with EN 12898;

— nominal thickness of the glass panes.

4.3.2.12 Energy conservation and heat retention - Radiation properties: Light transmittance and reflectance

The light transmittance and reflectance shall be determined in accordance with EN 410.

4.3.2.13 Energy conservation and heat retention - Radiation properties: Solar energy characteristics

The solar energy transmittance and reflectance shall be determined in accordance with EN 410.

4.4 Durability

When products conform to the definition of laminated glass or laminated safety glass as 4.2 the characteristics' performances in 4.3.2 are ensured during an economically reasonable working life.

The durability of glass products, including their characteristics, shall be ensured by the following:

— Compliance with this European Standard;

— Compliance with instructions from the glass product manufacturer or supplier.

The manufacturer shall supply specific installation instructions or make reference to appropriate technical specifications.

NOTE The durability of glass products depends on:

-building and construction movements due to various actions;

-building and construction vibrations due to various actions;

-deflection and racking of the glass support due to various actions;

-glass support design (e.g. drainage of infiltrated water in the rebate, prevention of direct contact between glass support members and glass);

-accuracy of glass support and glass support member dimensions;

-quality of the assembling of glass support members up to a glass support;

-quality of installation of the glass support into or onto the buildings or constructions;

-glass support expansion due to adsorbed moisture from the air or other sources;

-the quality of installation of the glass product into or onto its support.

4.5 Dangerous substances

Materials used in products shall not release any dangerous substances in excess of the maximum permitted levels specified in a relevant European Standard for the material or permitted in the national regulations of the Member State of destination.

5 Evaluation of conformity

5.1 General

Evaluation of conformity in accordance with this European Standard shall be as a result of Factory Production Control and Initial Type Testing in accordance with this European Standard:

1) Factory production control;

This shall include the following:

a) Inspection of samples taken at the factory in accordance with a prescribed test plan;

b) Initial inspection of the factory and of factory production control;

c) Continuous surveillance and assessment of the factory production control.

2) Initial type testing of the product;

NOTE There may be a need to involve a third party, with 1b, 1c, and/or 2, for the purpose of regulatory marking (see Annex ZA).

5.2 Initial type testing of the product (see 5.1, 2)

5.2.1 General

All the product's characteristics shall be initial type tested to verify they are in conformity with the requirements of this European Standard. In addition instead of performing any actual testing, initial type testing may make use of:

— generally accepted and/or conventional and/or standardised values, in the Clause 2 referenced standards, or in publications that are referred to in these standards;

— standardised calculation methods and recognised calculation methods in the Clause 2 referenced standards, or in publications that are referred to in these standards;

— test report(s) on the basis of 5.2.1.2 when made available except for the characteristics listed in 5.2.2.

— where components are used whose characteristics have already been determined, by the component manufacturer, on the basis of conformity with other product standards, these characteristics need not be reassessed providing they remain unchanged by the manufacturing process;

— release of dangerous substances may be assessed indirectly by controlling the content of the substance concerned;

— durability may be assessed indirectly by controlling the production processes according to this European Standard;

NOTE 1 Products CE marked in accordance with appropriate harmonised European specifications may be presumed to have the performances stated with the CE marking.

NOTE 2 There may be a need to involve a third party for the purpose of regulatory marking (see Annex ZA).

When actual testing is required then the Initial Type Testing (ITT) shall be undertaken on a sample representative of the product taken from direct production or a prototype, any plant and/ or line.

Whenever a change occurs in the raw material or the production process (subject to the definition of the family), which would change significantly one or more of the characteristics, the type tests shall be repeated for the appropriate characteristics (see Annex D).

5.2.1.1 Multiple lines/sites

If a manufacturer operates more than one line and/or site, the following can reduce the requirement for multiple Initial Type Testing (ITT):

a) The manufacturers' technical file for a product shall specifically covers all sites and/or lines of the same manufacturer[3];

b) The manufacturer shall establish a direct relationship between production control, initial type testing and on-going internal audit testing;

c) The manufacturer has a responsible individual designated to ensure product compliance based on:

— The operation of a consistent Factory Production Control system on all applicable sites and/or lines,

— The manufacturer having obtained evidence that shows the product to be consistent, with respect to both product characteristics and intended use characteristics,

— The manufacturer has in place an internal auditing scheme, including product consistency.

5.2.1.2 Historic Data

Tests previously performed in accordance with the provisions of this European Standard (same product, same characteristic(s), same or more onerous test method, sampling method and attestation of conformity) may be taken into account.

5.2.2 Initial type testing of laminated glass and laminated safety glass

5.2.2.1 General

To establish if a product conforms to the definition of laminated glass or laminated safety glass, initial type testing shall consist of:

— determining that the laminated safety glass material design conforms to EN ISO 12543-2.

— determining that the laminated glass material design conforms to EN ISO 12543-3.

5.2.2.2 Test specimens

The test specimens for the initial type test shall conform to the minimum specification(s) of the product family design for a specific intended use/characteristic (see 4.3.2.1 to 4.3.2.13).

NOTE 1 When the intended uses comprises bullet resistance, explosion resistance and/or burglar resistance, and the product is to be defined as a laminated safety glass then the classification according to EN 12600 can be undertaken on test specimens that consist of two glasses, thickness 3 mm nominal, separated by an interlayer, thickness 0,76 mm nominal. When for a type of glass no 3 mm nominal exists, the nearest thickness should be used. When for a type of interlayer no 0,76 mm nominal exist, the nearest thickness should be used.

[3] The terms 'manufacturer' and 'producer' are understood as being synonyms (see CPD working document NB-CPD/02/019-issued 24 April 2002 – page1)

The test specimens for the radiation test (see Clause 6 of EN ISO 12543-4:1998) shall conform to the minimum specification of the product family related to interlayer type.

NOTE 2 The undertaking of a radiation test can be unnecessary if test reports are supplied by interlayer supplier.

5.2.3 Initial type testing (ITT) of characteristic's performances

All characteristics in 4.3.2 shall be subject to initial type testing in accordance with 5.2.1.

NOTE Annex D includes information on those changes that may require a new ITT

5.3 Factory production control (FPC) and inspection of samples in accordance with a prescribed test plan (see 5.1, 1a and b)

Factory production control means the permanent internal control of production exercised by the manufacturer.

All elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures. This production control system documentation shall ensure a common understanding of quality assurance and enable the achievement of the required product characteristics and the effective operation of the production control system to be checked.

Factory production control shall be according to Annex A of this European Standard.

NOTE 1 A factory production control system similar to EN ISO 9001 made product specific to this European Standard is deemed to satisfy the requirements of this clause.

NOTE 2 There may be a need to involve a third party for the purpose of regulatory marking (see Annex ZA).

Annex A of this European Standard also summarizes the tests to be carried out by the manufacturer as part of the production control in the factory, and as further testing of samples taken at the factory in accordance with a prescribed test plan.

5.4 Initial inspection of factory and of factory production control (see 5.1, 1c)

The initial inspection of the factory and of the factory production control shall cover the parameters listed in Table 3 in conjunction with Annex A.

NOTE There may be a need to involve a third party for the purpose of regulatory marking (see Annex ZA).