SLOVENSKI STANDARD
oSIST prEN 16612:2013

01-september-2013

Steklo v gradbeništvu - Ugotavljanje odpornosti steklenih plošč proti obremenitvi z izračunom in preskušanjem

Glass in building - Determination of the load resistance of glass panes by calculation and testing

Glas im Bauwesen - Bestimmung des Belastungswiderstandes von Glasscheiben durch Berechnung und Prüfung

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Verre dans la construction - Détermination de la résistance des feuilles de verre par calcul et par essai

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Ta slovenski standard je istoveten z: **prEN 16612**

ICS:

81.040.20	Steklo v gradbeništvu	Glass in building

oSIST prEN 16612:2013 **en,fr,de**

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

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English Version

Glass in building - Determination of the load resistance of glass panes by calculation and testing

Verre dans la construction - Détermination de la résistance des feuilles de verre par calcul et par essai

Glas im Bauwesen - Bestimmung des Belastungswiderstandes von Glasscheiben durch Berechnung und Prüfung

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

If this draft becomes a European Standard, 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.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (prEN 16612:2013) 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.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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Introduction

This European Standard gives the principles of determining the load resistance of glass.

The principles of determining the load resistance of glass are based on the structural Eurocode EN 1990: Basis of structural design. The actions are determined in accordance with the structural Eurocode series EN 1991: Basis of structural design - Actions on structures, including the National annexes.

In the design processes, the reliability is part of national competency. For that reason this European Standard foresees that, to conform the rules applied by the Eurocodes, the material partial factors γ_M are subject to nationally determined parameters:

– values for the ultimate limit state (ULS).

The values can be found in an informative (National) annex to this European Standard.

When a Member State does not use its prerogative and no values for the material partial factor have been determined, the recommended values given in this European Standard should be used.

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1 Scope

This European Standard gives the principles of determining the load resistance of glass. It gives

- the general method of calculation, and
- determination of load resistance by testing for any application.

This European Standard does not determine suitability for purpose. Resistance to applied loads is only one part of the design process, which may also need to take into account

- environmental factors (e.g. sound insulation, thermal properties),
- safety characteristics (e.g. fire performance, breakage characteristics in relation to human safety, security)

2 Normative references

The following 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 410, *Glass in building - Determination of luminous and solar characteristics of glazing*

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EN 572, *Glass in building - Basic soda lime silicate glass products*

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EN 572-1, *Glass in building - Basic soda lime silicate glass products - Part 1: Definitions and general physical and mechanical properties*

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

EN 1036, *Glass in building - Mirrors from silver coated float glass for internal use*

EN 1096, *Glass in building - Coated glass*

EN 1279, *Glass in building - Insulating glass units*

EN 1748-1, *Glass in building - Basic borosilicate glass products*

EN 1748-1-1, *Glass in building - Basic borosilicate glass products - Part 1: Definitions and general physical and mechanical properties*

EN 1748-2, *Glass in building - Basic glass ceramics products*

EN 1748-2-1, *Glass in building - Basic glass ceramics products - Part 1: Definitions and general physical and mechanical properties*

EN 1863, *Glass in building - Heat strengthened soda lime silicate glass*

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

EN 1990:2002, *Eurocode – Basis of structural design*

EN 1991, *Actions on structures*

EN 1991-1-4, *Wind actions*

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EN 1997, *Geotechnical design*

EN 1998, *Design of structures for earthquake*

EN 12150, *Glass in building - Thermally toughened soda lime silicate safety glass*

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

EN 12337, *Glass in building - Chemically strengthened soda lime silicate glass*

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

EN ISO 12543, *Glass in building - Laminated and laminated safety glass*

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

EN 13024, *Glass in building - Thermally toughened borosilicate safety glass*

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

EN 13363-2:2005, *Solar protection devices combined with glazing – Calculation of total solar energy transmittance – Part 2: Detailed calculation method*

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EN 14178, *Glass in building - Basic alkaline earth silicate glass products*

EN 14178-1, *Glass in building - Basic alkaline earth silicate glass products - Part 1: Definitions and general physical and mechanical properties*

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EN 14179, *Glass in building - Heat soaked thermally toughened soda lime silicate safety glass*

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

EN 14321-1, *Glass in building - Thermally toughened alkaline earth silicate safety glass*

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

EN 14449, *Glass in building - Laminated glass and laminated safety glass - Evaluation of conformity/Product Standard*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
annealed glass
glass which has been treated during manufacture to minimise the residual stress in the glass, allowing it to be cut by scoring and snapping

EXAMPLES Examples are float glass, drawn sheet glass, patterned glass and wired glass.

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3.2
effective thickness (of laminated glass)
thickness calculated for laminated glass which, when used in place of the glass thickness in an engineering formula, will result in a reasonably accurate determination of the deflection of and / or stress in the laminated glass

3.3
prestressed glass
glass which has been subjected to a strengthening treatment, by heat or chemicals, which induces a compressive surface stress into the whole surface of the glass, balanced by a tensile stress within the body of the glass

EXAMPLES Examples are thermally toughened safety glass, heat strengthened glass and chemically strengthened glass.

3.4
enamelled glass
glass which has a glass powder emulsion applied to the surface, by e.g. painting or screen printing, which is subsequently fired into the surface of the glass

EXAMPLE Examples are enamelled heat strengthened glass, enamelled toughened glass and enamelled heat soaked toughened glass.

3.5
main structure
beams, columns, floor forming the main structure of the building (see Figure 1)

Note 1 to entry: The main structure is commonly class of consequence CC2 or CC3.

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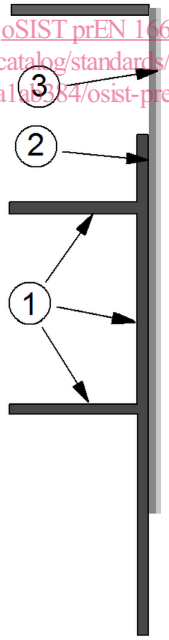

Key
1 main structure
2 secondary structure
3 infill panel

Figure 1 — Identification of structure

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Note 2 to entry: Elements of main structure are structural in so far as they carry themselves and secondary structures, and, in case of failure, endanger the fundamental stability of the building. The main structural elements must have a safety and a reliability appropriate to their design use and larger factor of safety than the one applicable to the secondary structure or to the non structural infill elements. These main structures are the reference structure and constitute the point of reference for the coefficients determined hereafter.

3.6
secondary structure
windows assembly frames, which are secondary structures insofar as their stability is their own

EXAMPLE An example of glass secondary structure is glass fins.

Note 1 to entry: Secondary structures are commonly class of consequence CC1 or CC2.

Note 1 to entry: A failure of these secondary structures only affects the infill panels or the non-structural elements carried by this secondary structure and in no case has any effects on the main structure of the building. The secondary structures can be replaced independently of the main structures.

3.7
infill panels
elements placed in structures in order to close a building and which do not contribute in any manner to the stability of the main structure

Note 1 to entry: Infill panels are commonly a class of consequence lower than CC1.

3.8
classes of consequence
classes which allow for the fact that the failure of the secondary structures or the infill panels does not have the same economic and/or human consequences of that of the failure of the main structures

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Note 1 to entry: An adapted factor of safety is thus acceptable on the actions. The coefficient of class of consequence, k_{FI}, expresses the adaptation of the factor of safety applicable to the secondary structures and infill panels compared to that applicable for the main structures according to the EN 1990, Annex B. This coefficient is integrated in the partial coefficients relating to the actions, γ_Q and γ_G, except in the case where the action has a favourable effect in a combination of actions. The coefficient of class of consequence does not apply to the partial coefficients relating to materials.

3.9
unfactored load
action as obtained from EN 1991 (e.g. wind load, snow load), including all the factors relevant for determining the action, but before applying the partial factors for actions γ_Q, γ_G and/or ψ

4 Symbols and abbreviations

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

A	Surface area of the pane (= a x b)
a	Shorter dimension of the pane
a^*	Characteristic length of an insulating glass unit
b	Longer dimension of the pane
C_d	Limiting design value of the relevant serviceability criterion
c_H	Coefficient for the effect of altitude change on isochore pressure (=0,12 kPa/m)

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c_T	Coefficient for the effect of cavity temperature change on isochore pressure (=0,34 kPa/K)
E	Young's modulus
E_d	Effect of the action(s)
$E_{SLS;d}$	Serviceability limit state value of the effect of the action(s)
$E_{ULS;d}$	Ultimate limit state value of the effect of the action(s)
$E_{ULS;G}$	Ultimate limit state value of the effect of a permanent action
$E_{ULS;i}$	Ultimate limit state value of the effect of a non-dominant action
$E_{ULS;1}$	Ultimate limit state value of the effect of the dominant action
$E\{F_{SLS;d}\}$	Calculation of the effect of the serviceability limit state design value
$E\{F_{ULS;d}\}$	Calculation of the effect of the ultimate limit state design value
F_d	Design value of the action
$F_{d;1}$	Design value of the action on pane 1 of an insulating glass unit
$F_{d;2}$	Design value of the action on pane 2 of an insulating glass unit
$F_{SLS;d}$	Serviceability limit state design value of a single action or of a combination of actions.
$F_{ULS;d}$	Ultimate limit state design value of a single action or of a combination of actions.
$f_{b;k}$	Characteristic value of the bending strength of prestressed glass
$f_{g;d}$	Design value of strength for the surface of glass panes
$f_{g;k}$	Characteristic value of the bending strength of annealed glass
G	Value of self weight load
G_2	Value of self weight load of pane 2
H	Altitude
H_P	Altitude of production of insulating glass unit
h	Nominal thickness of the pane
h_1	Nominal thickness of pane 1 of an insulating glass unit or ply 1 of a laminated glass
h_2	Nominal thickness of pane 2 of an insulating glass unit or ply 2 of a laminated glass
h_3	Nominal thickness of pane 3 of an insulating glass unit or ply 3 of a laminated glass
h_e	External heat transfer coefficient
$h_{ef;w}$	Effective thickness of a laminated glass for calculating out-of-plane bending deflection
$h_{ef;\sigma;j}$	Effective thickness of a laminated glass for calculating out-of-plane bending stress of ply j

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h_i	Internal heat transfer coefficient
h_j	Nominal thickness of pane *j* of an insulating glass unit or ply *j* of a laminated glass
h_k	Nominal thickness of pane *k* of an insulating glass unit or ply *k* of a laminated glass
$h_{m;1}$	The distance of the mid-plane of the glass ply 1 from the mid-plane of the laminated glass
$h_{m;2}$	The distance of the mid-plane of the glass ply 2 from the mid-plane of the laminated glass
$h_{m;3}$	The distance of the mid-plane of the glass ply 3 from the mid-plane of the laminated glass
$h_{m;j}$	The distance of the mid-plane of the glass ply *j* from the mid-plane of the laminated glass
$h_{m;k}$	The distance of the mid-plane of the glass ply *k* from the mid-plane of the laminated glass
h_s	Cavity heat transfer coefficient
h_{s1}	Cavity heat transfer coefficient - cavity 1
h_{s2}	Cavity heat transfer coefficient - cavity 2
J_A	Variable used in calculations of cavity temperatures for triple glazed insulating glass units
J_B	Variable used in calculations of cavity temperatures for triple glazed insulating glass units
J_C	Variable used in calculations of cavity temperatures for triple glazed insulating glass units
J_D	Variable used in calculations of cavity temperatures for triple glazed insulating glass units
k_1	Coefficient used in the calculation of large deflection stresses
k_4	Coefficient used in the calculation of large deflection deflections
k_5	Coefficient used in the calculation of large deflection volume changes
k_{FI}	Coefficient of class of consequence expressing the reduction of safety applicable to the secondary structures and infill panels compared to that applicable for the main structures
k_{mod}	Factor for the load duration
$k_{mod;1}$	Factor for the load duration of the dominant action in a load combination
$k_{mod;c}$	Factor for the load duration when there are combined loads
$k_{mod;G}$	Factor for the load duration of a permanent in a load combination
$k_{mod;i}$	Factor for the load duration of a non-dominant action in a load combination
k_{sp}	Factor for the glass surface profile
k_v	Factor for strengthening of prestressed glass
p	Pressure
p_0	Isochore pressure for an insulating glass unit

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