SLOVENSKI STANDARD
kSIST-TS FprCEN/TS 19100-1:2021

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Projektiranje steklenih konstrukcij - 1. del: Osnove projektiranja in materiali

Design of glass structures - Part 1: Basis of design and materials

Bemessung und Konstruktion von Tragwerken aus Glas - Teil 1: Grundlagen der Bemessung und Materialien

Conception et calcul des structures en verre - Partie 1 : Bases de conception et matériaux

Ta slovenski standard je istoveten z: **FprCEN/TS 19100-1**

ICS:

91.080.99 Druge konstrukcije Other structures

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TECHNICAL SPECIFICATION

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TECHNISCHE SPEZIFIKATION

FINAL DRAFT FprCEN/TS 19100-1

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ICS 91.080.99

English Version

Design of glass structures - Part 1: Basis of design and materials

Conception et calcul des structures en verre - Partie 1 : Bases de conception et matériaux

Bemessung und Konstruktion von Tragwerken aus Glas - Teil 1: Grundlagen der Bemessung und Materialien

This draft Technical Specification is submitted to CEN members for Vote. It has been drawn up by the Technical Committee CEN/TC 250.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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European foreword

This document (FprCEN/TS 19100-1:2021) has been prepared by Technical Committee CEN/TC 250 “Structural Euro-codes”, the secretariat of which is held by BSI. CEN/TC 250 is responsible for all Structural Eurocodes and has been assigned responsibility for structural and geotechnical design matters by CEN.

This document is currently submitted to the Vote on TS.

This document has been prepared under Mandate M/515 issued to CEN by the European Commission and the European Free Trade Association.

This document has been drafted to be used in conjunction with relevant execution, material, product and test standards, and to identify requirements for execution, materials, products and testing that are relied upon by this document.

0 Introduction

0.1 Introduction to the Eurocodes

The Structural Eurocodes comprise the following standards generally consisting of a number of Parts:

- EN 1990 Eurocode: Basis of structural and geotechnical design
- EN 1991 Eurocode 1: Actions on structures
- EN 1992 Eurocode 2: Design of concrete structures
- EN 1993 Eurocode 3: Design of steel structures
- EN 1994 Eurocode 4: Design of composite steel and concrete structures
- EN 1995 Eurocode 5: Design of timber structures
- EN 1996 Eurocode 6: Design of masonry structures
- EN 1997 Eurocode 7: Geotechnical design
- EN 1998 Eurocode 8: Design of structures for earthquake resistance
- EN 1999 Eurocode 9: Design of aluminium structures

The Eurocodes are intended for use by designers, clients, manufacturers, constructors, relevant authorities (in exercising their duties in accordance with national or international regulations), educators, software developers, and committees drafting standards for related product, testing and execution standards.

NOTE Some aspects of design are most appropriately specified by relevant authorities or, where not specified, can be agreed on a project-specific basis between relevant parties such as designers and clients. The Eurocodes identify such aspects making explicit reference to relevant authorities and relevant parties.

0.2 Introduction to FprCEN/TS 19100 (all parts)

FprCEN/TS 19100 applies to the structural design of mechanically supported glass components and assemblies of glass components. It complies with the principles and requirements for the safety and serviceability of structures, the basis of their design and verification that are given in EN 1990, *Basis of structural design*.

FprCEN/TS 19100 is subdivided into three parts:

— *Part 1: Basis of design and materials*

— *Part 2: Design of out-of-plane loaded glass components*

— *Part 3: Design of in-plane loaded glass components and mechanical joints*

0.3 Introduction to FprCEN/TS 19100-1

FprCEN/TS 19100-1 applies to the structural design of mechanically supported glass components and assemblies of glass components according FprCEN/TS 19100-2 and FprCEN/TS 19100-3.

0.4 Verbal forms used in the Eurocodes

The verb “shall" expresses a requirement strictly to be followed and from which no deviation is permitted in order to comply with the Eurocodes.

The verb “should” expresses a highly recommended choice or course of action. Subject to national regulation and/or any relevant contractual provisions, alternative approaches could be used/adopted where technically justified.

The verb “may" expresses a course of action permissible within the limits of the Eurocodes.

The verb “can" expresses possibility and capability; it is used for statements of fact and clarification of concepts.

0.5 National annex for FprCEN/TS 19100-1

FprCEN/TS 19100-1 gives values within notes indicating where national choices can be made. Therefore, a national document implementing FprCEN/TS 19100-1 can have a National Annex containing all Nationally Determined Parameters to be used for the assessment of buildings and civil engineering works in the relevant country.

When not given in the National Annex, the national choice will be the default choice specified in the relevant Technical Specification.

The national choice can be specified by a relevant authority.

When no choice is given in the Technical Specification, in the National Annex, or by a relevant authority, the national choice can be agreed for a specific project by appropriate parties.

National choice is allowed in FprCEN/TS 19100-1 through the following clauses:

3.1.16 NOTE

4.1.2. (1) NOTE 2

4.2.4 (1) NOTE 2

4.4.2 (2) NOTE

4.4.2 (3) NOTE

5.2 (1) NOTE 4

7.2.2 (2) NOTE

7.2.2 (3) NOTE

7.2.2 (5) NOTE

7.2.4 (2) NOTE 2

7.2.4 (2) NOTE 3

8.2 (2) NOTE

8.3.2 (1) NOTE 1

Clause 9 (2) NOTE

National choice is allowed in FprCEN/TS 19100-1 on the application of the following informative annexes:

Annex A Bending strength resistance based on nominal product strengths

Annex B Bending strength resistance based on intrinsic glass strength and glass surface pre-stress

Annex C Thermally induced stress caused by temperature differentials in the glass pane

Annex D Risk Assessment

The National Annex can contain, directly or by reference, non-contradictory complementary information for ease of implementation, provided it does not alter any provisions of the Eurocodes.

1 Scope

1.1 Scope of FprCEN/TS 19100-1

(1) FprCEN/TS 19100-1 gives basic design rules for mechanically supported glass components. This document is concerned with the requirements for resistance, serviceability, fracture characteristics and glass component failure consequences in relation to human safety, robustness, redundancy and durability of glass structures.

(2) This document covers the basis of design, materials, durability and structural design.

(3) This document also covers construction rules for the structural design of glass components.

1.2 Assumptions

(1) The assumptions of EN 1990 apply to FprCEN/TS 19100-1.

(2) This document is intended to be used in conjunction with EN 1990, EN 1991 (all parts), EN 1993-1-1, EN 1995-1-1, EN 1998-1, EN 1999-1-1 and EN 12488.

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.

NOTE See the Bibliography for a list of other documents cited that are not normative references, including those referenced as recommendations (i.e. through 'should' clauses) and permissions (i.e. through 'may' clauses).

EN 572 (all parts), *Glass in building - Basic soda lime silicate glass products*

EN 1279-5:2018, *Glass in building - Insulating glass units - Part 5: Product standard*

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 (all parts), *Eurocode 1 - Actions on structures*

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

EN 12488, *Glass in building - Glazing recommendations - Assembly principles for vertical and sloping glazing*

EN 13022-1, *Glass in building - Structural sealant glazing - Part 1: Glass products for structural sealant glazing systems for supported and unsupported monolithic and multiple glazing*

EN 13022-2, *Glass in building - Structural sealant glazing - Part 2: Assembly rules*

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

EN 15434, *Glass in building - Product standard for structural and/or ultra-violet resistant sealant (for use with structural sealant glazing and/or insulating glass units with exposed seals)*

3 Terms, definitions and symbols

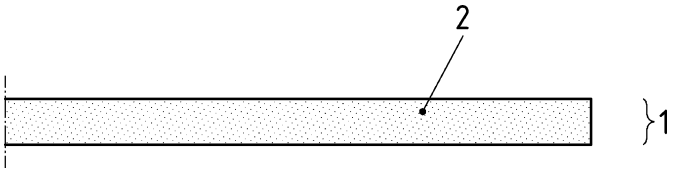
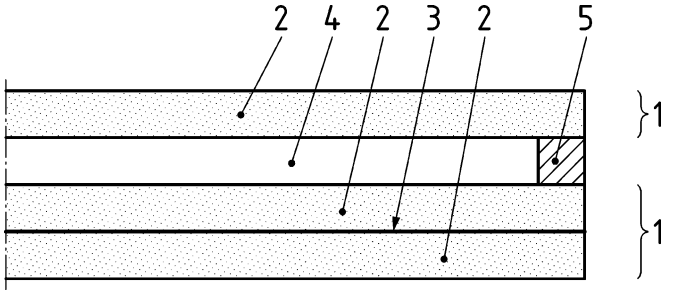
3.1 Terms and definitions

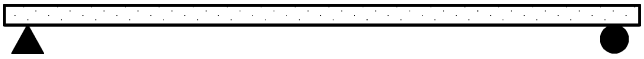
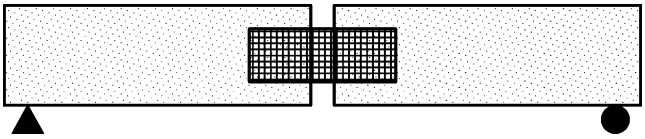
For the purposes of this document, the following terms and definitions apply.

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

- ISO Online browsing platform: available at https://www.iso.org/obp
- IEC Electropedia: available at http://www.electropedia.org/

Table 3.1— Glass component, glass member and system of glass members

Glass component	Monolithic glass (MG)	 **Key** 1 pane 2 single ply
	Laminated glass (LG)	 **Key** 1 pane 2 ply 3 interlayer
	Insulated glass unit (IGU)	 **Key** 1 pane 2 ply 3 interlayer 4 cavity 5 spacer

Glass member	Glass component + boundary conditions	
System of glass members	Glass components + their interconnections + boundary conditions	

3.1.1
glass component
glass product being monolithic, laminated, and/or insulating glass unit, after installation

Note 1 to entry: See Table 3.1.

3.1.2
glass member
glass component with clear mechanical boundary conditions so that the effects (stresses or sectional forces) of a defined action can be calculated

3.1.3
insulating glass unit
IGU
assembly consisting of at least two panes of glass, separated by one or more spacers, hermetically sealed along the periphery, mechanically stable and durable

3.1.4
limit State Scenario
LSS
set of limit states (SLS, ULS, FLS and PFLS) to be verified whilst designing a glass component

3.1.5
ultimate Limit State
ULS
state associated with collapse or with other similar forms of structural failure

Note 1 to entry: Generally, corresponds to the maximum load-carrying resistance of a structure or structural member.

3.1.6
serviceability Limit State
SLS
state that correspond to conditions beyond which specified service requirements for a structure or structural member are no longer met

3.1.7
failure
event where the total loss of structural resistance of the glass component or supports or bonding occurs

3.1.8
fracture
macroscopic physical disintegration due to crack propagation in glass

Note 1 to entry: For monolithic sections, a glass fracture results into a failure of the component; for laminated sections, a glass fracture of a ply or even of all plies does not necessarily result into a failure of the component.

3.1.9
fracture Limit State
FLS
state beyond which, during accidental fracture of a glass component or part of glass component

— the prevention of injuries by contact with glass fragments and/or,

— the prevention of body to pass through and/or,

— the ability to limit the failure to that glass component or part of glass component

are no longer satisfied without an appropriate choice of glass mode of breakage, boundary conditions and other mechanical characteristics

3.1.10
post Fracture Limit State
PFLS
state beyond which, in case of accidental failure of a glass component, the required residual load bearing capacity provided by

— redundancy of the glass component,

— undamaged ply(ies) of that glass component,

— structure alternative load path(s)

during a defined period is no longer satisfied

3.1.11
redundancy
provision or existence of additional load paths or structural systems than strictly necessary to resist design actions

3.1.12
robustness
ability of a structure to withstand unforeseen adverse events without being damaged to an extent disproportionate to the original cause

Note 1 to entry: See EN 1990 and EN 1991-1-7.

3.1.13
ply
sheet of monolithic glass, cut to size and shape and possibly edge-worked

3.1.14
in-plane loaded glass component
glass component subjected to a significant force component parallel to the glass surface

3.1.15
out-of-plane loaded glass component
glass component subjected to a significant force component perpendicular to the glass surface

3.1.16
vertical glass component
glass component which subtends an angle of no more than ± 15° to the vertical

Note 1 to entry: The value of the angle is given in EN 13830, unless the National Annex gives different values for use in a country.

3.1.17
interlayer
one or more layers of material acting as an adhesive and separator between plies of glass and/or plastic glazing sheet material

Note 1 to entry: The interlayer can also give additional performance to the finished product, for example impact resistance, resistance to fire, solar control and acoustic insulation.

Note 2 to entry: The interlayer itself can also encapsulate non-adhesive films and plates, wires, grids, etc.

3.1.18
laminated glass
LG
assembly consisting of one ply of glass with one or more plies of glass and/or plastics sheet material joined together with one or more interlayers (see EN ISO 12543-1)

Note 1 to entry: The number of glass plies and the requirements on the interlayer depend on the application of the glass component.

3.1.19
laminated safety glass
laminated glass, where in case of breakage the interlayer serves to retain the glass fragments, limits the size of opening, offers residual resistance and reduces the risk of cutting or piercing injuries (see EN ISO 12543-1)

3.1.20
effective thickness
mechanically equivalent thickness used in structural calculation to represent the “as if monolithic thickness” of laminated glass when calculating its resistance or stiffness

3.1.21
thermal stress
stress induced by thermal expansion, e.g. due to temperature differences in the glass

3.1.22
cavity pressure
pressure applied to the panes of insulating glass units due to the internal volume of the hermetically sealed cavity or cavities being affected by variable cavity loading and permanent cavity loading

3.1.23
variable cavity loading
pressure acting on the panes of insulating glass unit resulting from the effect of sealed cavity volume variations due to temperature and atmospheric changes