



**SLOVENSKI STANDARD**  
**SIST-TS CEN/TS 19100-1:2022**

**01-februar-2022**

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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

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**Ta slovenski standard je istoveten z: CEN/TS 19100-1:2021**

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**ICS:**

91.080.99      Druge konstrukcije      Other structures

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TECHNICAL SPECIFICATION  
SPÉCIFICATION TECHNIQUE  
TECHNISCHE SPEZIFIKATION

**CEN/TS 19100-1**

November 2021

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 Technical Specification (CEN/TS) was approved by CEN on 25 July 2021 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

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

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

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## European foreword

This document (CEN/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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

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.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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**CEN/TS 19100-1:2021 (E)****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 CEN/TS 19100 (all parts)**

CEN/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*.

CEN/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 their mechanical joints*

**0.3 Introduction to CEN/TS 19100-1**

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

CEN/TS 19100-1 gives values within notes indicating where national choices can be made. Therefore, a national document implementing CEN/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 CEN/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 1

7.2.2 (3) NOTE

7.2.2 (4) 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

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**CEN/TS 19100-1:2021 (E)**

National choice is allowed in CEN/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.

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## 1 Scope

### 1.1 Scope of CEN/TS 19100-1

(1) CEN/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 CEN/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*

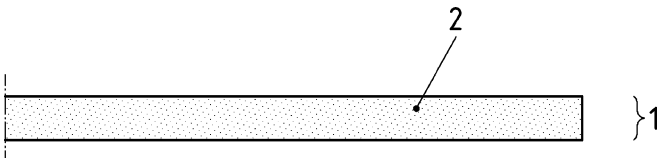
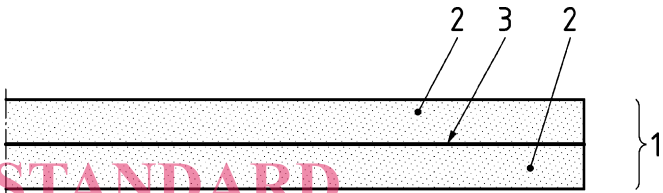
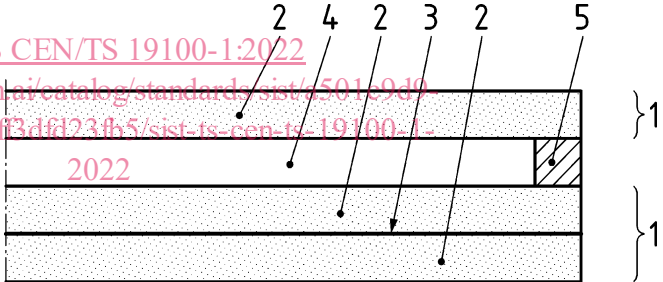
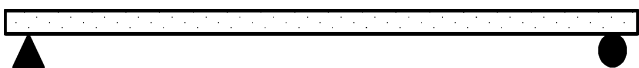
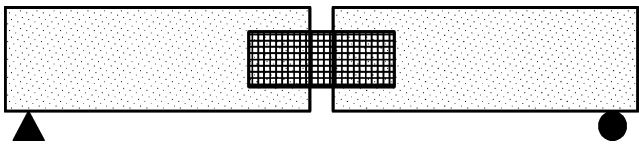
EN 15434, *Glass in building - Product standard for structural and/or ultra-violet resistant sealant (for use with structural sealant glazing and/or insulating glass units with exposed seals)*

### 3 Terms, definitions and symbols

#### 3.1 Terms and definitions

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

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

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

Note 1 to entry: See Table 3.1.

**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.

[SOURCE: prEN 1990:2021, 3.1.2.15]

**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

[SOURCE: prEN 1990:2021, 3.1.2.16]

**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.

**CEN/TS 19100-1:2021 (E)****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

[SOURCE: prEN 1990:2021, 3.1.2.29]

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  $\pm 15^\circ$  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