

English Version

Design of glass structures - Part 3: Design of in-plane loaded glass components and their mechanical joints

Conception et calcul des structures en verre - Partie 3 :
Conception et calcul des composants en verre chargés
dans leur plan et de leurs assemblages

Bemessung und Konstruktion von Tragwerken aus
Glas - Teil 3: In Scheibenebene belastete Bauteile und
mechanische Verbindungen

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.

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European foreword

This document (CEN/TS 19100-3:2021) 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 given 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.

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 19100-1 (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 and geotechnical 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 19100-3

This document applies to the structural design of in-plane loaded glass components in conjunction with CEN/TS 19100-1 and CEN/TS 19100-2.

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 19100-3

This document gives values within notes indicating where national choices can be made. Therefore, a national document implementing CEN/TS 19100-3 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 19100-3 through the following clauses:

4.1 (1) NOTE

4.2.1 (2) NOTE

4.2.1 (5) NOTE 1

4.2.1 (5) NOTE 2

4.2.3 (5)

4.3.1 (2) NOTE

4.3.1 (3) NOTE

4.3.1 (7) NOTE

7.3.2 (1) NOTE 2

8.2 (3) NOTE 1

10.3.1 (4) NOTE 1

10.3.1 (4) NOTE 2

10.3.3 (1) NOTE

10.3.4.3 (2) NOTE 1

10.4.1 (5) NOTE

National choice is allowed in CEN/TS 19100-3 on the application of the following informative annexes:

Annex A, Calculation of the critical buckling load N_{cr} or critical bending moment $M_{cr,LT}$

Annex B, Calculation of $I_{z,eff}$ and $I_{T,eff}$ of laminated glass

Annex C, Calculation of K_m - values for simplified calculation

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 CEN/TS 19100-3

(1) This document gives design rules for mechanically supported glass components primarily subjected to in-plane loading. It also covers construction rules for mechanical joints for in-plane loaded glass components.

NOTE In-plane loaded glass elements are primarily subjected to in-plane loads, e.g. transferred from adjacent parts of a structure. They can also be subjected to out-of-plane loading.

1.2 Assumptions

(1) The assumptions of EN 1990 apply to this document.

(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 1990, *Eurocode - Basis of structural and geotechnical design*

CEN/TS 19100-1:2021, *Design of glass structures - Part 1: Basis of design and materials*

CEN/TS 19100-2:2021, *Design of glass structures - Part 2: Design of out-of-plane loaded glass components*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in CEN/TS 19100-1:2021 and CEN/TS 19100-2:2021 and the following apply.

3.1.1

shear element made of glass

glass element sustaining on purpose loads or stresses in-plane (F_x , F_z , p_x , p_z)

Note 1 to entry: The element may be loaded also by loading transversal to the plane (q_y).

3.1.2

buckling length

length of an equivalent member with pinned ends, which has the same buckling resistance as a given member or segment of member, whereas the system length corresponds to the distance between two consecutive points in a given plane where a member is braced against lateral displacement in this plane, or between one such point and the end of the member

3.1.3

second order analysis

geometrically non-linear analysis taking account of the out-of-plane deflections whilst calculating equilibrium of stresses or sectional forces of a glass pane