BS EN 1999-1-1:2023

BSI Standards Publication

Eurocode 9 — Design of aluminium structures

Part 1-1: General rules

bsi.

National foreword

This British Standard is the UK implementation of EN 1999-1-1:2023. It supersedes BS EN 1999-1-1:2007+A2:2013, which will be withdrawn on 30 March 2028.

The UK participation in its preparation was entrusted to Technical Committee B/525/9, Structural use of aluminium.

A list of organizations represented on this committee can be obtained on request to its committee manager.

National choice is allowed in this standard where explicitly stated within notes. The National Annex to this standard contains the national choices to be used for buildings and civil engineering works constructed in the UK.

The first generation of EN Eurocodes was published between 2002 and 2007, with conflicting British Standards withdrawn in 2010. This document forms part of the second generation of EN Eurocodes.

The second generation of EN Eurocodes is expected to be published between 2023 and 2026. These documents are being published as soon as they are available. This is being done to enable users to prepare for the transition from the first generation to second generation of EN Eurocodes.

UK adoptions of the first generation of EN Eurocodes will be withdrawn by BSI on 30 March 2028. Until that date, the first generation documents should be considered as the applicable standards for buildings and civil engineering works constructed in the UK unless otherwise specified by the relevant authority or in the specification for a particular project.

This standard is intended to be used with its National Annex and other referenced documents, including other second generation Eurocodes, as an interdependent suite of documents.

While the use of provisions in this standard in conjunction with first generation Eurocodes is not precluded, it should be undertaken with care and should only be done when users are satisfied that it will not result in a lower level of reliability than the minimum level set in the first generation Eurocodes and associated UK National Annexes.

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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 (EN 1999-1-1:2023) has been prepared by Technical Committee CEN/TC250 "Structural Eurocodes", 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 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 September 2027 and conflicting national standards shall be withdrawn at the latest by March 2028.

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 supersedes EN 1999-1-1:2007.

The main changes compared to the previous edition are listed below:

— Reduction in the number of invitations for Nationally Determined Parameters;

— Introduction of a new material, alloy EN-AW 5383;

— Revision and improvement of the buckling curves;

— Addition of the case of out-of-plane loading on stiffened plating;

— New connection types: Friction Stir Welding, Bolt-Channels and Screw Grooves;

— Improvement and additional provisions for T-stub connection model in tension;

— Clarification of the distinction between buckling members with longitudinal welds and members with transverse welds;

— New provisions covering when the initial bow imperfection L/1000 for members is not fulfilled (Annex V);

— New Annex to determine the extent of HAZ from hardness tests (Annex Q);

— New Annex on weld studs connected by arc stud welding with tip ignition (Annex R);

— New Annex on bridges (Annex S);

— New Annex on lattice space roof structures (Annex T);

— New Annex on composite aluminium-concrete beams (Annex U).

The first generation of EN Eurocodes was published between 2002 and 2007. This document forms part of the second generation of the Eurocodes, which have been prepared under Mandate M/515 issued to CEN by the European Commission and the European Free Trade Association.

The Eurocodes have 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 the Eurocodes.

The Eurocodes recognize the responsibility of each Member State and have safeguarded their right to determine values related to regulatory safety matters at national level through the use of National Annexes.

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 implement this European Standard: 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, Türkiye 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

— New parts are under development, e.g. Eurocode for design of structural glass

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 EN 1999 (all parts)

EN 1999 (all parts) applies to the design of buildings and civil engineering and structural works made of aluminium. 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.

EN 1999 (all parts) is only concerned with requirements for resistance, serviceability, durability and fire resistance of aluminium structures. Other requirements, e.g. concerning thermal or sound insulation, are not considered.

EN 1999 (all parts) does not cover the special requirements of seismic design. Provisions related to such requirements are given in EN 1998, which complements, and is consistent with EN 1999.

For the design of new structures, EN 1999 is intended to be used, for direct application, together with EN 1990, EN 1991, EN 1992, EN 1993, EN 1994, EN 1995, EN 1997, EN 1998 and EN 1999.

Eurocode 9 is subdivided in various parts:

— EN 1999-1-1 Design of Aluminium Structures — Part 1-1: General rules;

— EN 1999-1-2 Design of Aluminium Structures — Part 1-2: Structural fire design;

— EN 1999-1-3 Design of Aluminium Structures — Part 1-3: Structures susceptible to fatigue;

— EN 1999-1-4 Design of Aluminium Structures — Part 1-4: Cold-formed structural sheeting;

— EN 1999-1-5 Design of Aluminium Structures — Part 1-5: Shell structures.

0.3 Introduction to EN 1999-1-1

This document gives basic design rules for structures made of wrought aluminium alloys and limited guidance for cast alloys.

This document is the first of the five parts of EN 1999. It gives generic design rules that are intended to be used with the other parts EN 1999-1-2 to EN 1999-1-5.

EN 1999-1-1 can be used for design cases not covered by the Eurocodes (other structures, other actions, other materials) and serving as a reference document for other CEN TC´s concerning structural matters.

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 EN 1999-1-1

National choice is allowed in this standard where explicitly stated within notes. National choice includes the selection of values for Nationally Determined Parameters (NDPs).

The national standard implementing EN 1999-1-1 can have a National Annex containing all national choices to be used for the design of buildings and civil engineering works to be constructed in the relevant country.

When no national choice is given, the default choice given in this standard is to be used.

When no national choice is made and no default is given in this standard, the choice can be specified by a relevant authority or, where not specified, agreed for a specific project by appropriate parties.

National choice is allowed in EN 1999-1-1 through the following clauses:

4.1.2(3)	4.4.3(2)	4.5(1)	5.2.1(1)
9.1(2)	9.2(2)	10.6.2.2(1)	A.3.2(1)
A.4(1)	A.4(3) – 2 choices	A.4(4)	A.5(1)
E.3.1(2)	E.3.1(3)	H.2(6)	O.2(2) – 2 choices
S.2(2)	S.4.1.2(3)	S.4.1.2(4)	S.6(3)
S.10.4(1)			

National choice is allowed in EN 1999-1-1 on the application of the following informative annexes:

Annex B	Annex C	Annex D	Annex F
Annex G	Annex H	Annex I	Annex J
Annex K	Annex L	Annex M	Annex N
Annex O	Annex P	Annex Q	Annex R
Annex T	Annex U		

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 EN 1999-1-1

(1) EN 1999-1-1 gives basic design rules for structures made of wrought aluminium alloys and limited guidance for cast alloys (see Clause 5 and Annex C).

This document does not cover the following, unless otherwise explicitly stated in this document:

— components with material thickness less than 0,6 mm;

— welded components with material thickness less than 1,5 mm;

— connections with:

  — steel bolts and pins with diameter less than 5 mm;

  — aluminium bolts and pins with diameter less than 8 mm;

  — rivets and thread forming screws with diameter less than 3,9 mm.

1.2 Assumptions

(1) In addition to the general assumptions of EN 1990 the following assumptions apply:

— execution complies with EN 1090-3 and EN 1090-5;

— the mechanical properties comply with the product standards listed in 5.2.2.

(2) EN 1999 is intended to be used in conjunction with:

— European Standards for construction products relevant for aluminium structures;

— EN 1090-1, *Execution of steel structures and aluminium structures – Part 1: Requirements for conformity assessment of structural components;*

— EN 1090-3, *Execution of steel structures and aluminium structures – Part 3: Technical requirements for aluminium structures;*

— EN 1090-5, *Execution of steel structures and aluminium structures – Part 5: Technical requirements for cold-formed structural aluminium elements and cold-formed structures for roof, ceiling, floor and wall applications.*