BS EN 1993-1-1:2022

BSI Standards Publication

Eurocode 3 — Design of steel structures

Part 1-1: General rules and rules for buildings

bsi.

National foreword

This British Standard is the UK implementation of EN 1993-1-1:2022. It supersedes BS EN 1993-1-1:2005+A1:2014, which will be withdrawn on 30 March 2028.

The UK participation in its preparation was entrusted to Technical Committee CB/203, Design & execution of steel structures.

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The first generation of EN Eurocodes was published between 2002 and 2007, with conflicting British Standards withdrawn in 2010.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UK adoptions of the first generation of EN Eurocodes will be withdrawn by BSI on 30 March 2028.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
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EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 1993-1-1:2022) has been prepared by Technical Committee CEN/TC 250 “Structural 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 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 1993-1-1:2005 and its amendments and corrigenda.

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.

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

— the scope of EN 1993-1-1 was extended to steel grades up to S700;

— the scope was extended to the design of elliptical hollow sections;

— the methods for the structural analysis were clarified and summarized in a flowchart;

— a new method for the design of semi-compact sections (Class 3) has been implemented;

— the effects of torsion on the resistance of cross-sections and members have been improved;

— a new method for the verification of beams to lateral torsional buckling has been introduced;

— the simplified method for lateral torsional buckling has been fully revised;

— the design of uniform members with mono-symmetric cross-sections was explicitly covered;

— a simplified design approach has been introduced for fatigue;

— an informative annex provides statistical data of material and dimensional properties as used for the calibration of the partial factors.

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

0.2 Introduction to EN 1993 (all parts)

EN 1993 (all parts) applies to the design of buildings and civil engineering works in steel. 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.

EN 1993 (all parts) is concerned only with requirements for resistance, serviceability, durability and fire resistance of steel structures. Other requirements, e.g. concerning thermal or sound insulation, are not covered.

EN 1993 is subdivided in various parts:

EN 1993-1, *Design of steel structures — Part 1: General rules and rules for buildings;*

EN 1993-2, *Design of steel structures — Part 2: Steel bridges;*

EN 1993-3, *Design of steel structures — Part 3: Towers, masts and chimneys;*

EN 1993-4, *Design of steel structures — Part 4: Silos and tanks;*

EN 1993-5, *Design of steel structures — Part 5: Piling;*

EN 1993-6, *Design of steel structures — Part 6: Crane supporting structures;*

EN 1993-7, *Design of steel structures — Part 7: Design of sandwich panels* (under preparation).

EN 1993-1 in itself does not exist as a physical document, but comprises the following 14 separate parts, the basic part being EN 1993-1-1:

EN 1993-1-1, *Design of steel structures — Part 1-1: General rules and rules for buildings;*

EN 1993-1-2, *Design of steel structures — Part 1-2: Structural fire design;*

EN 1993-1-3, *Design of steel structures — Part 1-3: Cold-formed members and sheeting;*

NOTE Cold-formed hollow sections supplied according to EN 10219 (all parts) are covered in EN 1993-1-1.

EN 1993-1-4, *Design of steel structures — Part 1-4: Stainless steel structures;*

EN 1993-1-5, *Design of steel structures — Part 1-5: Plated structural elements;*

EN 1993-1-6, *Design of steel structures — Part 1-6: Strength and stability of shell structures;*

EN 1993-1-7, *Design of steel structures — Part 1-7: Plate assemblies with elements under transverse loads;*

EN 1993-1-8, *Design of steel structures — Part 1-8: Design of joints;*

EN 1993-1-9, *Design of steel structures — Part 1-9: Fatigue;*

EN 1993-1-10, *Design of steel structures — Part 1-10: Material toughness and through-thickness properties;*

EN 1993-1-11, *Design of steel structures — Part 1-11: Design of structures with tension components;*

EN 1993-1-12, *Design of steel structures — Part 1-12: Additional rules for steel grades up to S960;*

EN 1993-1-13, *Design of steel structures — Part 1-13: Rules for beams with large web openings;*

EN 1993-1-14, *Design of steel structures — Part 1-14: Design assisted by finite element analysis* (under preparation).

All parts numbered EN 1993-1-2 to EN 1993-1-14 treat general topics that are independent from the structural type such as structural fire design, cold-formed members and sheeting, stainless steels, plated structural elements, etc.

All parts numbered EN 1993-2 to EN 1993-7 treat topics relevant for a specific structural type such as steel bridges, towers, masts and chimneys, silos and tanks, piling, crane supporting structures, etc. EN 1993-2 to EN 1993-7 refer to the generic rules in EN 1993-1 and supplement, modify or supersede them, where relevant.

0.3 Introduction to EN 1993-1-1

EN 1993-1-1 gives general design rules for steel structures. It also includes supplementary design rules for steel buildings. The focus in EN 1993-1-1 is on design methods and design rules for individual members (beams, columns and beam-columns) and skeletal structures (frames) regarding resistance and stability.

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 1993-1-1

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 1993-1-1 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 1993-1-1 through the following clauses:

4.4.3 (2)	5.1 (1)	5.2.1 (1)	5.2.2 (1)
7.2.1 (4)	7.2.2 (9)	7.3.3.1 (1)	7.3.3.2 (1)
7.4.1(3)	8.1 (1)	8.2.8 (3)	8.3.2.3 (1)
8.3.3 (2)	8.3.4 (1)	9.2 (2)B	A.4 (2)
A.4 (3)	A.4 (5)		

National choice is allowed in EN 1993-1-1 on the application of the following informative annexes:

Annex E

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 1993-1-1

(1) EN 1993-1-1 gives basic design rules for steel structures.

(2) It also gives supplementary provisions for the structural design of steel buildings. These supplementary provisions are indicated by the letter "B" after the paragraph number, thus ( )B.

1.2 Assumptions

(1) The assumptions of EN 1990 apply to EN 1993-1-1.

(2) EN 1993 is intended to be used in conjunction with EN 1990, EN 1991 (all parts), the parts of EN 1992 to EN 1999 where steel structures or steel components are referred to within those documents, EN 1090-2, EN 1090-4 and ENs, EADs and ETAs for construction products relevant to steel structures.

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 1090-2, *Execution of steel structures and aluminium structures — Part 2: Technical requirements for steel structures*

EN 1090-4, *Execution of steel structures and aluminium structures — Part 4: Technical requirements for cold-formed structural steel elements and cold-formed structures for roof, ceiling, floor and wall applications*

EN 1990:—[1], *Eurocode — Basis of structural and geotechnical design*

EN 1991 (all parts), *Eurocode 1 — Actions on structures*

EN 1993-1 (all parts), *Eurocode 3: Design of steel structures*

3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in EN 1990 and the following terms, definitions and symbols apply.

3.1 Terms and definitions

3.1.1
frame
whole or a portion of a structure, comprising an assembly of directly connected structural elements, designed to act together to resist load

Note 1 to entry: This term refers to both moment-resisting frames and triangulated frames; it covers both plane frames and three-dimensional frames.

[1] Under preparation. Stage at the time of publication: FprEN 1990:2022.