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English Version

Eurocode 3 - Design of steel structures - Part 1-1: General rules and rules for buildings

Eurocode 3 - Calcul des structures en acier - Partie 1-1 : Règles générales et règles pour les bâtiments

Eurocode 3 - Bemessung und Konstruktion von Stahlbauten - Teil 1-1: Allgemeine Bemessungsregeln und Regeln für den Hochbau

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

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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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 (prEN 1993-1-1:2020) 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 document is currently submitted to the CEN Enquiry.

This document will supersede 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.

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 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.*

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 are covered in EN 1993-1-1.

EN 1993-1-4, *Design of Steel Structures — Part 1-4: Stainless steels;*

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: Strength and stability of planar plated structures transversely loaded;*

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 strength of steel structures;*

EN 1993-1-10, *Design of Steel Structures — Part 1-10: Selection of steel for fracture toughness and through-thickness properties;*

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

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: Beams with large web openings;*

EN 1993-1-14, *Design of Steel Structures — Part 1-14: Design assisted by finite element analysis.*

All subsequent parts 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 subsequent 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.

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 (2)

— 5.2.1 (1)

— 5.2.2 (1)

— 5.2.3 (1)P

— 7.2.1 (4)

— 7.2.2 (9)

— 7.3.3.1 (2)

— 7.3.3.2 (1)

— 7.4.1(3)

— 8.1 (1)

— 8.3.2.3 (1)

— 8.3.2.4 (1)B

— 8.3.2.4 (3)B

— 8.3.3 (2)

— 8.3.4 (1)

— 9.2 (2)B

— A.3 (2)

— A.3 (3)

— A.3 (4)

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

— Annex E (informative) – Basis for the calibration of partial factors

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*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

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. Current stage: prEN 1990:2020.

3.1.2
sub-frame
frame that forms part of a larger frame, but is treated as an isolated frame in a structural analysis

3.1.3
semi-continuous framing
framing in which the structural properties of the members and joints need explicit consideration in the global analysis

3.1.4
continuous framing
framing in which only the structural properties of the members need to be considered in the global analysis

3.1.5
simple framing
framing in which the joints are not designed to resist moments

3.1.6
system length
distance in a given plane between two adjacent points at which a member is braced against lateral displacement in this plane, or between one such point and the end of the member

3.1.7
buckling length
system length of an otherwise similar member with pinned ends, which has the same critical buckling load as a given member or segment of member

3.1.8
equivalent member
simply supported single span member of uniform cross-section with constant compressive axial force used for buckling verification

Note 1 to entry: Its length, cross-section and axial force are equal to the appropriate buckling length, cross-section and axial force at the investigated position in the structure.

3.1.9
shear lag effect
non-uniform stress distribution in wide flanges due to shear deformation

3.1.10
capacity design
design method for achieving the plastic deformation capacity of a member by providing additional strength in its connections and in other parts connected to it

3.1.11
uniform built-up member
built-up member made of parallel chords with nominally constant cross-section along their whole length, connected by regularly spaced lacings or battens

3.1.12
uniform member
member with a nominally constant cross-section along its whole length