SLOVENSKI STANDARD
SIST EN 1993-1-2:2024

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Nadomešča:
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Evrokod 3 - Projektiranje jeklenih konstrukcij - 1-2. del: Požarnoodporno projektiranje

Eurocode 3 - Design of steel structures - Part 1-2: Structural fire design

Eurocode 3 - Bemessung und Konstruktion von Stahlbauten - Teil 1-2: Tragwerksbemessung für den Brandfall

Eurocode 3 - Calcul des structures en acier - Partie 1-2 : Calcul du comportement au feu

Ta slovenski standard je istoveten z: **EN 1993-1-2:2024**

ICS:

13.220.50	Požarna odpornost gradbenih materialov in elementov	Fire-resistance of building materials and elements
91.010.30	Tehnični vidiki	Technical aspects
91.080.13	Jeklene konstrukcije	Steel structures

SIST EN 1993-1-2:2024 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1993-1-2

March 2024

ICS 13.220.50; 91.010.30; 91.080.13

Supersedes EN 1993-1-2:2005

English Version

Eurocode 3 - Design of steel structures - Part 1-2: Structural fire design

Eurocode 3 - Calcul des structures en acier - Partie 1-2 : Calcul du comportement au feu

Eurocode 3 - Bemessung und Konstruktion von Stahlbauten - Teil 1-2: Tragwerksbemessung für den Brandfall

This European Standard was approved by CEN on 1 January 2024.

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This European Standard exists 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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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Page

European foreword

This document (EN 1993-1-2:2024) has been prepared by Technical Committee CEN/TC 250 “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of an identical text or by endorsement, at the latest by September 2027, and conflicting national standards shall be withdrawn at the latest by March 2028.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 1993-1-2:2005 and its 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:

- reduction in number of National Choices (NDPs): NDPs have reduced from 5 to 4;
- enhanced ease of use;
- new structure harmonized with fire parts of other Eurocodes;
- high strength steels: Nominal fires are applicable to steel grades up to and including S700. Physically based thermal actions are applicable to steel grades up to and including S500;
- emissivity coefficient for hot-dip galvanized steel;
- existing buckling curve for LTB has been improved to take in to account the beneficial effect of non-uniform bending diagrams;
- Annex C for stainless steel member has been changed with a completely new content;
- Annex D has changed the calculation of the temperature of joints in fire;
- Annex D now includes welded steel tubular joints;
- former Annex E for Class 4 cross-sections was withdrawn. New design rules for class 4 cross-sections were included in EN 1993-1-2;
- new Annex E for beams with large web openings.

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 organisations 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.

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: 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: 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 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: 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: 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: 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 like 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 like 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 1993-1-2

EN 1993-1-2 describes the principles, requirements and rules for the structural design of steel buildings exposed to fire. The focus in EN 1993-1-2 is on design methods and design rules for individual members (beams, columns, beam-columns), joints and skeletal structures (frames) regarding resistance and stability under fire conditions.

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 1993-1-2

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 1993-1-2 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 1993-1-2 through notes to the following clauses:

4.5 (1) 4.7 (2) 7.5 (2) – 2 choices

National choice is allowed in EN 1993-1-2 on the application of the following informative annexes:

None

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 1993-1-2

(1) This document provides rules for the design of steel structures for the accidental situation of fire exposure. This Part of EN 1993 only identifies differences from, or supplements to, normal temperature design.

(2) This document applies to steel structures required to fulfil a loadbearing function.

(3) This document does not include rules for separating function.

(4) This document gives principles and application rules for the design of structures for specified requirements in respect of the aforementioned loadbearing function and the levels of performance.

(5) This document applies to structures, or parts of structures, that are within the scope of EN 1993-1-1 and are designed accordingly.

(6) This document is intended to be used in conjunction with EN 1991-1-2, EN 1993-1-1, EN 1993-1-3, EN 1993-1-4, EN 1993-1-5, EN 1993-1-6, EN 1993-1-7, EN 1993-1-8, EN 1993-1-11, EN 1993-1-13 or EN 1993-1-14.

(7) In this document, carbon steel is meant when the term steel is used. Only in Annex C stainless steel is addressed.

1.2 Assumptions

(1) Unless specifically stated, EN 1990, EN 1991(all parts) and EN 1993-1-1 apply.

(2) The design methods given in this document are applicable if

— the execution quality is as specified in EN 1090-2 and/or EN 1090-4, and

— the construction materials and products used are as specified in EN 1993-1-1:2022, Table 5.1 and Table 5.2 and in EN 1993-1-3:2024, Table 5.1 and Table 5.2, or in the relevant material and product specifications.

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

— the choice of the relevant design fire scenario is made by appropriate qualified and experienced personnel, or is given by the relevant national regulation;

— any fire protection measure taken into account in the design will be adequately maintained.

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 1990:2023, *Eurocode - Basis of structural and geotechnical design*

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

EN 1991-1-2:2024, *Eurocode 1: Actions on structures - Part 1-2: General actions - Actions on structures exposed to fire*

EN 1993-1-1:2022, *Eurocode 3 - Design of steel structures - Part 1-1: General rules and rules for buildings*

EN 1993-1-3:2024, *Eurocode 3 - Design of steel structures - Part 1-3: General rules - Supplementary rules for cold-formed members and sheeting*

EN 1993-1-4, *Eurocode 3 - Design of steel structures - Part 1-4: General rules - Supplementary rules for stainless steels*

EN 1993-1-5:2024, *Eurocode 3 - Design of steel structures - Part 1-5: Plated structural elements*

EN 1993-1-6, *Eurocode 3 - Design of steel structures - Part 1-6: Strength and Stability of Shell Structures*

EN 1993-1-7, *Eurocode 3 - Design of steel structures - Part 1-7: Plated structures subject to out of plane loading*

EN 1993-1-8:2024, *Eurocode 3: Design of steel structures - Part 1-8: Design of joints*

EN 1993-1-11, *Eurocode 3 - Design of steel structures - Part 1-11: Design of structures with tension components*

EN 1993-1-13:2024, *Eurocode 3 — Design of steel structures - Part 1-13: Beams with large web openings*

EN 1993-1-14, *Eurocode 3 — Design of steel structures - Part 1-14: Design assisted by finite element analysis*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1990, EN 1991-1-2 and the following apply.

3.1.1
box value of section factor
ratio between the exposed surface area of a notional bounding box to the section and the volume of steel

3.1.2
critical temperature of structural steel element
temperature for a given load level, at which failure is expected to occur in a structural steel element assuming a uniform temperature distribution

3.1.3
effective yield strength
stress level for a given temperature, at which the stress-strain relationship of steel is truncated to provide a yield plateau

3.1.4
fire protection material
any material or combination of materials applied to a structural member for the purpose of increasing its fire resistance

3.1.5
part of structure
isolated part of a structure with appropriate support and boundary conditions

3.1.6
section factor
ratio between the exposed surface area and the volume of steel for a steel member, or ratio between the internal surface area of the exposed encasement and the volume of steel for an enclosed member

3.2 Symbols

For the purposes of this document, the following symbols apply.

3.2.1 Latin upper case letters

A_i	an elemental area of the cross-section with a temperature $\theta_{a,i}$;
A_m	surface area exposed to fire of a member per unit length;
A_m / V	section factor of unprotected steel members;
A_p	appropriate area of fire protection material per unit length of the member;
A_p/ V	section factor for steel members insulated by fire protection material;
C_i	protection coefficient of member face i;
E_a	modulus of elasticity of steel for normal temperature design;
$E_{a,\theta}$	slope of the linear elastic range for steel at elevated temperature θ_a;
E_d	design effect of actions at normal temperature, determined in accordance with EN 1991-1-1;
$E_{d,fi}$	design effect of actions for the fire situation, determined in accordance with EN 1991-1-2, including the effects of thermal expansions and deformations;
$E_{p0,2,\theta}$	tangent modulus at $f_{p0,2,\theta}$;
$F_{b,Rd}$	design bearing resistance per bolt according to EN 1993-1-8;
$F_{b,Rd,fi,t}$	design bearing resistance per bolt in the fire situation at time t;
$F_{v,Rd}$	design shear resistance per bolt per shear plane calculated assuming that the shear plane passes through the threads of the bolt according to EN 1993-1-8;
$F_{v,Rd,fi,t}$	design shear resistance per bolt per shear plane in the fire situation at time t;
$F_{w,Rd}$	design resistance per unit length of a fillet weld according to EN 1993-1-8;
$F_{w,Rd,fi,t}$	design resistance per unit length of a fillet weld in the fire situation at time t;
I_f	radiative heat flux from an opening;
I_z	radiative heat flux from a flame;
$I_{z,i}$	radiative heat flux from a flame to a column face i;
L	system length of a column in the relevant storey;

L_i length along axis between the opening and the relevant point;

M number of openings on side m;

$M_{b,Rd,fi,t}$ design buckling resistance moment in the fire situation at time t;

$M_{c,Rd}$ plastic moment resistance of the gross cross-section $M_{pl,Rd}$ for normal temperature design; the elastic moment resistance of the gross cross-section $M_{el,Rd}$ for normal temperature design;

M_{cr} elastic critical moment for lateral torsional buckling based on the gross cross-sectional properties, taking into account loading conditions, actual moment distribution and lateral restraints;

$M_{Rd,fi,t}$ design moment resistance in the fire situation at time t;

$M_{Rd,fi,\theta}$ design moment resistance of the cross-section for a uniform temperature θ_a;

N number of openings on side n;

$N_{b,Rd,fi,t}$ design buckling resistance in the fire situation at time t of a compression member;

N_{cr} elastic critical axial force for the relevant buckling mode based on the gross cross-sectional properties, using the buckling length under fire conditions;

$N_{Rd,fi,t}$ design resistance in the fire situation at time t of a tension member with a non-uniform temperature distribution across the cross-section;

$N_{Rd,fi,\theta}$ design resistance of a tension member with a uniform temperature θ_a;

$N_{t,Rd}$ design tension resistance of the cross-section for normal temperature design, according to EN 1993-1-1;

$R_{d,fi,t}$ design resistance in the fire situation at time t;

$R_{d,fi,0}$ value of $R_{d,fi,t}$ for time $t = 0$;

T_f temperature of fire;

T_m temperature of the steel member;

T_o flame temperature at the opening;

T_x flame temperature at the flame tip;

T_z flame temperature;

$T_{z,1}$ flame temperature [K] from Annex B of EN 1991-1-2:2024, level with the bottom of a beam;

$T_{z,2}$ flame temperature from Annex B of EN 1991-1-2:2024, level with the top of a beam;

V volume of a member per unit length;

$V_{c,Rd}$ design value of the resistance to shear force for normal temperature design, according to EN 1993-1-1;

$V_{Rd,fi,t}$ design shear resistance in the fire situation at time t;

X_k characteristic value of a strength or deformation property (generally f_k or E_k) for normal temperature design to EN 1993-1-1).