SLOVENSKI STANDARD
SIST EN 1992-1-2:2024

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Evrokod 2 - Projektiranje betonskih konstrukcij - 1-2. del: Projektiranje požarnovarnih konstrukcij

Eurocode 2 - Design of concrete structures – Part 1-2: Structural fire design

Eurocode 2 - Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken - Teil 1-2: Allgemeine Regeln - Tragwerksbemessung für den Brandfall

Eurocode 2 - Calcul des structures en béton - Partie 1-2: Règles générales - Calcul du comportement au feu

Ta slovenski standard je istoveten z: **EN 1992-1-2:2023**

ICS:

13.220.50	Požarna odpornost gradbenih materialov in elementov	Fire-resistance of building materials and elements
91.010.30	Tehnični vidiki	Technical aspects
91.080.40	Betonske konstrukcije	Concrete structures

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1992-1-2

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Supersedes EN 1992-1-2:2004

English Version

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

Eurocode 2 - Calcul des structures en béton - Partie 1-2: Règles générales - Calcul du comportement au feu

Eurocode 2 - Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken - Teil 1-2: Allgemeine Regeln - Tragwerksbemessung für den Brandfall

This European Standard was approved by CEN on 23 July 2023.

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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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COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 1992-1-2:2023) 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of an identical text or by endorsement, at the latest by September 2027, and conflicting national standards shall be withdrawn at the latest by March 2028.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 1992-1-2:2004 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:

- simplified design methods were improved and amended and provisions were updated in tabulated data to ensure consistency between tabulated design data, simplified and advanced design methods;
- simplified analytical formulae were added for the determination of temperature profiles in members;
- specific rules for spalling were integrated;
- informative annexes provide guidance for fire design of steel fibre reinforced concrete structures and of recycled aggregates concrete structures;
- the number of alternative design rules was reduced;
- the structure and table of contents was harmonized with other fire parts.

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.

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 Eurocodes 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 1992 (all parts)

(1) EN 1992 applies to the design of buildings, bridges and civil engineering structures in plain, reinforced and prestressed concrete. 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.

(2) EN 1992 is only concerned with the requirements for resistance, serviceability, durability and fire resistance of concrete structures. Other requirements, e.g. concerning thermal or sound insulation, are not considered.

(3) EN 1992 is subdivided into various parts:

— EN 1992-1-1, Design of concrete structures — Part 1-1: General rules and rules for buildings, bridges and civil engineering structures,

— EN 1992-1-2, Design of concrete structures —Part 1-2: Structural fire design,

— EN 1992-4, Design of concrete structures —Part 4: Design of fastenings for use in concrete.

0.3 Introduction to EN 1992-1-2

(1) EN 1992-1-2 describes the requirements and rules for the structural design of buildings and civil engineering works exposed to fire.

(2) EN 1992-1-2 is intended for clients (e.g. for the formulation of their specific requirements), designers, contractors and relevant authorities.

(3) The general objectives of fire protection are to limit risks with respect to the individual and society, neighbouring property, and where required, environment or directly exposed property, in the case of fire.

(4) The fire parts of the Structural Eurocodes deal with specific aspects of passive fire protection in terms of designing structures and parts thereof for adequate loadbearing resistance and for limiting fire spread as relevant.

(5) Required functions and levels of performance can be specified either in terms of nominal (standard) fire resistance rating, generally given in national fire regulations or by referring to fire safety engineering for assessing passive and active measures, see EN 1991-1-2:—[1].

(6) Supplementary requirements concerning, e.g.:

— the possible installation and maintenance of sprinkler systems;

— conditions on occupancy of building or fire compartment;

— the use of approved insulation and coating materials, including their maintenance;

are not given in this standard, because they are subject to specification by the competent authority.

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 1992-1-2

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 1992-1-2 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 1992-1-2 through the following clauses:

4.5(1) 9.2(1) 10(10)

National choice is allowed in EN 1992-1-2 on the application of the following informative annexes:

Annex B Annex C 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 1992-1-2

(1) This document deals with the design of concrete structures for the accidental situation of fire exposure and is intended to be used in conjunction with EN 1992-1-1 and EN 1991-1-2:—[1]. This document identifies differences from, or supplements to, normal temperature design.

(2) This document applies to concrete structures required to fulfil a loadbearing function, separating function, insulation function or all of them.

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

(4) This document applies to structures, or parts of structures, that are within the scope of EN 1992-1-1 and are designed accordingly.

1.2 Assumptions

(1) 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 shall be adequately maintained for the duration of the intended use of the construction.

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. in 'should' clauses), permissions ('may' clauses), possibilities ('can' clauses), and in notes.

EN 1363-2, *Fire resistance tests - Part 2: Alternative and additional procedures*

EN 1990, *Eurocode - Basis of structural design*

EN 1991-1-2:—[1], *Eurocode 1 — Actions on structures — Part 1-2: Actions on structures exposed to fire*

EN 1992-1-1:2023, *Eurocode 2 — Design of concrete structures — Part 1-1: General rules and rules for buildings, bridges and civil engineering structures*

EN 1991-1-7:—[2], *Eurocode 1 — Actions on structures — Part 1-7: Accidental actions*

[1] Under preparation. Stage at the time of publication: FprEN 1991-1-2:2023.

[2] Under preparation. Stage at the time of publication: prEN 1991-1-7:2023.

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:—[1] and EN 1992-1-1 and the following apply.

3.1.1
axis distance
distance between the axis of the reinforcing bar and the nearest surface of concrete

3.1.2
critical temperature of reinforcement
temperature of reinforcement at which loadbearing failure of the member under fire conditions is expected to occur at a given stress level

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

3.1.4
part of structure
isolated part of a structure with appropriate support and boundary conditions

3.1.5
fire protection material
any material or combination of materials applied to a structural member for the purpose of increasing its fire resistance

3.1.6
reduced cross-section
cross-section of the member used in structural fire design when parts of the cross-section with assumed zero strength and stiffness are removed

3.1.7
spalling
fire induced spalling of concrete consists of the breaking off of layers or fragments of concrete from the surface of a structural member

Note 1 to entry: Depending on the severity of the phenomenon, it can influence the performance of the structural member.

3.2 Symbols

3.2.1 Latin upper case letters

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

A_c	Cross-sectional area of concrete
A_{cij}	Elemental concrete area for refined assessment of members subjected to bending and axial load
A_s	Cross-sectional area of steel reinforcement

A_{s0}	Cross-sectional area of longitudinal reinforcement at axis distance *a* from the most compressed side of the column
A_{s1}	Cross-sectional area of longitudinal reinforcement at axis distance *a* from the tensile/least compressed side of the column
$A_{s,i}$	Cross-sectional area of steel reinforcement i
$A_{s,prov}$	Provided cross-sectional area of longitudinal reinforcement
$A_{s,req}$	Required cross-sectional area of longitudinal reinforcement for the design at ambient temperature according to EN 1992-1-1
E	Integrity
E_d	Design effect of actions
$E_{d,fi}$	Design effect of actions under fire conditions
E_p	Slope of the linear elastic range in the stress-strain relationship of prestressing steel
$E_{p,\theta}$	Slope of the linear elastic range in the stress-strain relationship of prestressing steel at temperature θ
E_s	Slope of the linear elastic range in the stress-strain relationship of reinforcing steel
$E_{s,\theta}$	Slope of the linear elastic range in the stress-strain relationship of reinforcing steel at temperature θ
$F_{sd,0c,fi}$	Resisting compression force of longitudinal reinforcement at axis distance *a* from the most compressed side of the column
$F_{sd,1t,fi}$	Resisting tensile force of longitudinal reinforcement at axis distance *a* from the tensile side of the column
$F_{sd,1c,fi}$	Resisting compression force of longitudinal reinforcement at axis distance *a* from the least compressed side of the column
I	Insulation
M_{Ed}	Design value of the bending moment at ambient temperature
$M_{Ed,fi}$	Design value of the bending moment under fire conditions
$M_{Rd,fi}$	Ultimate moment capacity in the fire situation
$M_{0Ed,fi}$	Design value of first order moment under fire conditions including the effect of imperfections
$M_{0Rd,fi}$	Ultimate first order moment in the fire situation
M_{2fi}	Nominal second order moment in the fire situation
$N_{Ed.fi}$	Design value of the axial load in the fire situation
N_{Rd}	Design value of axial resistance
R	Design resistance
R	Loadbearing function / capacity
RXXX	Fire resistance time in minutes (15 ≤ X ≤ 240)
R_a, R_b	Coefficients to determine loadbearing capacity R
$R_{d,fi,t}$	Design resistance in the fire situation at time t
$R_{\mu fi}$, R_n, R_n	Coefficients to determine loadbearing capacity R

$X_{d,\theta}$	Design value of a strength or stiffness property at temperature θ
X_k	Characteristic value of a strength or stiffness property

3.2.2 Latin lower case letters

a	Nominal axis distance measured between the centre of the reinforcement and the exposed surface
a_c	Dimension of corner zone affected by two-sided heat transfer
a_{eff}	Increased nominal axis distance
a_{fi}	Reduced axis distance of the reinforcement
a_i	Nominal axis distance for the reinforcement “i”
a_m	Average axis distance
a_{sd}	Nominal axis distance measured between the centre of the reinforcement and lateral surface exposed to fire
a_z	Thickness of rim zone
b_{min}	Minimum member width/minimum beam width
b_{mod}	Increased minimum width of tensile member or tensile zone of beams
b_w	Web width
$b_{w,min}$	Minimum web width
c	Curvature
$c_{1/r}$	Curvature distribution factor
c_p	Specific heat of concrete
$c_{p,peak}$	Specific heat (peak value)
d	Effective depth of a cross-section
d_1, d_2	Height of section element
d_{eff}	Effective height of the bottom flange of I-shaped beams
d_{fi}	Reduced effective depth of a cross-section under fire conditions
e_0	Total first order eccentricity
e_1	Additional eccentricity due to imperfections
e_2	Eccentricity due to deformation of compression member
e_d	Maximum distance between the compression resultant and the deformed axis of the compression member
$e_{thermal}$	Eccentricity attributed to thermal effects
$f_{c,\theta}$	Characteristic value of cylinder compressive strength of concrete at temperature θ
f_{ck}	Characteristic compressive concrete strength
$f_{ct,\theta}$	Characteristic value of tensile strength of concrete at temperature θ
$f_{ctk,0,05}$	Characteristic tensile strength of concrete
f_{ctm}	Mean tensile strength of concrete