SLOVENSKI STANDARD
oSIST prEN 1991-1-2:2021

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Evrokod 1: Vplivi na konstrukcije - 1-2. del: Splošni vplivi - Vplivi požara na konstrukcije

Eurocode 1: Actions on structures - Part 1-2: General actions - Actions on structures exposed to fire

Eurocode 1: Einwirkungen auf Tragwerke - Teil 1-2: Allgemeine Einwirkungen - Brandeinwirkungen auf Tragwerke

Eurocode 1: Actions sur les structures - Partie 1-2: Actions générales - Actions sur les structures exposées au feu

Ta slovenski standard je istoveten z: **prEN 1991-1-2**

ICS:

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

oSIST prEN 1991-1-2:2021 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 1991-1-2

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ICS 13.220.50; 91.010.30

Will supersede EN 1991-1-2:2002

English Version

Eurocode 1: Actions on structures - Part 1-2: General actions - Actions on structures exposed to fire

Eurocode 1: Actions sur les structures - Partie 1-2: Actions générales - Actions sur les structures exposées au feu

Eurocode 1: Einwirkungen auf Tragwerke - Teil 1-2: Allgemeine Einwirkungen - Brandeinwirkungen auf Tragwerke

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.

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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 1991-1-2:2021) 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 document is currently submitted to the CEN Enquiry.

This document will supersede EN 1991-1-2:2002.

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 recognise 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.

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 structure*

— 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>

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 1991

EN 1991 provides the actions to be considered for the structural design of buildings, bridges and other civil engineering works, or parts thereof, including temporary structures, in conjunction with EN 1990 and the other Eurocodes.

The actions on structures, including in some cases geotechnical structures in conjunction with EN 1997 as appropriate, provided in EN 1991 are intended to be applied in conjunction with the other Eurocodes for the verification of safety, serviceability and durability, as well as robustness of structures, including the execution phase.

EN 1991 does not cover actions for structures in seismic regions, unless explicitly prescribed by EN 1998.

EN 1991 is applicable to existing structures for their:

— structural assessment,

— retrofitting (strengthening, repair) design,

— assessment for changes of use.

NOTE 1 In this case, additional or amended provisions can be necessary.

EN 1991 is applicable to the design of structures where materials or actions outside the scope of the other Eurocodes are involved.

NOTE 2 In this case, additional or amended provisions can be necessary.

0.3 Introduction to prEN 1991-1-2

prEN 1991-1-2 describes the thermal and mechanical actions for the structural design of buildings exposed to fire, including the following safety requirements and design procedures.

prEN 1991-1-2 is intended to be used with EN 1990, the other Parts of EN 1991 and EN 1992 to EN 1999 for the design of structures.

0.3.1 Safety requirements

The general objectives 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.

Construction Products Regulation (EU) No 305/2011 gives the following requirement for the limitation of the consequence in case of fire:

"The construction works must be designed and built in such a way, that in the event of an outbreak of fire

— the load bearing capacity of the construction can be assumed for a specified period of time,

— the generation and spread of fire and smoke within the works are limited,

— the spread of fire to neighbouring construction works is limited,

— the occupants can leave the works or can be rescued by other means,

— the safety of rescue teams is taken into consideration".

According to the Interpretative Document N°2 "Safety in Case of Fire"[1)] the essential requirement may be observed by following various possibilities for fire safety strategies prevailing in the Member States like conventional fire scenarios (nominal fires) or "natural" (physically based) fire scenarios, including passive and/or active fire protection measures.

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, where allowed by national fire regulations, by referring to fire safety engineering for assessing passive and active measures.

The fire parts of Structural Eurocodes deal with specific aspects of passive fire protection in terms of designing structures and parts thereof for adequate load bearing resistance and for limiting fire spread as relevant.

Numerical values for partial factors and other reliability elements are given to provide an acceptable level of reliability. They have been selected assuming that an appropriate level of workmanship and of quality management applies.

1) See 2.2, 3.2(4) and 4.2.3.3 of ID N°2.

0.3.2 Design procedures

A full analytical procedure for structural fire design would take into account the behaviour of the structural system at elevated temperatures, the potential heat exposure and the beneficial effects of active and passive fire protection systems, together with the uncertainties associated with these three features and the importance of the structure (consequences of failure).

At the present time, it is possible to undertake a procedure for determining adequate performance which incorporates some, if not all, of the above parameters and to demonstrate that the structure, or its components, will give adequate performance in a real building fire. However, where the procedure is based on a nominal (standard) fire, the classification system, which calls for specific periods of fire resistance, takes into account (though not explicitly) the features and uncertainties described above.

Figure 1 illustrates the two design procedures provided by prEN 1991-1-2, i.e. the prescriptive approach and the performance-based approach. The prescriptive approach uses nominal (standard) fires to generate thermal actions. The performance-based approach, using fire safety engineering, refers to thermal actions based on physical and chemical parameters.

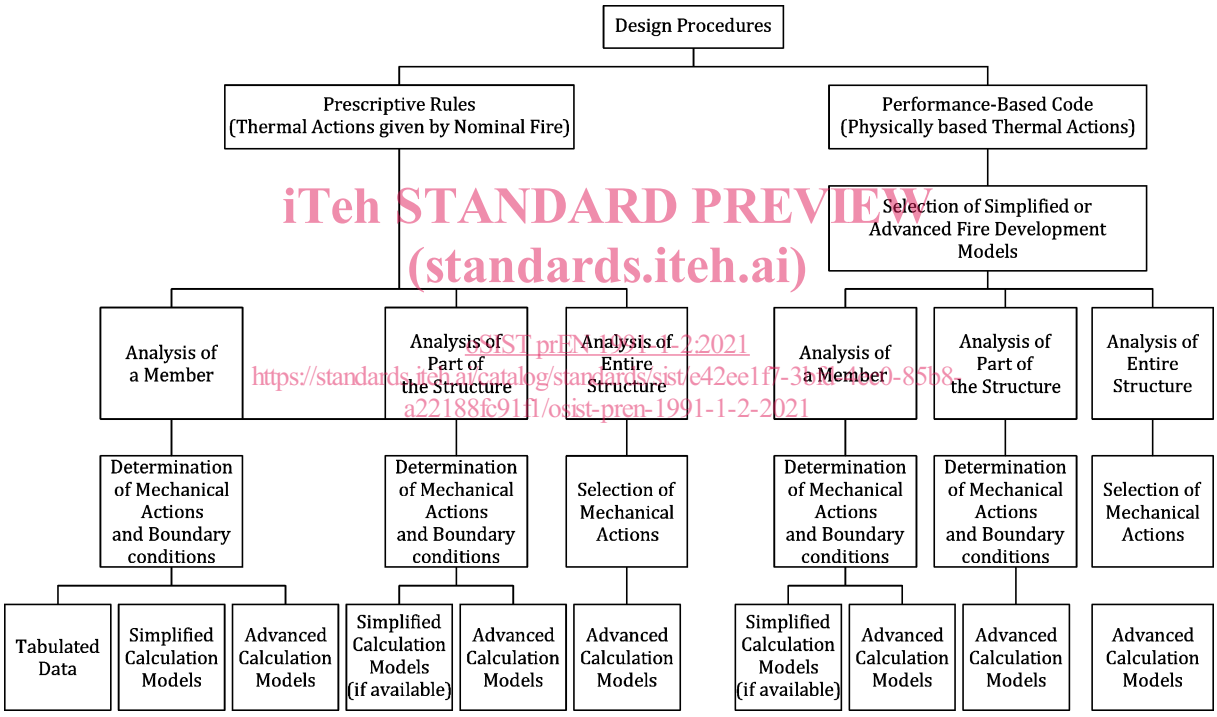

Figure 1 — Alternative design procedures

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 prEN 1991-1-2

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

The national standard implementing prEN 1991-1-2 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 choice is given in this standard, the choice can be specified by the relevant authority or, where not specified, agreed for a specific project by the relevant parties.

National choice is allowed in prEN 1991-1-2 through the following clauses:

— 4.4(4)

— 6.2.2(2)

— 6.3.1(2)

— 6.3.2(3)

— 6.3.2(4)

National choice is allowed in this document on the use of the following informative annex:

Annex A (informative) Parametric temperature-time curves

Annex B (informative) Thermal actions for external members — Simplified calculation method

Annex C (informative) Localised fire

Annex D (informative) Advanced fire models

Annex E (informative) Fire load densities, Fire Growth Rates and Rate of Heat Releases

Annex F (informative) Equivalent time of fire exposure

Annex G (informative) Configuration factor

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 prEN 1991-1-2

(1) The methods given in this Eurocode are applicable to buildings and civil engineering works, with a fire load related to the building and its occupancy.

(2) prEN 1991-1-2 deals with thermal and mechanical actions on structures exposed to fire. It is intended to be used in conjunction with the fire design Parts of EN 1992 to EN 1996 and EN 1999 which give rules for designing structures for fire resistance.

(3) prEN 1991-1-2 contains thermal actions either nominal or physically based. More data and models for physically based thermal actions are given in annexes.

(4) prEN 1991-1-2 does not cover the assessment of the damage of a structure after a fire.

(5) prEN 1991-1-2 does not cover supplementary requirements concerning, for example:

— 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.

1.2 Assumptions

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

— any active and passive fire protection systems taken into account in the design will be adequately maintained;

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

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.

prEN 1990:2020, *Eurocode: Basis of structural and Geotechnical design*

EN 1992 (all parts), *Eurocode 2: Design of concrete structures*

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

EN 1994 (all parts), *Eurocode 4: Design of composite steel and concrete structures*

EN 1995 (all parts), *Eurocode 5: Design of timber structures*

EN 1996 (all parts), *Eurocode 6: Design of masonry structures*

EN 1999 (all parts), *Eurocode 9: Design of aluminium structures*

EN 13501-2, *Fire classification of construction products and building elements — Part 2: Classification using data from fire resistance tests, excluding ventilation services*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1 Common terms used in Eurocode Fire parts

3.1.1.1
equivalent time of fire exposure
time of exposure to the standard fire curve supposed to have the same heating effect as a real fire in the compartment

3.1.1.2
external member
structural member located outside the building that may be exposed to fire through openings in the building enclosure

3.1.1.3
compartment, fire compartment
space within a building, extending over one or several floors, which is enclosed by separating elements such that fire spread beyond the compartment is prevented during the relevant fire exposure

3.1.1.4
fire resistance
ability of a structure, a part of a structure or a member to fulfil its required functions (load bearing function and/or fire separating function) for a specified load level, for a specified fire exposure and for a specified period of time

3.1.1.5
fully developed fire
state of full involvement of all combustible surfaces in a fire within a specified space

3.1.1.6
global structural analysis (for fire)
structural analysis of the entire structure, when either the entire structure, or only a part of it, are exposed to fire

Note 1 to entry: Indirect fire actions are considered throughout the structure.

3.1.1.7
indirect fire actions
internal forces and moments caused by thermal expansion

3.1.1.8
integrity
E
ability of a separating element of building construction, when exposed to fire on one side, to prevent the passage through it of flames and hot gases and to prevent the occurrence of flames on the unexposed side

3.1.1.9
insulation
I
ability of a separating element of building construction when exposed to fire on one side, to restrict the temperature rise of the unexposed face below specified levels

3.1.1.10
load bearing function
R
ability of a structure or a member to sustain specified actions during the relevant fire, according to defined criteria

3.1.1.11
member
basic part of a structure (such as beam, column, but also assembly such as stud wall, truss) considered as isolated with appropriate boundary and support conditions

3.1.1.12
member analysis (for fire)
thermal and mechanical analysis of a structural member exposed to fire in which the member is assumed as isolated, with appropriate support and boundary conditions

Note 1 to entry: Indirect fire actions are not considered, except those resulting from thermal gradients.

3.1.1.13
normal temperature design
ultimate limit state design for ambient temperatures according to Part 1-1 of EN 1992 to EN 1996 or EN 1999

3.1.1.14
separating function
ability of a separating element to prevent fire spread (e.g. by passage of flames or hot gases — cf. integrity) or ignition beyond the exposed surface (cf. insulation) during the relevant fire

3.1.1.15
separating element
load bearing or non-load bearing element (e.g. wall) forming part of the enclosure of a fire compartment

3.1.1.16
standard fire resistance
ability of a structure or part of it (usually only members) to fulfil required functions (load-bearing function and/or separating function), for the exposure to heating according to the standard fire curve for a specified load combination and for a stated period of time

3.1.1.17
structural members
physically distinguishable part of a structure, e.g. column, beam, plate, foundation

3.1.1.18
temperature analysis
procedure of determining the temperature development in members based on the thermal actions (net heat flux) and the thermal material properties of the members and of protective surfaces, where relevant

3.1.1.19
thermal actions
actions on the structure described by the net heat flux to the members

3.1.2 Special terms relating to design in general

3.1.2.1
advanced fire model
design fire based on mass conservation and energy conservation aspects

3.1.2.2
computational fluid dynamics model
fire model able to solve numerically the partial differential equations giving, in all points of the compartment, the thermo-dynamical and aero-dynamical variables

3.1.2.3
fire wall
separating element that is a wall separating two spaces (e.g. two buildings) that is designed for fire resistance and structural stability, and may include resistance to horizontal loading such that, in case of fire and failure of the structure on one side of the wall, fire spread beyond the wall is avoided

3.1.2.4
one-zone model
fire model where homogeneous temperatures of the gas are assumed in the compartment

3.1.2.5
simplified fire model
design fire based on a limited application field of specific physical parameters

3.1.2.6
two-zone model
fire model where different zones are defined in a compartment: the upper layer, the lower layer, the fire and its plume, the external gas and walls

Note 1 to entry: In the upper and lower layers, uniform temperature of the gas is assumed.

3.1.3 Terms relating to thermal actions

3.1.3.1
combustion factor
factor representing the efficiency of combustion, varying between 1 for complete combustion to 0 for combustion fully inhibited

3.1.3.2
design fire
quantitative description of assumed fire characteristics within a design fire scenario specified

3.1.3.3
design fire load density
fire load density considered for determining thermal actions in fire design

3.1.3.4
design fire scenario
specific fire scenario on which an analysis will be conducted

3.1.3.5
external fire curve
nominal fire curve intended for the outside of separating (EI) external walls and parapets which can be exposed to fire from a compartment situated below or adjacent to the respective external wall

3.1.3.6
fire activation risk
parameter taking into account the probability of ignition, function of the compartment area and the occupancy

3.1.3.7
fire load density
fire load per unit area related to the floor area q_f, or related to the surface area of the total enclosure, including openings, q_t

3.1.3.8
fire load
quantity of energy which is released by complete combustion of all combustible materials in a compartment or a localised fire area (building contents and construction elements)

3.1.3.9
fire scenario
qualitative description of the course of a fire with time identifying key events that characterize the fire and differentiate it from other possible fires

Note 1 to entry: It typically defines the ignition and fire growth process, the fully developed stage and decay stage together as well as systems that impact the course of the fire and the nature of local environment.

3.1.3.10
flash-over
simultaneous ignition of all the fire loads in a compartment

3.1.3.11
hydrocarbon fire curve
nominal fire curve for representing effects of a hydrocarbon type fire

3.1.3.12
localised fire
fire involving only a limited area of the compartment

3.1.3.13
opening factor
factor representing the amount of ventilation depending on the area of openings in the compartment walls, on the height of these openings and on the total area of the enclosure surfaces

3.1.3.14
rate of heat release
heat (energy) released by a combustible product as a function of time

3.1.3.15
standard fire curve
nominal curve defined in EN 13501-2 for representing a model of a fully developed fire in a compartment