SLOVENSKI STANDARD

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

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

Ta slovenski standard je istoveten z: **EN 1991-1-2:2002**

ICS:

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

SIST EN 1991-1-2:2004 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

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EN 1991-1-2

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English version

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

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

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

This European Standard was approved by CEN on 1 September 2002.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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Foreword

This document (EN 1991-1-2:2002) has been prepared by Technical Committee CEN/TC 250 "Structural Eurocodes", the secretariat of which is held by BSI.

CEN/TC250/SC1 is responsible for Eurocode 1.

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 May 2003, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document supersedes ENV 1991-2-2:1995.

Annexes A, B, C, D, E, F and G are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Background of the Eurocode programme

In 1975, the Commission of the European Community decided on an action programme in the field of construction, based on article 95 of the Treaty. The objective of the programme was the elimination of technical obstacles to trade and the harmonisation of technical specifications.

Within this action programme, the Commission took the initiative to establish a set of harmonised technical rules for the design of construction works which, in a first stage, would serve as an alternative to the national rules in force in the Member States and, ultimately, would replace them.

For fifteen years, the Commission, with the help of a Steering Committee with Representatives of Member States, conducted the development of the Eurocodes programme, which led to the first generation of European codes in the 1980's.

In 1989, the Commission and the Member States of the EU and EFTA decided, on the basis of an agreement[1] between the Commission and CEN, to transfer the preparation and the publication of the Eurocodes to CEN through a series of Mandates, in order to provide them with a future status of European Standard (EN). This links de facto the Eurocodes with the provisions of all the Council's Directives and/or Commission's Decisions dealing with European Standards (e.g. the Council Directive 89/106/EEC on construction products - CPD - and Council Directives 93/37/EEC, 92/50/EEC and 89/440/EEC on public works and services and equivalent EFTA Directives initiated in pursuit of setting up the internal market).

The Structural Eurocode programme comprises the following standards generally consisting of a number of Parts:

EN 1990, Eurocode: Basis of structural design.

EN 1991, Eurocode 1: Actions on structures.

prEN 1992, Eurocode 2: Design of concrete structures.

prEN 1993, Eurocode 3: Design of steel structures.

[1] Agreement between the Commission of the European Communities and the European Committee for Standardisation (CEN) concerning the work on EUROCODES for the design of building and civil engineering works (BC/CEN/03/89).

prEN 1994, Eurocode 4: Design of composite steel and concrete structures.

prEN 1995, Eurocode 5: Design of timber structures.

prEN 1996, Eurocode 6: Design of masonry structures.

prEN 1997, Eurocode 7: Geotechnical design.

prEN 1998, Eurocode 8: Design of structures for earthquake resistance.

prEN 1999, Eurocode 9: Design of aluminium structures.

Eurocode standards recognise the responsibility of regulatory authorities in each Member State and have safeguarded their right to determine values related to regulatory safety matters at national level where these continue to vary from State to State.

Status and field of application of Eurocodes

The Member States of the EU and EFTA recognise that EUROCODES serve as reference documents for the following purposes:

– as a means to prove compliance of building and civil engineering works with the essential requirements of Council Directive 89/106/EEC, particularly Essential Requirement N°1 - Mechanical resistance and stability - and Essential Requirement N°2 - Safety in case of fire;

– as a basis for specifying contracts for construction works and related engineering services;

– as a framework for drawing up harmonised technical specifications for construction products (ENs and ETAs).

The Eurocodes, as far as they concern the construction works themselves, have a direct relationship with the Interpretative Documents[2] referred to in Article 12 of the CPD, although they are of a different nature from harmonised product standards[3]. Therefore, technical aspects arising from the Eurocodes work need to be adequately considered by CEN Technical Committees and/or EOTA Working Groups working on product standards with a view to achieving full compatibility of these technical specifications with the Eurocodes.

The Eurocode standards provide common structural design rules for everyday use for the design of whole structures and component products of both a traditional and an innovative nature. Unusual forms of construction or design conditions are not specifically covered and additional expert consideration will be required by the designer in such cases.

[2] According to Art. 3.3 of the CPD, the essential requirements (ERs) shall be given concrete form in interpretative documents for the creation of the necessary links between the essential requirements and the mandates for harmonised ENs and ETAGs/ETAs.

[3] According to Art. 12 of the CPD the interpretative documents shall:

a) give concrete form to the essential requirements by harmonising the terminology and the technical bases and indicating classes or levels for each requirement where necessary;

b) indicate methods of correlating these classes or levels of requirement with the technical specifications, e.g. methods of calculation and of proof, technical rules for project design, etc.;

c) serve as a reference for the establishment of harmonised standards and guidelines for European technical approvals.

The Eurocodes, de facto, play a similar role in the field of the ER 1 and a part of ER 2.

National standards implementing Eurocodes

The national standards implementing Eurocodes will comprise the full text of the Eurocode (including any annexes), as published by CEN, which may be preceded by a national title page and national foreword, and may be followed by a national annex.

The national annex may only contain information on those parameters which are left open in the Eurocode for national choice, known as Nationally Determined Parameters, to be used for the design of buildings and civil engineering works to be constructed in the country concerned, i.e.:

– values and/or classes where alternatives are given in the Eurocode;

– values to be used where a symbol only is given in the Eurocode;

– country specific data (geographical, climatic, etc), e.g. snow map;

– the procedure to be used where alternative procedures are given in the Eurocode.

It may also contain:

– decisions on the application of informative annexes and

– references to non-contradictory complementary information to assist the user to apply the Eurocode.

Links between Eurocodes and harmonised technical specifications (ENs and ETAs) for products

There is a need for consistency between the harmonised technical specifications for construction products and the technical rules for works[4]. Furthermore, all the information accompanying the CE Marking of the construction products which refer to Eurocodes shall clearly mention which Nationally Determined Parameters have been taken into account.

Additional information specific to EN 1991-1-2

EN 1991-1-2 describes the thermal and mechanical actions for the structural design of buildings exposed to fire, including the following aspects:

Safety requirements

EN 1991-1-2 is intended for clients (e.g. for the formulation of their specific requirements), designers, contractors and relevant authorities.

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.

Construction Products Directive 89/106/EEC gives the following essential requirement for the limitation of fire risks:

[4] See Art.3.3 and Art.12 of the CPD, as well as 4.2, 4.3.1, 4.3.2 and 5.2 of ID N°1.

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

– the load bearing resistance 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[5]" 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" (parametric) fire scenarios, including passive and/or active fire protection 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.

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.

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

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

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

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).

[5] See 2.2, 3.2(4) and 4.2.3.3 of ID N°2.

At the present time it is possible to undertake a procedure for determining adequate performance which incorporates some, if not all, of these 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 explicitely) the features and uncertainties described above.

Application of this Part 1-2 is illustrated below. The prescriptive approach and the performance-based approach are identified. The prescriptive approach uses nominal fires to generate thermal actions. The performance-based approach, using fire safety engineering, refers to thermal actions based on physical and chemical parameters.

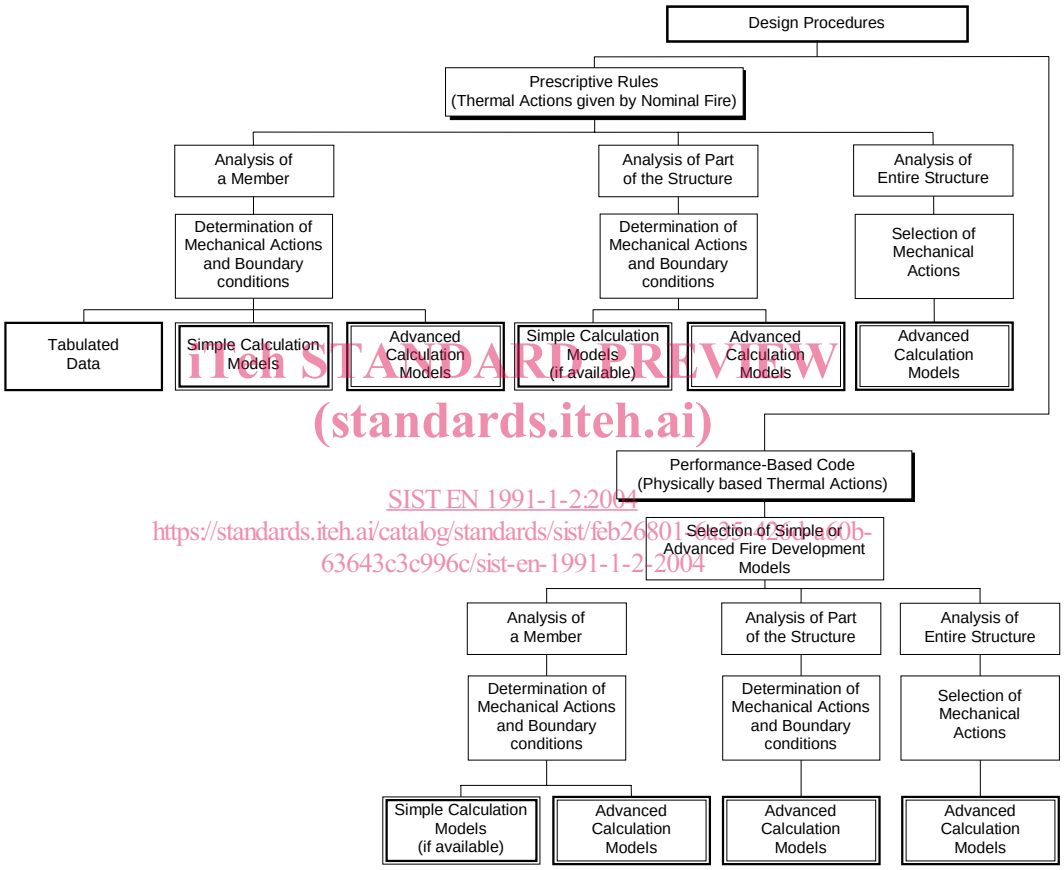

Figure 1 — Alternative design procedures

Design aids

It is expected, that design aids based on the calculation models given in EN 1991-1-2 will be prepared by interested external organizations.

The main text of EN 1991-1-2 includes most of the principal concepts and rules necessary for describing thermal and mechanical actions on structures.

National annex for EN 1991-1-2

This standard gives alternative procedures, values and recommendations for classes with notes indicating where national choices have to be made. Therefore the national standard implementing EN 1991-1-2 should have a national annex containing all Nationally Determined Parameters to be used for the design of buildings and civil engineering works to be constructed in the relevant country.

National choice is allowed in EN 1991-1-2 through:

- 2.4(4)
- 3.1(10)
- 3.3.1.1(1)
- 3.3.1.2(1)
- 3.3.1.2(2)
- 3.3.1.3(1)
- 3.3.2(1)
- 3.3.2(2)
- 4.2.2(2)
- 4.3.1(2)

Section 1 General

1.1 Scope

(1) The methods given in this Part 1-2 of EN 1991 are applicable to buildings, with a fire load related to the building and its occupancy.

(2) This Part 1-2 of EN 1991 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 prEN 1992 to prEN 1996 and prEN 1999 which give rules for designing structures for fire resistance.

(3) This Part 1-2 of EN 1991 contains thermal actions related to nominal and physically based thermal actions. More data and models for physically based thermal actions are given in annexes.

(4) This Part 1-2 of EN 1991 gives general principles and application rules in connection to thermal and mechanical actions to be used in conjunction with EN 1990, EN 1991-1-1, EN 1991-1-3 and EN 1991-1-4.

(5) The assessment of the damage of a structure after a fire, is not covered by the present document.

1.2 Normative references

(1)P This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE The following European Standards which are published or in preparation are cited in normative clauses:

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

EN 1990:2002, *Eurocode: Basis of structural design.*

EN 1991, *Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight and imposed loads.*

prEN 1991, *Eurocode 1: Actions on structures - Part 1-3: General actions - Snow loads.*

prEN 1991, *Eurocode 1: Actions on structures - Part 1-4: General actions - Wind loads.*

prEN 1992, *Eurocode 2: Design of concrete structures.*

prEN 1993, *Eurocode 3: Design of steel structures.*

prEN 1994, *Eurocode 4: Design of composite steel and concrete structures.*

prEN 1995, *Eurocode 5: Design of timber structures.*

prEN 1996, *Eurocode 6: Design of masonry structures.*

prEN 1999, *Eurocode 9: Design of aluminium structures.*

1.3 Assumptions

(1)P In addition to the general assumptions of EN 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.

1.4 Distinction between Principles and Application Rules

(1) The rules given in EN 1990:2002, 1.4 apply.

1.5 Terms and definitions

(1)P For the purposes of this European Standard, the terms and definitions given in EN 1990:2002, 1.5 and the following apply.

1.5.1 Common terms used in Eurocode Fire parts

1.5.1.1
equivalent time of fire exposure
time of exposure to the standard temperature-time curve supposed to have the same heating effect as a real fire in the compartment

1.5.1.2
external member
structural member located outside the building that may be exposed to fire through openings in the building enclosure

1.5.1.3
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

1.5.1.4
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

1.5.1.5
fully developed fire
state of full involvement of all combustible surfaces in a fire within a specified space

1.5.1.6
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. Indirect fire actions are considered throughout the structure

1.5.1.7
indirect fire actions
internal forces and moments caused by thermal expansion

1.5.1.8
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

1.5.1.9
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

1.5.1.10
load bearing function (R)
ability of a structure or a member to sustain specified actions during the relevant fire, according to defined criteria

1.5.1.11
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

1.5.1.12
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. Indirect fire actions are not considered, except those resulting from thermal gradients

1.5.1.13
normal temperature design
ultimate limit state design for ambient temperatures according to Part 1-1 of prEN 1992 to prEN 1996 or prEN 1999

1.5.1.14
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

1.5.1.15
separating element
load bearing or non-load bearing element (e.g. wall) forming part of the enclosure of a fire compartment

1.5.1.16
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 temperature-time curve for a specified load combination and for a stated period of time

1.5.1.17
structural members
load-bearing members of a structure including bracings

1.5.1.18
temperature analysis
procedure of determining the temperature development in members on the basis of the thermal actions (net heat flux) and the thermal material properties of the members and of protective surfaces, where relevant

1.5.1.19
thermal actions
actions on the structure described by the net heat flux to the members

1.5.2 Special terms relating to design in general

1.5.2.1
advanced fire model
design fire based on mass conservation and energy conservation aspects

1.5.2.2
computational fluid dynamic 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

1.5.2.3
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

1.5.2.4
one-zone model
fire model where homogeneous temperatures of the gas are assumed in the compartment

1.5.2.5
simple fire model
design fire based on a limited application field of specific physical parameters

1.5.2.6
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. In the upper layer, uniform temperature of the gas is assumed

1.5.3 Terms relating to thermal actions

1.5.3.1
combustion factor
combustion factor represents the efficiency of combustion, varying between 1 for complete combustion to 0 for combustion fully inhibited

1.5.3.2
design fire
specified fire development assumed for design purposes