SLOVENSKI STANDARD

PSIST ENV 1995-1-2:2000

01-april-2000

Eurocode 5: Projektiranje lesenih konstrukcij - Del 1-2: Splošna pravila - Projektiranje požarnoodpornih konstrukcij

Eurocode 5: Design of timber structures - Part 1-2: General rules - Structural fire design

Eurocode 5: Bemessung und Konstruktion von Holzbauten - Teil 1-2: Allgemeine Regeln - Tragwerksbemessungen für den Brandfall

Eurocode 5: Calcul des structures en bois - Partie 1-2: Regles générales - Calcul du comportement au feu

Ta slovenski standard je istoveten z: ENV 1995-1-2:1994

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
91.080.20	Lesene konstrukcije	Timber structures

PSIST ENV 1995-1-2:2000 sl,en

EUROPEAN PRESTANDARD

PRÉNORME EUROPÉENNE

EUROPÄISCHE VORNORM

ENV 1995-1-2

November 1994

ICS 13.220.50; 91.040.00; 91.080.20

Descriptors: buildings, timber construction, building codes, computation, fire tests

English version

Eurocode 5: Design of timber structures - Part 1-2: General rules - Structural fire design

Eurocode 5: Calcul des structures en bois - Partie 1-2: Règles générales - Calcul du comportement au feu

Eurocode 5: Bemessung und Konstruktion von Holzbauten - Teil 1-2: Allgemeine Regeln - Tragwerksbemessung für den Brandfall

This European Prestandard (ENV) was approved by CEN on 1993-06-22 as a prospective standard for provisional application. The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into an European Standard (EN).

CEN members are required to announce the existance of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

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

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart,36 B-1050 Brussels

Ref. No. ENV 1995-1-2:1994 E

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Foreword

Objectives of the Eurocodes

(1) The "Structural Eurocodes" comprise a group of standards for the structural and geotechnical design of buildings and civil engineering works.

(2) They cover execution and control only to the extent that it is necessary to indicate the quality of the construction products, and the standard of workmanship needed to comply with the assumptions of the design rules.

(3) Until the necessary set of harmonised technical specifications for products and methods for the testing their performance are available, some of the Structural Eurocodes cover some of these aspects in informative Annexes.

Background to the Eurocode Programme

(4) The Commission of the European Communities (CEC) initiated the work of establishing a set of harmonised technical rules for the design of building and civil engineering works which would initially serve as an alternative to the differing rules in force in the various Member States and would ultimately replace them. These technical rules became known as the "Structural Eurocodes".

(5) In 1990, after consulting their respective Member States, the CEC transferred the work of further development, issue and updating of the Structural Eurocodes to CEN, and the EFTA Secretariat agreed to support the CEN work.

(6) CEN Technical Committee CEN/TC 250 is responsible for all Structural Eurocodes.

Eurocode Programme

(7) Work is in hand on the following Eurocodes, each generally consisting of a number of parts:

EN 1991 Eurocode 1	Basis of design and 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 provisions for earthquake resistance of structures
EN 1999 Eurocode 9	Design of aluminium alloy structures

(8) Separate sub-committees have been formed by CEN/TC 250 for the various Eurocodes listed above.

(9) This part 1.1 of Eurocode 5 is being published as a European Prestandard (ENV) with an initial life of three years.

(10) This Prestandard is intended for experimental application and for the submission of comments.

(11) After approximately two years CEN members will be invited to submit formal comments to be taken into account in determining future actions.

(12) Meanwhile feedback and comments on this Prestandard should be sent to the Secretariat of CEN/TC 250/SC 5 at the following address:

Secretariat of CEN TC 250/SC 5
BST
Box 5603
S-114 86 STOCKHOLM

or to your national standards organization.

National Application Documents (NAD's)

(13) In view of the responsibilities of authorities in member countries for safety, health and other matters covered by the essential requirements of the Construction Products Directive (CPD), certain safety elements in this ENV have been assigned indicative values which are identified as "boxed" or by [ ]. The authorities in each member state are expected to review the "boxed values" and may substitute alternative definitive values for these safety elements for use in national application.

(14) Some of the supporting European or International standards may not be available by the time this Prestandard is issued. It is therefore anticipated that a National Application Document (NAD) giving any substitute definitive values for safety elements, referencing compatible supporting standards and providing guidance on the national application of this Prestandard, will be issued by each member state or its Standards Organization.

(15) It is intended that this Prestandard is used in conjunction with the National Application Document valid in the country where the building or civil engineering work is located.

Matters specific to this Prestandard

Safety requirements

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

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

(18) Required functions and levels of performance are generally specified by the National authorities - mostly in terms of standard fire resistance ratings. Where fire safety engineering for assessing passive and active measures is accepted, requirements by authorities will be less prescriptive and may allow for alternative strategies.

(19) This ENV 1995-1-2, together with ENV 1991-2-2 gives the supplements to ENV 1995-1-1 which are necessary, so that structures designed according to this set of Structural Eurocodes may also comply with structural fire resistance requirements.

Design procedures

(20) 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 fire protection systems, together with the uncertainties associated with these features and the consequences of failure.

(21) 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.

(22) However, the principal current procedure in European countries is one based on results from standard fire resistance tests. The classification systems in regulations, which call for periods of fire resistance, take into account (though not explicitly) the features and uncertainties described above.

(23) Due to the limitations of the test method, further tests or analysis may be performed. Nevertheless, the results of standard fire tests form the bulk of input for calculation methods for structural fire design. This prestandard therefore deals in the main with the design for the standard fire resistance.

(24) In this ENV 1995-1-2 the desires of the designers are met by giving calculation methods of different complexity. Among the application rules the designer will *in the first place* find a simple method, which would lead to safe, but perhaps less economic structures. In the second place the designer will find more complex methods, which would increase the amount of design work but also could lead to more economic constructions. In the third place general methods are given, which require more information than is given in this Eurocode. Generally, as an alternative to calculation methods, it is possible to make use of design by testing.

(25) The first category of simple methods is applicable for standard fire exposure and is represented by

- Actions and structural system according to 2.5.4
- Charring depths according to 3.1
- Load bearing capacity of members according to 4.1
- Load bearing capacity of joints according to 4.5

(26) The second category of more complicated methods is represented by

- Actions and structural system according to 2.5.3 or 2.5.4
- Charring depths and load bearing capacity of members for standard fire exposure according to Annex A
- Charring depths and load bearing capacity of members for parametric fire exposure according to Annex D
- Additional application rules regarding load bearing capacity of joints according to Annex B

(27) The third category of general methods is represented by

- Actions according to ENV 1991-2-2
- Structural system according to 2.5.2
- Charring rates and load bearing capacity of members according to section 4.3. Further information is given in Annex E

(28) Tabulated data of design solutions for the designer are not included. It is anticipated that such design aids will be found in handbooks etc.

Section 1 General

1.1 Scope

(1)P This Part 1.2 of ENV 1995 deals with the design of timber structures for the accidental situation of fire exposure and shall be used in conjunction with ENV 1995-1-1 and ENV 1991-2-2. This Part only identifies differences or supplements to the design at normal temperature.

(2)P Part 1.2 of ENV 1995 deals only with passive methods of fire protection. Active methods are not covered.

(3)P Part 1.2 of ENV 1995 applies to building structures where for reasons of general fire safety, they are required to fulfill certain functions in exposure to fire, in terms of
- avoiding premature collapse of the structure (load-bearing failure)
- limiting fire spread (flames, hot gases, excessive heat) beyond designated areas (separating function).

(4)P Part 1.2 of ENV 1995 gives detailed rules for the design structures for the specified requirements with respect to the aforementioned functions and levels of performance.

(5)P Part 1.2 of ENV 1995 applies to those structures or parts of structures which are within the scope of ENV 1995-1-1 and are designed accordingly.

1.2 Normative references

This Part incorporates dated or undated normative references cited at the appropriate places in the text. For undated references the latest edition of the publication referred to applies.

European Standards:

EN 301	Adhesives, phenolic and aminoplastic for load bearing timber structures; classification and performance requirements
EN 309	Particleboards - Definition and classification
EN 316	Wood fibreboards - Definition, classification and symbols
EN 313-1	Plywood - Classification and terminology Part 1: Classification
EN 338	Structural Timber - Strength classes
ENV 1991-2-2	Eurocode 1: Basis of design and actions on structures Part 2.2: Actions on structures - Actions on structures exposed to fire
ENV 1993-1-2	Eurocode 3: Design of steel structures Part 1.2: General rules - Supplementary rules for structural fire design
ENV 1995-1-1:1993	Eurocode 5: Design of timber structures Part 1.1: General rules - General rules and rules for buildings

Drafts of European Standards:

prEN 300	Oriented strand boards (OSB)
prEN 520	Gypsum plasterboards - Specifications - Test methods
prEN 912	Timber fasteners - Specifications for connectors for timber
prEN 1194	Glued laminated timber - Strength classes and determination of characteristic values

Note: In CEN TC 127 the following standard is in preparation:

Draft ENV YYY5: Part 5 Fire tests on elements of building construction - Test method for determining the contribution to the fire resistance of structural members: By applied protection to timber structural elements

1.3 Definitions

For the purposes of this prestandard the following definitions apply:

Char-line: Border line between the char-layer and the residual cross section

Design fire load density: The fire load density considered for determining thermal action in fire design; the value of q_d makes allowance for uncertainties and safety requirements

Effective cross section: Cross section of the member in structural fire design used in the effective cross-section method. It is obtained from the residual cross section by removing parts of the cross section with assumed zero strength and stiffness

Effects of actions E: External or internal forces and moments, stresses, deformations, displacements of the structure (as compared to action effects S which comprise only internal forces and moments)

Fire compartment: A space in a building, extending over one or several floors, which is enclosed by separating members such that fire spread beyond the compartment is prevented during the relevant fire exposure

Fire load density: The fire load per unit area, related to the floor area: q_f, related to the surface area of the total enclosure, including openings: q_t

Fire protection material: A material which has been shown, by fire resistance tests, to be capable of remaining in position and of providing adequate thermal insulation for the fire resistance period under consideration

Fire resistance: The ability of a structure, a part of a structure or a member to fulfill its required functions (load bearing, and/or separating function) for a specified fire exposure, for a specified period of time.

Global structural analysis (for fire): An analysis of the entire structure, when either the entire structure, or only parts of it, are exposed to fire. Indirect fire actions are considered throughout the structure

Indirect fire actions: Thermal expansions or thermal deformations causing forces and moments

Integrity criterion "E": A criterion by which the ability of a separating construction to prevent passage of flames and hot gases is assessed

Load bearing criterion "R": A criterion by which the ability of a structure or member to sustain specified actions during the relevant fire, is assessed

Member analysis (for fire): The thermal and mechanical analysis of a structural member exposed to fire in which the member is considered as isolated, with appropiate support and boundary conditions. Indirect fire actions are not considered, except those resulting from thermal gradients

Normal temperature design: Ultimate limit state design for ambient temperatures according to ENV 1995-1-1

Parametric fire exposure: Gas temperature in the environment of surfaces of members etc as a function of time, determined on the basis of fire models and the specific physical parameters describing the conditions in the fire compartment

Protected members: Members for which measures are taken to reduce the temperature rise in the member due to fire

Residual cross section: Cross section of the original member reduced with the charring depth

Separating function: The ability of a separating member (?or assembly) to prevent fire spread by passage of flames or hot gases (integrity) or ignition beyond the exposed surface (thermal insulation) during the relevant fire exposure

Separating construction: Load bearing or non load bearing construction (e.g. walls and floors) forming the enclosure of a fire compartment

Standard temperature-time curve: The nominal temperature-time curve given in ENV 1991-2-2

Standard fire resistance: The ability of a structure or part of it (usually only members) to fulfill required functions (load bearing function, and/or separation function) for exposure to heating according to the standard temperature-time curve - for a stated period of time

Structural members: The load bearing members of a structure, including bracings

Sub-assembly analysis (for fire): The structural analysis of parts of the structure exposed to fire, in which the respective part of the structure is considered as isolated, with appropriate support and boundary conditions. Indirect fire actions within the sub-assembly are considered, but no time-dependent interaction with other parts of the structure
Note 1: Where the effects of indirect fire actions within the sub-assembly are negligible, sub-assembly analysis is equivalent to member analysis
Note 2: Where the effects of indirect fire actions between the sub-assembly are negligible, sub-assembly analysis is equivalent to global structural analysis

Support and boundary conditions: Effects of actions and restraints at supports and boundaries when analysing the entire structure or only parts of the structure

Temperature analysis: The 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 the protective surfaces, where relevant

Temperature-time curves: Gas temperatures in the environment of member surfaces as a function of time. They may be:
- Nominal: Conventional curves, adopted for classification or verification of the fire resistance, e.g. the standard time-temperature curve
- Parametric: Determined on the basis of fire models and the specific physical parameters defining the conditions in the fire compartment

Thermal actions: Actions on the structure described by the net heat flux to the members

Thermal insulation criterion "I": A criterion by which the ability of a separating member to

prevent excessive transmission of heat is assessed

1.4 Symbols

Main symbols:

A	Area
E	Modulus of elasticity; Effect of actions
E XX	Integrity criterion for XX minutes in standard fire exposure
F	Opening factor
I XX	Thermal insulation criterion for XX minutes in standard fire exposure.
R	Resistance
R XX	Load bearing criterion for XX minutes in standard fire exposure
V	Volume
X	Material property
a	Distance
b	Width
c	Specific heat
d	Depth, height
f	Strength
k	Coefficient (always with a subscript)
l	Length
n	Number
p	Perimeter
q	Fire load density related to floor area
r	Radius
t	Time in minutes; Thickness; Total
α	Angle
β	Charring rate
γ	Partial coefficients
η	Coefficient (always with a subscript)
λ	Thermal conductivity
ξ	Coefficient
ρ	Density
ω	Moisture content
Θ	Temperature

Subscripts:

char	Charring
d	Design
ef	Effective
f	Floor
fi	Fire; Fire design
g	Gap
ins	Insulation
k	Characteristic
m	Material property; Bending
max	Maximum
mean	Mean value
min	Minimum
mod	Modification
n	Normal temperature design