
Eurocode 6: Projektiranje zidanih konstrukcij – 1-2. del: Splošna pravila – Projektiranje požarnovarnih konstrukcij

Eurocode 6: Design of masonry structures - Part 1-2: General rules - Structural fire design

Eurocode 6: Bemessung und Konstruktion von Mauerwerksbauten - Teil 1-2: Allgemeine Regeln - Tragwerksbemessung für den Brandfall

Eurocode 6: Calcul des ouvrages en maçonnerie - Partie 1-2: Règles générales - Calcul du comportement au feu

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91.010.30	Technical aspects	Technical aspects
91.080.30	Zidane konstrukcije	Masonry

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EUROPEAN PRESTANDARD

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PRÉNORME EUROPÉENNE

EUROPÄISCHE VORNORM

July 1995

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Descriptors: buildings, construction, masonry work, building codes, computation, fire tests

English version

Eurocode 6: Design of masonry structures - Part 1-2: General rules - Structural fire design

Eurocode 6: Calcul des ouvrages en maçonnerie
- Partie 1-2: Règles générales - Calcul du
comportement au feu

Eurocode 6: Bemessung und Konstruktion von
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- Tragwerksbemessung für den Brandfall

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This European Prestandard (ENV) was approved by CEN on 1994-06-10 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).

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CEN

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

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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 on and off site to comply with the assumptions of the design rules.
- (3) Until the necessary set of harmonized technical specifications for products and for the methods for testing their performance are available, some of the Structural Eurocodes cover some of these aspects in informative annexes.

Background of the Eurocode programme

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

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(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 Structural 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.

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EN 1998 Eurocode 8 : Design of structures for earthquake resistance.

EN 1999 Eurocode 9 : Design of aluminium alloy structures.

- (8) Separate sub-committees have been formed by CEN/TC250 for the various Eurocodes listed above.
- (9) This Part 1-2 of ENV 1996 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/SC6 at the following address:-

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Burggrafenstrasse 6
D-10787 Berlin
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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 by ("boxed values"). The authorities in each member country 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 country or its standards organisation.
- (15) It is intended that this prestandard is used in conjunction with the NAD valid in the country where the building and civil engineering work is located.

Matters specific to this prestandard

(16) The scope of Eurocode 6 is defined in clause 1.1.1 of ENV 1996-1-1 and the scope of this Part of Eurocode 6 is defined in clause 1.1. Additional parts of Eurocode 6 which are planned are indicated in clause 1.1.3 of ENV 1996-1-1.

(17) 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.

(18) The Construction Products Directive 89/106/EEC gives the following Essential Requirement for the limitation of fire risks:

"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."

(19) According to the Interpretative Document "Safety in Case of Fire" the Essential Requirement may be observed by following various fire safety strategies, including passive and active fire protection measures.

(20) 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 spread as relevant.

(21) Required functions and levels of performance are generally specified by the national authorities - mostly in terms of standard fire resistance rating. 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.

(22) This Part 1-2 of ENV 1996, together with ENV 1991-2-2, gives differences from or the supplements to ENV 1996-1-1 which are necessary so that structures designed according to this set of Structural Eurocodes may also comply with structural fire resistance requirements.

(23) 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 three features and the importance of the structure (consequences of failure). At the present time a full analytical procedure is not available for masonry, but one is being developed.

(24) 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, the principal current procedure in European countries is one based on results from standard fire resistance tests. The grading system in regulations, which call for specific periods of fire resistance, takes into account (though not explicitly) the features and uncertainties described above.

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

(26) Application of this Part of ENV 1996 with the thermal actions given in ENV 1991-2-2 is illustrated in table 1.

Table 1: Design procedure

Thermal actions given in ENV 1991-2-2	Design by prescriptive rules/tabulated data given in this Part of ENV 1996	Design by calculation methods given in this Part of ENV 1996
standard temperature-time curve	mainly from fire resistance tests	not yet applicable
other nominal temperature-time curves	not yet applicable	not yet applicable

1 General

1.1 Scope

(1)P This Part 1-2 of ENV 1996 deals with the design of masonry structures for the accidental situation of fire exposure and shall be used in conjunction with ENV 1996-1-1 and ENV 1991-2-2. This Part identifies only differences from or supplements to normal design.

(2) This Part deals only with passive methods of fire protection. Active methods are not covered.

(3) This Part 1-2 of ENV 1996-1 applies to elements of building structures which, for reasons of general fire safety, are required to fulfil certain functions in exposure to fire, in terms of:

- avoiding premature collapse of the structure (load-bearing function).
- limiting fire spread (flames, hot gases, excessive heat) and temperature rise beyond designated areas (separation failure).

(4) This Part gives Principles and Application Rules (see 1.2 in ENV 1996-1-1) for designing structures for specified requirements in respect of the aforementioned functions and levels of performance.

(5) This Part applies only to those masonry structures, or parts thereof, that are described in ENV 1996-1-1 and ENV 1996-2¹⁾ and are designed accordingly. This Part deals with the following:

- non-loadbearing internal walls.
- non-loadbearing external walls.
- loadbearing internal walls with separating or non-separating functions.
- loadbearing external walls with separating or non-separating functions.

1.2 Normative references

(1) This European prestandard 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 prestandard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

¹⁾ ENV 1996-2 is in course of preparation.

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|-----------|---|---|
| EN 771-1 | Specification for masonry units | Part 1: Clay masonry units. |
| EN 771-2 | Specification for masonry units | Part 2: Calcium silicate masonry units. |
| EN 771-3 | Specification for masonry units | Part 3: Aerated concrete masonry units. |
| EN 771-4 | Specification for masonry units | Part 4: Aggregate concrete masonry units. |
| EN 771-5 | Specification for masonry units | Part 5: Manufactured stone masonry units. |
| EN 772-13 | Methods of test for masonry units | Part 13: Determination of net and gross dry density of masonry units. |
| EN 998-2 | Specification for mortar for masonry | Part 2: Masonry mortar. |
| EN 1364 | Fire resistance tests of non-loadbearing elements in buildings. | |
| | Part 1 | Partitions. |
| | Part 2a | External walls. |
| EN 1365 | Fire resistance tests of loadbearing elements in buildings. | |
| | Part 1 | Internal walls. |
| | Part 2 | External walls. |
| EN 1366 | Fire resistance tests of service installations in buildings. | |
| | Part 2 | Dampers. |
| | Part 3 | Penetration seals. |
| | Part 4 | Linear gap seals. |
| EN QQQ | Material properties. | |
| | Part 5 | Masonry. |
| ENV 1991 | Eurocode 1: Basis of design and actions on structures. | |
| | Part 2-2 | Actions on structures exposed to fire. |

ENV 1996 Eurocode 6: Design of masonry structures.

Part 1-1 General rules for buildings.
Rules for reinforced and unreinforced masonry.

Part 2 Design and selection of materials and use of masonry.

(2) Normative reference is made to the following ISO standard

ISO 1000 SI Units

1.3 Definitions

(1) In addition to those definitions given in ENV 1996-1-1, the following definitions are used (further definitions are given in ENV 1991-2-2):

- **Fire compartment:** An enclosed space in a building that is separated from other parts of the same building by enclosing construction having a specified period of fire resistance, within which a fire can be contained (or from which a fire can be excluded), without spreading to (or from) another part of the building.

- **Fire resistance:** The ability of an element of a building construction to fulfil for a stated period of time the required load-bearing function, integrity and/or thermal insulation specified in the standard fire resistance test.

- **Fire wall:** A wall separating two spaces (generally two buildings) which is designed for fire resistance and structural stability, including resistance to horizontal loading (Criterion M) such that, in case of fire and failure of the structure on one side of the wall, fire spread beyond the wall is avoided.

NOTE: In some countries fire wall has been defined as a separating wall between fire compartments without a requirement for resistance to mechanical impact; the definition above should not be confused with that more limited one.

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

- **Loadbearing criterion "R":** A criterion by which the ability of a structure or member to sustain specified actions during the relevant fire is assessed.

- **Loadbearing wall:** Flat, membrane-like component predominantly subjected to compressive stress, for supporting vertical loads, for example floor loads, and also for supporting horizontal loads, for example wind loads.

- **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 appropriate support and

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

- **Non-loadbearing wall:** Flat membrane-like building component that is loaded predominantly only by its dead weight and does not provide bracing for loadbearing walls; however, it may have to transfer horizontal loads acting on its surface to loadbearing building components such as walls or floors.
- **Non-separating wall:** Loadbearing wall exposed to fire on two or more sides.
- **Normal temperature design:** Ultimate limit state design for ambient temperatures according to ENV 1996-1-1 for the fundamental combination (see ENV 1991-1).
- **Separating function:** The ability of a separating member to prevent fire spread by passage of flames or hot gases (cf. integrity) or ignition beyond the exposed surface (cf. thermal insulation) during the relevant fire exposure.
- **Separating member:** Structural and non-structural member (wall or floor) forming the enclosure of a fire compartment.
- **Standard fire resistance:** The ability of a structure or part of it (usually only members) to fulfill required functions (loadbearing function, and/or separating function), for exposure to heating according to the standard temperature-time curve, for a stated period of time.
- **Structural failure of a wall in the fire situation:** When the wall loses its ability, calculated in accordance with ENV 1996-1-1, to carry a load up to a resistance of N_{Rd} divided by average γ_f after a certain period of time.
- **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.
- **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

(1) Supplementary to ENV 1996-1-1, the following units and symbols are used:

N_{Rd}	design load bearing capacity taking into account the effects of slenderness and eccentricity.
R 30	or R 60, . . . a member meeting the load bearing criterion for 30, or 60, minutes in standard fire exposure.