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# DIN EN 1992-1-2

DIN

ICS 13.220.50; 91.010.30; 91.080.40

Supersedes
DIN EN 1992-1-2:2006-10 and
DIN EN 1992-1-2
Corrigendum 1:2009-01

# Eurocode 2: Design of concrete structures – Part 1-2: General rules – Structural fire design (includes Corrigendum AC:2008) English translation of DIN EN 1992-1-2:2010-12

Eurocode 2: Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken –
Teil 1-2: Allgemeine Regeln –
Tragwerksbemessung für den Brandfall
(enthält Berichtigung AC:2008)
Englische Übersetzung von DIN EN 1992-1-2:2010-12

Eurocode 2: Calcul des structures en béton –
Partie 1-2: Règles générales –
Calcul du comportement au feu
(Corrigendum AC:2008 inclus)
Traduction anglaise de DIN EN 1992-1-2:2010-12

Document comprises 99 pages

Translation by DIN-Sprachendienst.
In case of doubt, the German-language original shall be considered authoritative.





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*A comma is used as the decimal marker.*

## National foreword

This standard has been prepared by Technical Committee CEN/TC 250 “Structural Eurocodes” (Secretariat: BSI, United Kingdom).

The responsible German body involved in its preparation was the *Normenausschuss Bauwesen* (Building and Civil Engineering Standards Committee), Working Committee NA 005-52-22 AA *Konstruktiver baulicher Brandschutz.*

This European Standard is part of a series of standards dealing with structural design (Eurocodes) which are intended to be used as a ‘package’. In Guidance Paper L on the application and use of Eurocodes, issued by the EU Commission, reference is made to compulsory transitional periods for the introduction of the Eurocodes in the member states. The transitional periods correlate approximately with those given in the Foreword of this standard.

In Germany, this standard is to be applied in conjunction with the National Annex.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. DIN [and/or DKE] shall not be held responsible for identifying any or all such patent rights.

In this standard a distinction is made between “Principles” and “Application Rules” (see subclause 1.4). “Principles” are identified by the letter code “P” following the number of the clause (e.g. (1)P). Clauses without letter code “P” are considered to contain “Application Rules”.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ▌〈AC〉 〈AC〉▐.

### Amendments

This standard differs from DIN V ENV 1992-1-2:1997-05 as follows**:**

a) the prestandard status has been changed to that of a full standard;

b) the comments received from the national standards bodies have been taken into account and the text of the standard has been completely revised;

Compared with DIN EN 1992-1-2:2006-10 and DIN EN 1992-1-2 Corrigendum 1:2009-01, the following corrections have been made:

a) this standard is the consolidated version of the previous 2004 edition with Corrigendum AC:2008;

b) the standard has been editorially revised.

### Previous editions

DIN V ENV 1992-1-2: 1997-05
DIN EN 1992-1-2: 2006-10
DIN EN 1992-1-2 Corrigendum 1: 2009-01

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 1992-1-2

December 2004

# + AC

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ICS 13.220.50; 91.010.30; 91.080.40

Supersedes ENV 1992-1-2:1995

English version

# Eurocode 2: Design of concrete structures — Part 1-2: General rules — 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

EN 1992-1-2:2004 was approved by CEN on 2004-07-08 and Corrigendum AC:2008 on 2008-07-30.



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Ref. No. EN 1992-1-2:2004 + AC:2008 E

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A Temperature profiles

B Simplified calculation methods

C Buckling of columns under fire conditions

D Calculation methods for shear, torsion and anchorage

E Simplified calculation method for beams and slabs

## Foreword

This document (EN 1992-1-2:2004 + AC:2008) 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.

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 June 2005, and conflicting national standards shall be withdrawn at the latest by March 2010.

This document supersedes ENV 1992-1-2:1995.

According to the CEN-CENELEC Internal Regulations, the National Standard 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and 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 1980s.

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

[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).

publication of the Eurocodes to the 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 |
| 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 |

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 Documents2 referred to in Article 12 of the CPD, although they are of a different nature from harmonised product standards3. Therefore, technical aspects arising from the Eurocodes work need to be adequately considered by CEN Technical

[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.

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.

**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,
- decisions on the application of informative annexes,
- references to non-contradictory complementary information to assist the user to apply the Eurocode.

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

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 should clearly mention which Nationally Determined Parameters have been taken into account.

**Additional information specific to EN 1992-1-2**

EN 1992- 1-2 describes the Principles, requirements and rules for the structural design of buildings exposed to fire, including the following aspects.

*Safety requirements*

EN 1992-1-2 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.

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

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

"The construction works must be designed and build 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" 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 by referring to fire safety engineering for assessing passive and active measures, see EN 1991-1-2.

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).

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 call for specific periods of fire resistance, takes into account (though not explicitly), the features and uncertainties described above.

Application of design procedures is illustrated in Figure 0.1. 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. Additional information for alternative methods in this standard is given in Table 0.1.

For design according to this part, EN 1991-1-2 is required for the determination of thermal and mechanical actions to the structure.

*Design aids*

Where simple calculation models are not available, the Eurocode fire parts give design solutions in terms of tabulated data (based on tests or advanced calculation models), which may be used within the specified limits of validity.

It is expected, that design aids based on the calculation models given in EN 1992-1-2, will be prepared by interested external organisations.

The main text of EN 1992-1-2, together with informative Annexes A, B, C, D and E, includes most of the principal concepts and rules necessary for structural fire design of concrete structures.

**National Annex for EN 1992-1-2**

This standard gives alternative procedures, values and recommendations for classes with notes indicating where national choices may have to be made. Therefore the National Standard implementing EN 1992-1-2 should have a National Annex containing the Eurocode all Nationally Determined Parameters to be used for the design of buildings, and where required and applicable, for civil engineering works to be constructed in the relevant country.

National choice is allowed in EN 1992-1-2 through clauses:

- 2.1.3 (2)
- 2.3 (2)P
- 3.2.3 (5)
- 3.2.4 (2)
- 3.3.3 (1)
- 4.1 (1)P
- 4.5.1 (2)
- 5.2 (3)
- 5.3.2 (2)
- 5.6.1 (1)
- 5.7.3 (2)
- 6.1 (5)
- 6.2 (2)
- 6.3.1 (1)
- 6.4.2.1 (3)
- 6.4.2.2 (2)