



SLOVENSKI STANDARD
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Fire classification of construction products and building elements - Part 2: Classification using data from fire resistance tests, excluding ventilation services

Klassifizierung von Bauprodukten und Bauarten zu ihrem Brandverhalten - Teil 2: Klassifizierung mit den Ergebnissen aus den Feuerwiderstandsprüfungen, mit Ausnahme von Lüftungsanlagen

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Classement au feu des produits et éléments de construction - Partie 2: Classement a partir des données d'essais de résistance au feu a l'exclusion des produits utilisés dans les systemes de ventilation

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ICS 13.220.50

English version

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

Classement au feu des produits de construction et des éléments de bâtiment - Partie 2: Classement à partir des données des essais de résistance au feu, services de ventilation exclus

Klassifizierung von Bauprodukten und Bauarten zu ihrem Brandverhalten - Teil 2: Klassifizierung mit den Ergebnissen aus den Feuerwiderstandsprüfungen, mit Ausnahme von Lüftungsanlagen

This European Standard was approved by CEN on 9 April 2003.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.



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Foreword

This document (EN 13501-2:2003) has been prepared by Technical Committee CEN/TC 127 "Fire safety in buildings", the Secretariat of which is held by BSI.

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 February 2004, and conflicting national standards shall be withdrawn at the latest by February 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of the Construction Products Directive.

CEN, CENELEC and EOTA committees preparing technical specifications which contain performance requirements against resistance to fire tests should make reference to the resistance to fire classification given in this standard and not refer directly to any specific fire test method.

Some of the methods referred to by this standards are prENs which are still undergoing technical development. Users of this standard should, therefore, check the availability and acceptability of these prENs before seeking to apply them. Currently EN 13501-2 cannot be applied to classify curtain walling for resistance to fire. This will be possible once either EN 1364-3 "Fire resistance tests for non-loadbearing elements – Part 3: Curtain walling – Full configuration (complete assembly)" is made available or alternative provisions for classifying curtain walling for resistance to fire are made available.

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EN 13501 consists of the following parts:

- Part 1: *Classification using test data from reaction to fire tests*
- Part 2: *Classification using data from fire resistance tests, excluding ventilation services*
- Part 3: *Classification using data from fire resistance tests on components of normal building service installations*
- Part 4: *Classification using test data from fire resistance tests on smoke control systems*
- Part 5: *Classification using test data from external fire exposure to roof tests*

Annexes A and B are normative.

This document includes a Bibliography.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

The aim of this Part of this European Standard is to define a harmonised procedure for the classification for resistance to fire of construction products and elements. This classification is based on the test procedures listed in clause 2.

This Part of this European Standard is prepared in support of the second essential requirement in the EC Construction Products Directive (89/106/EEC) which is detailed in the Interpretative Document number 2 (ID2): Safety in case of fire (OJ C62 Vol 37). It reflects the Commission Decision of 3 May 2000 on the implementation of the Council Directive 89/106/EEC as regards the classification of the resistance to fire performance of construction products, construction works and parts thereof.

The Interpretative Document and the Commission Decision of 2 May 2000 specify performance and classes regarding fire resistance. These classes are identified by designation letters, each of which refers to an important characteristic of fire resistance behaviour.

This Part of this European Standard provides for a common understanding for these requirements. It interprets the functional requirements for the different groups of building elements and explains the method for deriving their classification on the basis of test results for individual elements.

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1 Scope

This Part of this European Standard specifies the procedure for classification of construction products and building elements using data from fire resistance and smoke leakage tests which are within the direct field of application of the relevant test method. This part of this European Standard currently cannot be applied to classify curtain walling for resistance to fire. Classification on the basis of extended application is outside the scope of this standard. For extended application, however, the same classes are used as specified in this standard.

This standard deals with:

a) Loadbearing elements without a fire separating function

walls
floors
roofs
beams
columns
balconies
walkways
stairs

b) Loadbearing elements with a fire separating function, with or without glazing, services and fixtures

walls
floors
roofs
raised floors

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c) Products and systems for protecting elements or parts of the works

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ceilings with no independent fire resistance
fire protective coatings, claddings and screens

d) Non-loadbearing elements or parts of works, with or without glazing, services and fixtures

partitions
facades (curtain walls) and external walls
ceilings with independent fire resistance
fire doors and shutters and their closing devices
smoke control doors
conveyor systems and their closures
penetration seals
linear joint seals
service ducts and shafts
chimneys

e) Wall and ceiling coverings with fire protection ability

f) Lift landing doors which are tested to prEN 81-8 are excluded from this standard. Lift landing doors which are tested to EN 1634-1 are classified in accordance with 7.5.5.

Relevant test methods which have been prepared for these elements are listed in clause 2.

2 Normative references

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 below. 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).

prEN 81-8, *Safety rules for the construction and installation of lifts — Part 8: Lift landing doors – Fire resistance testing.*

EN 1363-1, *Fire resistance tests — Part 1: General requirements.*

EN 1363-2, *Fire resistance tests — Part 2: Alternative and additional procedures.*

EN 1364-1, *Fire resistance tests for non-loadbearing elements — Part 1: Walls.*

EN 1364-2, *Fire resistance tests for non-loadbearing elements — Part 2: Ceilings.*

EN 1365-1, *Fire resistance tests for loadbearing elements — Part 1: Walls.*

EN 1365-2, *Fire resistance tests for loadbearing elements — Part 2: Floors and roofs.*

EN 1365-3, *Fire resistance tests for loadbearing elements — Part 3: Beams.*

EN 1365-4, *Fire resistance tests for loadbearing elements — Part 4: Columns.*

prEN 1365-5, *Fire resistance tests for loadbearing elements — Part 5: Balconies and walkways.*

prEN 1365-6, *Fire resistance tests for loadbearing elements — Part 6: Stairs.*

prEN 1366-3, *Fire resistance tests for service installations — Part 3: Penetration seals.*

prEN 1366-4, *Fire resistance tests for service installations — Part 4: Linear joint seals.*

prEN 1366-5, *Fire resistance tests for service installations — Part 5: Service ducts and shafts.*

prEN 1366-6, *Fire resistance tests for service installations — Part 6: Raised access floors and hollow floors.*

prEN 1366-7, *Fire resistance tests for service installations — Part 7: Conveyor systems and their closures.*

EN 1634-1, *Fire resistance tests for door and shutter assemblies — Part 1: Fire doors and shutters.*

EN 1634-3, *Fire resistance tests for door and shutter assemblies — Part 3: Smoke control doors and shutters.*

prEN 13216-1, *Chimneys – Test methods for system chimneys – Part 1: General test methods.*

ENV 13381-2, *Test methods for determining the contribution to the fire resistance of structural members - Part 2: Vertical protective membranes.*

ENV 13381-3, *Test methods for determining the contribution to the fire resistance of structural members - Part 3: Applied protection to concrete members.*

ENV 13381-4, *Test methods for determining the contribution to the fire resistance of structural members - Part 4: Applied protection to steel members.*

ENV 13381-5, *Test methods for determining the contribution to the fire resistance of structural members - Part 5: Applied protection to concrete/profiled sheet steel composite members*

ENV 13381-6, *Test methods for determining the contribution to the fire resistance of structural members - Part 6: Applied protection to concrete filled hollow steel columns.*

ENV 13381-7, *Test methods for determining the contribution to the fire resistance of structural members - Part 7: Applied protection to timber members.*

prEN 14600, *Fire resisting and/or smoke control doorsets and operable windows – Requirements and classification*

prEN 14135, *Coverings — Determination of fire protection ability.*

EN ISO 13943, *Fire safety — Vocabulary*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN ISO 13943, together with the following, apply.

3.1

element of building construction

defined construction component, e.g. wall, partition, floor, roof, beam or column (EN 1363-1). An element, for the purpose of this standard, covers both individual products and elements made up of one or more products

3.2

ceiling

non-loadbearing element of a building construction designed to provide horizontal fire separation (EN 1364-2)

3.3

self-supporting ceiling

ceiling with a span from wall to wall, without any additional suspension devices (EN 1364-2)

3.4

door or shutter assembly (doorset)

complete assembly, including any frame or guide, door leaf or leaves, rolling or folding curtain, etc., which is provided for closing of permanent openings in separating elements. This includes all side-panels, vision panels or transom panels, together with the door hardware and any seals (whether provided for the purpose of fire or smoke control or for other purposes such as draught control or acoustics) which are used in the assembly (EN 1634-1)

3.5

floor

horizontal element of building construction which is loadbearing (EN 1365-2)

3.6

roof

horizontal or sloped element of building construction which is loadbearing (EN 1365-2)

3.7

suspended ceiling

ceiling which is suspended from a supporting construction (EN 1364-2)

3.8

loadbearing wall

wall designed to support an applied load (EN 1365-1)

3.9

non-loadbearing wall

wall designed not to be subjected to any load other than its self weight (EN 1364-1)

3.10

internal wall

wall which provides fire separation. It can be exposed separately to a fire from either side (EN 1364-1 and EN 1365-1)

3.11**external wall**

wall forming the external envelope of a building which may be exposed separately to an internal or an external fire (EN 1364-1 and EN 1365-1)

3.12**insulated wall**

wall, with or without glazing, which satisfies both the integrity and insulation criteria for the achieved fire resistance period (EN 1364-1 and EN 1365-1)

3.13**uninsulated wall**

wall, with or without glazing, which satisfies the integrity and, where required, the radiation criteria for the achieved fire resistance period but which is not intended to provide insulation. Such a wall can consist entirely of uninsulated fire resistant glazing (EN 1364-1 and EN 1365-1)

3.14**separating wall**

wall with or without glazing provided within a building or between adjoining buildings to prevent the transfer of fire from one side to the other (EN 1364-1 and EN 1365-1)

3.15**curtain wall**

external non-loadbearing wall which is independent of the structural frame and supported in place in front of loadbearing structures. A curtain wall typically includes panels, glazing, seals, fixings, transoms and mullions

3.16**fire resistant glazing**

glazing system consisting of one or more transparent or translucent panes with a suitable method of mounting, with e.g. frames, seals and fixing materials, capable of satisfying the appropriate fire resistance criteria (EN 1364-1)

3.17**insulated glazing**

fire resistant glazing which satisfies both the integrity and insulation criteria for the achieved fire resistance period (EN 1364-1)

3.18**uninsulated glazing**

fire resistance glazing which satisfies the integrity and, where required, the radiation criteria for the achieved fire resistance period but which is not intended to provide insulation (EN 1364-1)

3.19**glazed element**

building element with one or more (light transmissive) panes, fire resistant or not, that are built in a frame with fixings and seals (EN 1364-1)

3.20**test specimen**

element (or part) of building construction provided for the purpose of determining either its fire resistance or its contribution to the fire resistance of another building element (EN 1363-1)

3.21**loadbearing element**

element that is intended for use in supporting an external load in a building and maintaining this support in the event of a fire (EN 1363-1)

3.22**separating element**

element that is intended for use in maintaining separation between two adjacent areas of a building in the event of a fire (EN 1363-1)

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3.23

smoke leakage

ability of an element of construction to reduce the passage of hot and/or cold gases or smoke from one side of the element to the other to below specified levels (EN 1363-1)

3.24

sustained flaming

continuous flaming for a period of time greater than 10 s (EN 1363-1)

3.25

load level

magnitude of the test load (mechanical actions) in relation to the loadbearing capacity of the member at normal temperature

NOTE The loadbearing capacity of the member at normal temperature is determined by testing or calculation, taking into account the actual mechanical properties of the loadbearing element tested.

3.26

covering

product intended to protect underlying elements against ignition, charring and other damage

3.27

direct field of application

includes the variations in the construction and the limits of use for the element which, without further analysis, are covered by the single test result, with respect to defined performance characteristics that have been achieved from a fire resistance test according to the appropriate test standard

3.28

extended field of application

includes variations in the construction and limits of use for an element that has been subject to one or more fire tests according to the appropriate standard. Extended application is done following procedures laid down in extended application standards

3.29

closure and conveyor system assembly

complete assembly of the closure for the conveyor system and, where relevant, its frame or guide, which is provided for closing off a permanent opening in a separating element. This includes the anchoring parts for the connection with the separating element, a length of any penetrating component on either side of the construction and the penetration seal, any sealing system between the closure for a conveyor system, the conveyor system and any closing and/or separating device (prEN 1366-7)

4 Fire scenarios

4.1 General

The second essential requirement of the Construction Products Directive addresses spread of fire and smoke and the loadbearing capacity of the construction. These requirements are considered to be satisfied by proving fire resistance of loadbearing and/or separating elements.

Fire resistance of loadbearing and/or separating elements shall be assessed using one or more of the levels of thermal attack given in 4.2 to 4.6. Further clauses of this standard identify which attack(s) shall be used for which elements.

NOTE 1 The various levels of thermal action given in 4.2 to 4.6 reflect different fire scenarios and the standards which prescribe their translation into practical tests give tolerances for their application.

NOTE 2 Other heating curves exist, for example the hydrocarbon curve. Also, for extreme fire scenarios (e.g. traffic tunnels, nuclear plants), more severe conventional curves can be specified. These are not, however, used for the classification of elements according to this standard.

4.2 The standard temperature/time curve (post flash-over fire)

When applied as a basis for testing, the standard temperature/time relationship shall be applied for the full duration of the test. The relationship, which is a model of a fully developed fire in a compartment, is given by the following relationship:

$$T = 345 \log_{10} (8t + 1) + 20$$

where

t is the time from the start of the test in minutes (min);

T is the average furnace temperature in °C.

NOTE Further details relating to the practical application of this curve and other test parameters, e.g. tolerances, are given in EN 1363-1.

4.3 The slow heating curve (smouldering fire)

The smouldering fire test shall only be used if it is expected that the fire resistance performance of the element may be reduced by exposure to temperatures associated with the growth stage of a fire. It is, therefore, particularly relevant to elements whose performance may be dependent upon high heating rates below approximately 500 °C (as provided during the standard temperature/time curve) for achievement of their classifications (i.e. mainly reactive or intumescent products).

The slow heating curve is given by the following relationship:

for $0 < t \leq 21$

$$T = 154t^{0,25} + 20$$

for $t > 21$

$$T = 345 \log_{10} (8(t-20) + 1) + 20$$

where

t is the time from start of test, in minutes;

T is the average furnace temperature in °C

NOTE Further details relating to the practical application of this curve, and other test parameters e.g. tolerances, are given in EN 1363-2.

4.4 The 'semi-natural' fire

During the 'semi-natural' fire test the temperature of the fire gases adjacent to the soffit of the ceiling shall reach 1 000 °C within 10 min to 20 min of the start of the test.

Because of the difficulties in achieving the necessary thermal attack in a conventional furnace, the attack shall be provided by fire from wooden cribs made from softwood.

NOTE 1 The 'semi-natural' fire is a fire which produces direct flame impingement with a high convective heat transfer content which is not realised in furnace tests using the standard temperature/time curve. The term 'semi-natural' fire corresponds to the single burning item exposure required for ceilings in 4.3.1.3.4 (a) of the Interpretative Document 2 (not to be confused with the "single burning item" test for reaction to fire). It is relevant only for lightweight suspended horizontal protective membranes having a low thermal inertia.

NOTE 2 Further details relating to the practical application of this thermal attack, and other test parameters, are given in prENV 13381-1.

4.5 The external fire exposure curve

This is a temperature/time relationship which represents the exposure of the external face of a wall to fire which may emerge from a window of a building, or from a free-burning external fire.

The curve is defined by the relationship:

$$T = 660 (1 - 0,687 e^{-0,32t} - 0,313 e^{-3,8t}) + 20$$

where

t is the time from start of test, in minutes;

T is the average furnace temperature in °C.

NOTE Further details relating to the practical application of this curve, and other test parameters e.g. tolerances, are given in EN 1363-2.

4.6 Constant temperature attack

In addition to the heating regimes given above, the evaluation of some elements shall be made using a notional constant value of temperature. The specified temperature depends upon the type of element. The rate at which this temperature is achieved is specified in each relevant test standard.

The following temperatures shall be used for the elements indicated:

20 °C for evaluating the leakage rate of smoke control doors at ambient temperature

200 °C for evaluating the leakage rate of medium temperature smoke control doors

500 °C for evaluating the fire performance of raised floors

1000 °C for evaluating soot fire resistance of chimneys and chimney related products

5 Resistance to fire performance characteristics

5.1 General

ID2 requires the assessment of the characteristic loadbearing capacity and/or integrity and/or insulation. Further optional characteristics are also specified by ID2, namely radiation, mechanical aspects, self-closing ability and smoke leakage. The need to classify based on these optional characteristics is dependent on national regulations and may be specified under certain conditions for certain elements. This clause provides the necessary details of each of the above characteristics.

Where a characteristic may have more than one different definition or type of performance, later clauses identify which specific definition applies to which element.

5.2 Performance characteristics

5.2.1 R - Loadbearing capacity

Loadbearing capacity R is the ability of the element of construction to withstand fire exposure under specified mechanical actions, on one or more faces, for a period of time, without any loss of structural stability.

The criteria which provide for assessment of imminent collapse will vary as a function of the type of loadbearing element.

They shall be either:

- a) for flexurally loaded elements e.g. floors, roofs, a rate of deformation (rate of deflection) and a limit state for the actual deformation (deflection); or
- b) for axially loaded elements e.g. columns, walls, a rate of deformation (rate of contraction) and a limit state for the actual deformation (contraction).

5.2.2 E - Integrity

5.2.2.1 General

Integrity E is the ability of the element of construction, that has a separating function, to withstand fire exposure on one side only, without the transmission of fire to the unexposed side as a result of the passage of flames or hot gases. They may cause ignition either of the unexposed surface or of any material adjacent to that surface.

The assessment of integrity shall generally be made on the basis of the following three aspects:

- cracks or openings in excess of given dimensions;
- ignition of a cotton pad;
- sustained flaming on the unexposed side.

The integrity shall be determined by all three methods during the test, and the cotton pad is applied until it ignites and once it has ignited it is withdrawn and the test continued until all three aspects have been exceeded (the sponsor has the option, however, of stopping the test once the desired level has been reached). The times of each mode of integrity failure are recorded.

Failure of the loadbearing capacity criterion shall also be considered as failure of integrity.

Classification of integrity shall be according to whether or not the element is also classified for insulation. Where it is classified both for integrity E and insulation I, the integrity value is that determined by whichever of the three criteria fails first. Where an element is classified E but without an I classification, the integrity value is defined as the time to failure of only the cracks/openings or sustained flaming criteria, whichever fails first.

The relevant test standards specify how the different areas of elements which have some insulated and some uninsulated parts are to be tested.

5.2.2.2 Specific

For some elements the determination of integrity performance requires additional measurement or shall not be determined by any of the three criteria given in 5.2.2.1. In those cases the relevant methodology is given in the specific test standard.

5.2.3 I - Insulation

5.2.3.1 General

Insulation I is the ability of the element of construction to withstand fire exposure on one side only, without the transmission of fire as a result of significant transfer of heat from the exposed side to the unexposed side. Transmission shall be limited so that neither the unexposed surface nor any material in close proximity to that surface is ignited. The element shall also provide a barrier to heat, sufficient to protect people near to it.

Where an element of construction has been evaluated for different levels of thermal performance associated with various discrete areas, its classification as a whole shall be given on the basis of the shortest time for which either the maximum or mean temperature rise criteria are satisfied on any discrete area.