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Fire classification of construction products and building elements – Part 2: Classification using data from fire resistance tests, excluding ventilation services; English version EN 13501-2:2016, English translation of DIN EN 13501-2:2016-12

Klassifizierung von Bauprodukten und Bauarten zu ihrem Brandverhalten –
Teil 2: Klassifizierung mit den Ergebnissen aus den Feuerwiderstandsprüfungen, mit Ausnahme von Lüftungsanlagen;
Englische Fassung EN 13501-2:2016,
Englische Übersetzung von DIN EN 13501-2:2016-12

Classement au feu des produits et éléments de construction –
Partie 2: Classement à partir des données d'essais de résistance au feu à l'exclusion des produits utilisés dans les systèmes de ventilation;
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National foreword

This document (EN 13501-2:2016) has been prepared by Technical Committee CEN/TC 127 “Fire safety in buildings” (Secretariat: BSI, United Kingdom).

The responsible German body involved in its preparation was *DIN-Normenausschuss Bauwesen* (DIN Standards Committee Building and Civil Engineering), Working Committee NA 005-52-02 AA *Brandverhalten von Baustoffen und Bauteilen — Bauteile.*

Amendments

This standard differs from DIN EN 13501-2:2010-02 as follows:

a) general editorial amendments have been made;

b) normative references have been updated.

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EUROPEAN STANDARD

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

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This European Standard was approved by CEN on 23 April 2016.

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European foreword

This document (EN 13501-2:2016) has been prepared by Technical Committee CEN/TC 127 "Fire safety in buildings", the secretariat of which is held by BSI.

This document supersedes EN 13501-2:2007+A1:2009.

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 December 2016, and conflicting national standards shall be withdrawn at the latest by December 2016.

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

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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 European Standard and not refer directly to any specific fire test method.

Changes have been made in this revision to bring it in line with the relevant current EC Decisions on fire resistance classification, and experience in use in the first edition.

EN 13501 *Fire classification of construction products and building elements* consists of the following Parts:

— *Part 1: Classification using 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: fire resisting ducts and fire dampers*

— *Part 4: Classification using data from fire resistance tests on components of smoke control systems*

— *Part 5: Classification using data from external fire exposure to roof tests*

— *Part 6: Classification using data from reaction to fire tests on electric cables*

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

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

This European Standard is prepared in support of the second basic requirement, in the EC Construction Products Regulation (305/2011) and is detailed in the Interpretative Document number 2 (ID2): Safety in case of fire (OJC62 Vol 37).

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 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 and/or extended application results for individual elements.

NOTE Test reports constitute the basis for extended application reports as explained in EN 15725.

1 Scope

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. Classification on the basis of extended application of test results is also included in the scope of this European Standard.

This European 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.

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

— 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;

— raised floors;

— 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 according to EN 81-58 are excluded from this European Standard. Lift landing doors which are tested in accordance with EN 1634-1, are classified in accordance with 7.5.5.

Relevant test methods which have been prepared for these elements are listed in Clauses 2 and 7.

2 Normative references

The following documents in whole or in part are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

EN 1364-1:2015, *Fire resistance tests for non-loadbearing elements - Part 1: Walls*

EN 1364-2:1999, *Fire resistance tests for non-loadbearing elements - Part 2: Ceilings*

EN 1364-3, *Fire resistance tests for non-loadbearing elements - Part 3: Curtain walling - Full configuration (complete assembly)*

EN 1364-4, *Fire resistance tests for non-loadbearing elements - Part 4: Curtain walling - Part configuration*

EN 1365-1:2012, *Fire resistance tests for loadbearing elements - Part 1: Walls*

EN 1365-2:2014, *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*

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

EN 1365-6, *Fire resistance tests for loadbearing elements - Part 6: Stairs*

EN 1366-3, *Fire resistance tests for service installations - Part 3: Penetration seals*

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

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

EN 1366-6, *Fire resistance tests for service installations - Part 6: Raised access and hollow core floors*

EN 1366-7:2004, *Fire resistance tests for service installations - Part 7: Conveyor systems and their closures*

EN 1634-1:2014, *Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware - Part 1: Fire resistance test for door and shutter assemblies and openable windows*

EN 1634-3:2004, *Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware - Part 3: Smoke control test for door and shutter assemblies*

EN 13216-1, *Chimneys - Test methods for system chimneys - Part 1: General test methods*

EN 13381-1, *Test methods for determining the contribution to the fire resistance of structural members - Part 1: Horizontal protective membranes*

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

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

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

EN 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 member*

EN 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*

EN 13381-8, *Test methods for determining the contribution to the fire resistance of structural members - Part 8: Applied reactive protection to steel members*

EN 13381-9, *Test methods for determining the contribution to the fire resistance of structural members - Part 9: Applied fire protection systems to steel beams with web openings*

EN 14135, *Coverings - Determination of fire protection ability*

EN 14600, *Doorsets and openable windows with fire resisting and/or smoke control characteristics — Requirements and classification*

EN 15080-8, *Extended application of results from fire resistance tests - Part 8: Beams*

EN 15080-12, *Extended application of results from fire resistance tests - Part 12: Loadbearing masonry walls*

EN 15254-2, *Extended application of results from fire resistance tests - Non-loadbearing walls - Part 2: Masonry and Gypsum Blocks*

EN 15254-4, *Extended application of results from fire resistance tests — Nonloadbearing walls — Part 4: glazed constructions*

EN 15254-5, *Extended application of results from fire resistance tests - Non-loadbearing walls - Part 5: Metal sandwich panel construction*

EN 15254-6, *Extended application of results from fire resistance tests - Non-loadbearing walls - Part 6: Curtain walling*

EN 15254-7, *Extended application of results from fire resistance tests - Non-loadbearing ceilings - Part 7: Metal sandwich panel construction*

EN 15269-1, *Extended application of test results for fire resistance and/or smoke control for door, shutter and openable window assemblies, including their elements of building hardware - Part 1: General requirements*

EN 15269-2, *Extended application of test results for fire resistance and/or smoke control for door, shutter and openable window assemblies, including their elements of building hardware - Part 2: Fire resistance of hinged and pivoted steel doorsets*

EN 15269-3, *Extended application of test results for fire resistance and/or smoke control for door, shutter and openable window assemblies, including their elements of building hardware - Part 3: Fire resistance of hinged and pivoted timber doorsets and openable timber framed windows*

EN 15269-5, *Extended application of test results for fire resistance and/or smoke control for door, shutter and openable window assemblies, including their elements of building hardware - Part 5: Fire resistance of hinged and pivoted metal framed glazed doorsets and openable windows*

prEN 15269-6, *Extended application of test results for fire resistance and/or smoke control for door, shutter and openable window assemblies, including their elements of building hardware - Part 6: Fire resistance of sliding timber doorsets*

EN 15269-7, *Extended application of test results for fire resistance and/or smoke control for door, shutter and openable window assemblies, including their elements of building hardware - Part 7: Fire resistance for steel sliding doorsets*

EN 15269-10, *Extended application of test results for fire resistance and/or smoke control for door, shutter and openable window assemblies including their elements of building hardware - Part 10: Fire resistance of steel rolling shutter assemblies*

prEN 15269-11, *Extended application of test results for fire resistance and/or smoke control for door, shutter and openable window assemblies, including their elements of building hardware — Part 11: Fire resistance for operable fabric curtains*

EN 15269-20, *Extended application of test results for fire resistance and/or smoke control for door, shutter and openable window assemblies, including their elements of building hardware - Part 20: Smoke control for hinged and pivoted steel, timber and metal framed glazed doorsets*

EN 15725, *Extended application reports on the fire performance of construction products and building elements*

EN 15882-3, *Extended applications of results from fire resistance tests for service installations - Part 3: Penetration seals*

EN 15882-4, *Extended application of results from fire resistance tests for service installations - Part 4: Linear joint seals*

EN ISO 13943:2010, *Fire safety - Vocabulary (ISO 13943:2008)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 13943:2010 and the following apply.

3.1
element of building construction
defined part of a construction component, such as wall, partition, floor, roof, beam or column

Note 1 to entry: Element covers both individual products and elements made up of one or more products.

[SOURCE: EN 1363-1: 2012]

3.2
ceiling
non-loadbearing element of a building construction designed to provide horizontal fire separation

[SOURCE: EN 1364-2:1999]

3.3
self-supporting ceiling
ceiling with a span from wall to wall, without any additional suspension devices

[SOURCE: EN 1364-2:1999]

3.4
door or shutter assembly (doorset)
pedestrian doorset or industrial type doorset including any frame or guide, door leaf or leaves, rolling or folding curtain, etc; which is provided to give a fire resisting capability when used for the closing of permanent openings in fire resisting elements, which includes any side panel(s), flush over panel(s) transom panel(s) and/or glazing together with the building hardware and any seals (whether provided for the purpose of fire resistance or smoke control or for other purposes such as draught or acoustics) which form the assembly

[SOURCE: EN 1634-1: 2014]

3.5
floor
horizontal separating element of building construction which is loadbearing

[SOURCE: EN 1365-2: 2014]

3.6
roof
horizontal or sloped separating element of building construction which is loadbearing and includes the roof covering

[SOURCE: EN 1365-2: 2014]

3.7
ceiling (suspended)
lining plus any supporting framework, including hangers, fixings and any insulation material suspended from the structural building member

[SOURCE: EN 1365-2: 2014]

3.8
ceiling system
full ceiling assembly submitted for test, including hangers and fixings, e.g. lighting and ventilation ductings and access points

[SOURCE: EN 1365-2: 2014]

3.9
loadbearing wall
wall designed to support a vertically applied load

3.10
non-loadbearing wall
wall designed not to be subjected to any load other than its self weight

[SOURCE: EN 1364-1:2015]

3.11
internal wall
wall with or without glazing which provides fire separation and which may be exposed separately to a fire from either side

[SOURCE: EN 1364-1:2015 and EN 1365-1: 2012]

3.12
external wall
wall forming the external envelope of a building including glazing which may be exposed separately to an internal or an external fire

[SOURCE: EN 1364-1:2015 and EN 1365-1: 2012]

3.13
insulated wall
wall, with or without glazing, which satisfies both the integrity and insulation criteria for the achieved fire resistance period

[SOURCE: EN 1364-1:2015 and EN 1365-1: 2012]

3.14
un-insulated 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.

Note 1 to entry: Such a wall can consist entirely of un-insulated fire resistant glazing.

[SOURCE: EN 1364-1:2015 and EN 1365-1:2012]

3.15
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

[SOURCE: EN 1365-1:2012]

3.16
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

3.17
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

[SOURCE: EN 1364-1:2015]

3.18
insulated glazing
fire resistant glazing which satisfies both the integrity and insulation criteria for the achieved fire resistance period

[SOURCE: EN 1364-1:2015]

3.19
un-insulated 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

[SOURCE: EN 1364-1:2015]

3.20
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

[SOURCE: EN 1364-1:2015]

3.21
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

[SOURCE: EN 1363-1:2012]

3.22
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

[SOURCE: EN 1363-1: 2012]

3.23
separating element
element that is intended for use in maintaining separation between two adjacent areas of a building in the event of a fire

[SOURCE: EN 1363-1: 2012]

3.24
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

3.25
sustained flaming
continuous flaming for a period of time greater than 10 s

[SOURCE: EN 1363-1: 2012]

3.26
load level
magnitude of the test load (mechanical actions) in relation to the loadbearing capacity of the member at normal temperature

Note 1 to entry: 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.

3.27
covering
product intended to protect underlying products against damage during a specified fire exposure

3.28
direct field of application
outcome of a process (involving the application of defined rules) whereby a test result is deemed to be equally valid for variations in one or more of the product properties and/or intended end use applications

3.29
extended field of application
outcome of a process (involving the application of defined rules that can incorporate calculation procedures) that predicts, for a variation of a product property and/or its intended end use application(s), a test result on the basis of one or more test results to the same test standard

3.30
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

[SOURCE: EN 1366-7:2004]

3.31
extended application result
predicted result for a performance parameter obtained following the process of extended field of application

3.32
extended application report
document reporting extended application results, including all details of the process leading to those results, prepared in accordance with EN 15725

4 Fire scenarios

4.1 General

The second essential requirement of the Construction Products Regulation 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 European 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 European 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:

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

where

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

T is the mean furnace temperature in degrees Celsius (°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 $0 < t \leq 21$

$$T = 154t^{0,25} + 20 \quad (2)$$

for $t > 21$

$$T = 345\log_{10}\left(8\left(t - 20\right) + 1\right) + 20 \quad (3)$$

where

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

T is the mean furnace temperature in degrees Celsius (°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 EN 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:

$$T = 660\left(1 - 0,687\,e^{0,32t} - 0,313\,e^{3,8t}\right) + 20 \quad (4)$$

where

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

T is the mean furnace temperature in degrees Celsius (°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;

— 1 000 °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);

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);

c) for raised floor the above criteria do not apply. Failure of loadbearing capacity is deemed to have occurred when the test specimen can no longer support the applied load, i.e. when the floor itself or one of its supporting members has collapsed.

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 for a maximum of 30 s or until it ignites. 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 for integrity (E) shall be according to whether or not the element is also classified for insulation (I, I_1 or I_2). Where an element is classified both for integrity and insulation, the value of integrity is that determined by whichever of the three aspects fails first. Where an element is classified without an insulation classification (i.e. for the classifications E, EW, RE and REW), the value of integrity is that determined by the time to failure of only the cracks/openings or sustained flaming aspects, whichever fails first.

The relevant test standards specify how the different areas of elements which have some insulated and some un-insulated 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 - Thermal insulation

5.2.3.1 General

Thermal 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.

5.2.3.2 Thermal insulation of elements except doors, shutters and closures for conveyor systems

For all separating elements except doors and shutters the performance level used to define thermal insulation shall be the mean temperature rise on the unexposed face limited to 140 °C above the initial mean temperature, with the maximum temperature rise at any point limited to 180 °C above the initial mean temperature.

In the case of elements with small surface areas (such as joint seals) the concept of mean temperature rise is irrelevant and thermal insulation shall be assessed on the basis of the maximum only.

Failure of any loadbearing or integrity criterion shall also mean failure of thermal insulation, whether or not the specific thermal insulation temperature limits have been exceeded.

5.2.3.3 Thermal insulation of doors and shutters

In the specific case of doors and shutters, one out of two options of the thermal insulation criterion shall be used:

– Thermal insulation I_1

The mean temperature rise on the unexposed face of the door leaf shall be limited to 140 °C above the initial mean temperature, with the maximum temperature rise at any point of the door leaf limited to 180 °C. No temperature measurements shall be taken into account on the door leaf within 25 mm from the border line of the visible part of the door leaf. The temperature rise at any point on the frame shall be limited to 180 °C, measured at 100 mm from the visible edge (on the unexposed face) of the door leaf, if the frame is wider than 100 mm, otherwise it shall be measured with the centre of the disc 20 mm from the junction between the frame and the supporting construction.

— Thermal insulation I_2

The mean temperature rise on the unexposed face of the door leaf shall be limited to 140 °C above the initial mean temperature, with the maximum temperature rise at any point of the door leaf limited to 180 °C. No temperature measurements shall be taken into account on the door leaf within 100 mm from the border line of the visible part of the door leaf. The temperature rise at any point on the frame shall be limited to 360 °C, measured at 100 mm from the visible edge (on the unexposed face) of the door leaf, if the frame is wider than 100 mm, otherwise it shall be measured at the frame/supporting boundary.

The thermal insulation classification shall be made specific by the use of the suffixes 1 and 2 corresponding, respectively, to the two definitions above (for example I_1). These suffices shall

be used only for fire doors and shutters and closures for conveyor systems (see also 5.2.3.4), but not for any other element with an I classification.

Failure of any integrity criterion shall also mean failure of thermal insulation, whether or not the specific thermal insulation temperature limits have been exceeded.

5.2.3.4 Thermal insulation of closure and conveyor system assemblies

In the specific case of closure and conveyor system assemblies, one out of three options of the thermal insulation criterion shall be used:

— Thermal insulation I_1

  The mean temperature rise on the unexposed face of the leaf of the closure shall be limited to 140 °C above the initial mean temperature, with the maximum temperature rise at any point of the closure leaf limited to 180 °C. No temperature measurements shall be taken into account on the closure leaf within 25 mm from the border line of the visible part of the leaf of the closure. The temperature rise at any point on the frame/guide shall be limited to 180 °C, measured at 100 mm from the visible edge (on the unexposed face) of the leaf of the closure, if the frame/guide is wider than 100 mm, otherwise it shall be measured at the frame/supporting construction boundary.

— Thermal insulation I_2

  The mean temperature rise on the unexposed face of the leaf of the closure shall be limited to 140 °C above the initial mean temperature, with the maximum temperature rise at any point of the leaf of the closure limited to 180 °C. No temperature measurements shall be taken into account on the leaf of the closure within 100 mm from the border line of the visible part of the leaf of the closure. The temperature rise at any point on the frame/guide shall be limited to 360 °C, measured at 100 mm from the visible edge (on the unexposed face) of the leaf of the closure, if the frame/guide is wider than 100 mm, otherwise it shall be measured at the frame/supporting boundary.

— Thermal insulation I

  In those cases where the test specimen is a pipe or duct configuration with no assessment of the closure for the conveyor system, this cannot result in an I_1 or I_2 classification. In this case an I classification shall be used.

Where a test specimen incorporates a closure for a conveyor system together with a penetration and its penetrating components, this shall result in an I classification allocated to the penetrating component or penetration seal. The complete closure and conveyor system assembly however shall be classified using the appropriate index for I_1 or I_2 to distinguish between the two possible ways of assessing the closure for the conveyor system.

Failure of any integrity criterion shall also mean failure of thermal insulation, whether or not the specific thermal insulation temperature limits have been exceeded.

5.2.4 W - Radiation

Radiation W is the ability of the element of construction to withstand fire exposure on one side only, so as to reduce the probability of the transmission of fire as a result of significant radiated heat either through the element or from its unexposed surface to adjacent materials. The element may also need to protect people in the vicinity. An element which satisfies the thermal insulation criterion I, I_1 or I_2 is also deemed to satisfy the W requirement for the same period.

Failure of integrity under the cracks or openings in excess of given dimensions or the sustained flaming at unexposed side criteria means automatically failure of the radiation criterion.

Elements for which the radiation criterion is evaluated shall be identified by the addition of a W to the classification (e.g. EW, REW). For such elements, the classification shall be given by the time for which the maximum value of radiation, measured as specified in the test standard, does not exceed a value of 15 kW/m^2.

5.2.5 M - Mechanical action

Mechanical action M is the ability of the element to withstand impact, representing the case where structural failure of another component in a fire causes an impact on the element concerned.

The element is subject to impact of predefined force shortly after the time for the desired R, E and/or I classification period. The element shall resist the impact without prejudice to the R, E, and/or I performance to have the classification supplemented by M.

5.2.6 C - Self-closing

Self-closing C is the ability of an open door or window to close fully into its frame and engage any latching device that may be fitted, without human intervention, by stored energy, or be mains power backed up by stored energy in case of power failure.

It applies to elements usually kept closed and which shall close automatically after every opening. It also applies to elements usually kept open which shall close in the event of a fire, and to mechanically operated elements which also shall close in the event of a fire.

Tests of self-closing ability are made under ambient conditions (and are subject to a durability classification based on intended use). The test shall be a pass/fail one. The test requirements are in accordance with EN 14600:

— C0: No performance determined;

— C1: Retained in the open position;

— C2: Low frequency of use for those with high incentive to exercise care such as doors to private residence and large industrial and commercial doors;

— C3: Medium frequency for use primarily by those with some incentive to exercise care;

— C4: High frequency for use primarily by those with some incentive to exercise care;

— C5: Subject to very frequent usage.

5.2.7 S - Smoke leakage

Smoke leakage S is the ability of the element to reduce or eliminate the passage of gases or smoke from one side of the element to the other.

S_a considers smoke leakage at ambient temperature only.

S_{200} considers smoke leakage at both ambient temperature and at 200 °C.

NOTE S_{200} has the same meaning as previously used S_m classification in compliance with EN 1634-3:2004, 3.1.5.

5.2.8 G - 'Soot fire' resistance

Soot fire resistance classification for chimneys and chimney related products stands for the ability of the element(s) to be resistant to soot fires. This includes aspects of leakage and thermal insulation.

A test is undertaken with a constant temperature attack of 1 000 °C, applied under appropriate test conditions, being maintained for 30 min after having reached the 1 000 °C level after 10 min.

Flues and other chimney products designed to be built into a surround (e.g. into a brick chimney) shall only satisfy a leakage requirement at the end of the test.

Elements where the external surface or surfaces of the chimney are within or adjacent to a building shall satisfy a thermal insulation requirement, defined as being a maximum temperature of adjacent materials not exceeding 100 °C when related to an ambient temperature of 20 °C.

Any distance to products with a reaction to fire classification different from A1, and necessary to achieve this requirement, shall be declared. This value shall not exceed the distance required to satisfy the criteria for normal operating conditions. The G classification shall be followed by the designation of the necessary distance.

This European Standard deals only with the performance requirements of chimneys when exposed to an internal soot fire. Other properties of chimneys, in particular high temperature gas tightness and thermal shock, while potentially a fire-related issue, are not considered as resistance to fire. They are therefore expected to be covered by the specific product specifications for chimneys.

5.2.9 K - Fire protection ability

Fire protection ability K is the ability of a wall or ceiling covering to provide for the material behind the covering protection against ignition, charring and other damage for a specified period of time.

Coverings are the outermost parts of building elements, such as walls, floors and roofs.

Fire protection ability K_1

For K_1 it shall be shown for the classification period (10 min) that the performance criteria are fulfilled when one of the following substrates is used in the test specimen:

— a chipboard with a density of (680 ± 50) kg/m^3 and a thickness of (19 ± 2) mm, which represents all materials with a density of not less than 300 kg/m^3 behind the covering or

— a material with a density of less than 300 kg/m^3 (a low density material), having a thickness of at least 50 mm, which represents a material of the same type, having a density and/or thickness equal or greater than that tested or

— any other specific substrate, which represents a material of the same composition behind the covering.

Fire protection ability K_2

For K_2 it shall be shown for the classification period (10 min or 30 min or 60 min) that the performance criteria are fulfilled when one of the following substrates is used in the test specimen:

— a chipboard with a density of (680 ± 50) kg/m^3, and a thickness of (19 ± 2) mm which represents all materials behind the covering or

— any other specific substrate, which represents a material of the same composition behind the covering.

6 Declaration of fire resistance performance

6.1 Classification periods

All classification periods against any of the characteristics shall be declared in minutes, using one of the periods: 10, 15, 20, 30, 45, 60, 90, 120, 180, 240 or 360.

NOTE Not all periods apply to all elements, and further clauses show which classification periods apply to which elements.

6.2 Designatory letters

For the classification of building elements use shall be made of the designatory letters explained in 5.2.

6.3 Declaration of performance

Combinations of these designatory letters, as appropriate, shall be used as part of the classification of performance. They shall be supplemented by the time, in elapsed completed minutes of the nearest lower class during which the functional requirements are satisfied. Additionally, the load level shall be specified.

In general the classes shall be expressed as follows:

For loadbearing elements:

REI *tt* : *tt* being the classification period during which all criteria loadbearing capacity, integrity and thermal insulation are satisfied;

RE *tt* : *tt* being the classification period during which the criteria loadbearing capacity and integrity are satisfied;

R *tt* : *tt* being the classification period during which the criterion loadbearing capacity is satisfied.

For non-loadbearing elements:

EI *tt* : *tt* being the classification period during which the criteria integrity and thermal insulation are satisfied;

E *tt* : *tt* being the classification period during which the criterion integrity is satisfied.

Thus the following example classes may be defined:

REI 15, RE 20 …

EI 45, E 60 …

Test results and extended application results shall always be rounded down to the nearest lower class. When characteristics are combined, the time declared shall be that for the characteristic having the shortest time. So a building element with a loadbearing capacity of 155 min, an integrity by the cotton pad of 80 min, integrity by cracks/flaming of 85 min and a thermal insulation of 42 min shall be classified REI 30/RE 60/R 120.

6.4 Combinations of classes

Only those combinations of designatory letters and performance times explained in Clause 7 shall be used for the relevant elements.

6.5 Particular classifications

6.5.1 Doors and shutters

In the specific case of doors and shutters for the thermal insulation criterion, two different levels are defined. Hence, the classification shall be made specific by the use of one of the suffixes 1 and 2, to indicate the subclass.

NOTE Integrity, however, is determined in exactly the same way as for other elements.

Where the test results and the extended application results lead to a difference in failure time for I_1 and I_2, the element may have more than one classification. For example, a door failing the first thermal insulation criterion after 50 min and the second criterion after 70 min (failing E after 95 min) shall be classed EI_1 45/EI_2 60/E 90.

Where the difference in performance does not lead to a difference in classification, the element shall be classed with the suffix of the strictest requirement. The suffix 1 here indicates that the door satisfies also the second thermal insulation criterion. For example, a door failing the first thermal insulation criterion after 50 min and the second criterion after 55 min (failing E after 70 min) shall be classed EI_1 45/E 60.

6.5.2 Conveyor systems and their closures

In the specific case of closures and conveyor system assemblies, for the thermal insulation criterion, three different levels are defined (see 5.2.3.4). Hence, the classification shall be made specific by the use of one of the suffixes 1 and 2, if applicable, to indicate any subclass.

As an example the complete closure and conveyor system assembly may have any one or more of the following classifications for different test specimens: EI_1 45, EI_2 60, EI 90, E 120.

The principles of integrity classification given in 6.5.1 shall also apply to closures and conveyor system assemblies.

6.6 Additional performance parameters

6.6.1 Optional performance parameters

Where required, the classification shall include the following optional performance parameter:

W when radiation has been measured and for the period the criterion of 15 kW/m² has been satisfied, the W criterion intervenes in the same way as the R, E and I criteria, e.g. REW 30, EW 30.

6.6.2 Expansion of performance parameters

The classification may be expanded by the use of any of the following performance parameters, when applicable:

M when particular mechanical actions are considered and the element satisfies the criteria of 5.2.5, e.g. REI 30-M;

S for elements with particular limitations on smoke leakage;

For fire resistant elements the S shall be added to the fire resistance classification (e.g. EI_2 60-S_{200}). Where no fire resistance classification is relevant, the element shall simply be classified S. The S classification shall be determined under ambient S_a and/or medium temperature conditions S_{200} as a function of the classification envisaged;

C for doors and shutters and closures for conveyor systems equipped with a self-closing device, e.g. EI_2 30-C3;

IncSlow where the response of a product to the slow heating curve has additionally been evaluated, this shall be indicated by the supplement IncSlow, e.g. EI 30-IncSlow;

sn where performance against the semi-natural fire is an additional regulatory requirement to the standard temperature/time exposure (only relevant for lightweight horizontal protective membranes having a low thermal inertia and not mandatory for all horizontal protective membranes), the classification of the element protected by that protective membrane shall be so identified, e.g. R 60-sn;

ef where performance against the external fire exposure curve instead of the standard temperature/time exposure is determined, the classification of the element shall be so identified, e.g. EI 60-ef;

r where performance against the constant temperature attack of 500 °C (reduced temperature exposure) instead of the standard temperature/time exposure is determined, the classification of the element shall be so identified, e.g. RE 30-r.

6.6.3 Particular performance parameters

G the performance parameter G shall be used for chimneys and chimney related products (such as flue blocks and connectors) designed to be resistant to soot fires;

K the performance parameters K_1 and K_2 shall be used for a covering which provides fire protection to materials behind it for a specified period of time.

6.7 Presentation of classification

The combination of classes and times for R, E, I and W shall be deduced from test results and/or extended application results. Only those combinations of classes and times as defined in the following clauses of this European Standard shall be used for the relevant elements. Combined classifications shall be declared in order of decreasing number of performance criteria and increasing time. The designatory letters for the expansion of performance parameters shall be added as far as relevant and as far as the conditions are satisfied. The classification(s) shall be awarded after verification that specific additional requirements for certain construction elements are satisfied.

The classification shall be presented according to the following template:

R	E	I	W		*t*	*t*	-	M	C	S	IncSlow	sn	ef	r

For loadbearing elements additionally the applied load and/or load level shall be included in the classification report (see 7.1.2.5).

The presentation of the particular performance parameters G and K is specified in 7.5.11 and 7.6.

NOTE The use of particular suffices and supplementary notations is described in relevant later clauses.

6.8 Declaration of fire resistance classes in product specifications

Product specifications including descriptive product specifications and claiming a given fire resistance classification in accordance with this European Standard shall justify their classification by fire resistance testing. This establishes the performance at an adequate level of confidence, taking into account the possible variations of the components and the production technique.

The product specification shall therefore include the necessary means for control of the relevant properties.

NOTE Suitable characterization testing of essential and critical components can be needed in support.

7 Classification procedure for fire resistance

7.1 General

7.1.1 Procedure

a) The envisaged field of application of the classification shall be proposed by the sponsor and includes aspects such as:

— exposure conditions: for asymmetrical elements, the side(s) to be exposed, one/two sides exposure for walls, three/four sides exposure for beams etc.;

— dimensions of the element: including span, height, width;

— boundary and support conditions: restrained or unrestrained, deflection and/or rotation load level (see 3.26);

— variation of constructional details;

— the envisaged class(es): i.e. combinations of performance criteria and time(s).

b) Taking into account the direct field of application of test results as specified in the relevant test method and/or the extended application results, the number of tests, standard temperature/time tests and other exposures, and the specimen to be tested shall be deduced.

c) As a function of the components involved in the construction element, and the type of element, the need for tests under other than the standard temperature/time curve shall be verified:

— the slow heating curve for elements whose performance may be dependent upon high heating rates below 500 °C, for achievement of their classification;

— the 'semi-natural' fire for lightweight suspended horizontal protective membranes;

— the external fire exposure curve for external faces of non-loadbearing walls;

— constant temperature attack for e.g. smoke control doors, raised floors, chimneys.

d) The standard temperature/time fire tests shall be carried out and for each test the times shall be determined, in elapsed minutes, for which the test specimen continues to satisfy the different aspects of the performance criteria:

R - Loadbearing capacity	- limiting deformation;
	- limiting rate of deformation;
E - Integrity	- ignition of cotton pad;
	- cracks and openings;
	- occurrence of sustained flaming on the unexposed side;

I - Thermal insulation	- mean temperature rise;
	- maximum temperature rise;
W - Radiation	- maximum radiation level.

For particular elements other aspects are measured or verified:

S - Smoke leakage	- limiting leakage rate;
M - Mechanical action	- resistance to impact;
C - Self-closing	- self closure in the event of fire;
G - Soot fire resistance	- resisting the thermal attack of a soot fire, for chimney related products;
K - Fire protection ability	- fire protecting ability of a covering for a specified period of time.

e) For any of the tests and criteria R, E, I, W and K the obtained times in minutes shall be rounded down to the nearest lower value included in the following series: 10, 15, 20, 30, 45, 60, 90, 120, 180, 240, 360.

f) If more than one test has to be carried out because of the envisaged field of application, the lowest result shall determine the classification for the entire field of application. As the classification is linked to the field of application, results of individual tests may lead to higher ranking for a more limited field of application.

g) Classification reports shall be prepared as shown in Annex A. A classification report can be issued for any one combination of performance parameters and times that are covered by results of tests and/or by extended application results.

7.1.2 General rules for deducing the number of standard temperature/time fire resistance tests

7.1.2.1 General principles

No tests shall be duplicated for aspects of repeatability and a single test normally allows the classification of all elements identical to the tested element and those included in the field of direct application.

Asymmetrical fire-separating elements may have a different performance depending on the side from which they are tested. A test shall therefore be carried out on each side unless the conditions in 7.1.2.2 apply.

Elements have a different performance depending on load-level and boundary conditions. The field of application of the classification is determined by the load level and boundary conditions applied in the test. Additional tests may be required in function of the envisaged field of application.

The number of tests required may further depend on:

a) the combination of performance criteria envisaged;

b) the need to apply other thermal attack conditions in addition to the standard temperature/time curve.

Elements are supplied in a wide variety of sizes, shapes and materials, including finishes to satisfy the requirements of the market. It is impractical to test every variation of shape, size or material for each element.

The extent to which a tested element may or may not be changed under the field of direct application is given in rules or guidelines in the relevant test standards, which limit the permitted variation away from the test specimen without further evaluation or calculation.

The extent to which a tested element may be changed under the field of extended application is given in rules or in the relevant extended application standards.

7.1.2.2 Exposure conditions

For separating elements that are required to be fire resisting from both sides, two specimens shall be tested (one for each direction) unless the separating element is fully symmetrical.

In such cases the fire resistance classification shall be based on the fire exposure from the side demonstrated as giving the lower fire resistance time.

Asymmetrical fire separating elements may be tested from one side only:

a) if the weakest side can be assumed;

b) where a classification for fire attack from one side only is envisaged.

If a fire separating element is tested from the assumed weakest side only, the assumption shall be based on laboratory experience and the relevant analysis shall be fully documented in the classification report.

If an asymmetrical element is classified for one side only, the classification report shall mention this explicitly.

Beams may be tested with a three or four sided exposure dependent upon the envisaged application.

Loadbearing walls may be tested with both sides exposed for some applications.

7.1.2.3 Dimensions

The test specimen shall normally be full size. When the specimen cannot be tested full size, the specimen size shall be in accordance with the specification of the relevant test method. In general, test results obtained for a given span, height or width shall also be valid for a smaller span, height or width. For applicability to larger dimensions the relevant test methods or the standards on extended application shall be consulted.

7.1.2.4 Boundary and support conditions

When considering the field of application, tests with different boundary conditions may be necessary unless the most severe condition is known.

NOTE The ultimate load depends to a great extent on the boundary and support conditions.

7.1.2.5 Load level

Usually the field of application can be extended to lower load levels.

NOTE Load levels (see 3.26) are best expressed in percentage of ultimate loadbearing capacity at ambient temperature. If the ultimate loadbearing capacity at ambient temperature is not known, the classification report will mention the actual test load and the relevant mechanical material properties of the materials used.

7.1.2.6 Variation of constructional details

In general, the field of application of a test result is limited to elements with identical constructional details.

Different variations of constructional details shall not be included in a single test specimen, unless it can be shown that they will not interfere with the performance of each other.

7.1.3 Field of application

Field of application can be defined using test reports and other relevant data in accordance with the procedures specified in EN 15725, which e.g. describes the role of extended application in the classification process.

7.2 Classification of loadbearing elements without a fire separating function

7.2.1 General

This category of loadbearing elements includes:

— walls without fire separating function (7.2.2);

— floors without fire separating function (7.2.3);

— roofs without fire separating function (7.2.3);

— beams (7.2.4);

— columns (7.2.5);

— balconies (7.2.6);

— walkways (7.2.6);

— stairs (7.2.6).

The relevant performance criterion for loadbearing elements is R.

The following classes are defined:

R 15, R 20, R 30, R 45, R 60, R 90, R 120, R 180, R 240 and R 360.

7.2.2 Classification of loadbearing walls without separating function

7.2.2.1 Test method and field of application rules

Loadbearing walls without a separating function shall be tested as columns by the method given in EN 1365-4. Extended application shall be carried out as described in EN 15080-12 and in EN 15725.

7.2.2.2 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard and in EN 15080-8 and EN 15080-12.

The test method provides information on the following:

— test specimen/construction;

— field of direct application of test results;

— guidance on test specimen design.

Aspects influencing the number of tests to be carried out shall include for example:

a) the range of exposure conditions to be covered;

b) side(s) to be tested for asymmetrical elements;

c) the range of loading conditions to be covered, with or without eccentricity;

d) constructional variations required such as walls with and/or without glazing.

7.2.2.3 Performance criterion

The performance criterion shall be loadbearing capacity. Failure of loadbearing capacity shall be deemed to have occurred when both of the following criteria have been exceeded:

a) axial contraction $C = h/100$ (mm) and

b) rate of axial contraction $dC/dt = 3\ h/1\ 000$ (mm/min)

where h is the initial height in mm.

7.2.2.4 Classes

The following classes are defined:

R 15, R 20, R 30, R 45, R 60, R 90, R 120, R 180, R 240 and R 360.

7.2.3 Classification of loadbearing floors and roofs without fire separating function

7.2.3.1 Test method and field of application rules

Floors and roofs shall be tested in accordance with EN 1365-2. Floors and roofs shall be tested and classified for the fire applied from below only[1)].

In exceptional cases, where a loadbearing floor or roof is exposed to fire from both sides simultaneously, it shall be tested as a balcony/walkway.

7.2.3.2 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard. The test method provides information on the following:

— test specimen/construction;

— field of direct application of test results;

[1)] Fire from below floors is generally more critical than fire from above. However, in addition to the classification requirements from below, requirements can also be related to the thickness and quality of the flooring/floor and its subsequent design to safe guard against fire from above. This can also be applicable to other elements which are part of a floor, such as shutters.

— guidance on test specimen design.

Aspects influencing the number of tests to be carried out shall include for example:

a) range of loading conditions to be covered;

b) constructional variations required such as floors and roofs with and/or without glazing, materials and components including thermal insulation materials and water proofing layers for roofs;

c) the required validity of the roof test for a range of inclinations;

d) the range of support and restraint conditions to be covered;

e) the ceiling system where this is a part of the floor/roof.

7.2.3.3 Performance criterion

The performance criterion shall be loadbearing capacity. Failure of loadbearing capacity shall be deemed to have occurred when both of the following criteria have been exceeded:

a) deflection $D = L^2 / 400\ d$ (mm); and

b) rate of deflection $dD/dt = L^2/9\ 000\ d$ (mm/min)

where L is the clear span in mm and d is the distance from the extreme fibre of the cold design compression zone to the extreme fibre of the cold design tension zone of the structural section, in mm.

7.2.3.4 Classes

The following classes are defined:

R 15, R 20, R 30, R 45, R 60, R 90, R 120, R 180, R 240 and R 360.

7.2.4 Classification of beams

7.2.4.1 Test method and field of application rules

Beams shall be tested in accordance with EN 1365-3. Extended application shall be carried out as described in EN 15080-8 and in EN 15725.

7.2.4.2 Tests to be carried out

The design of the specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard and in the relevant part of EN 15080-8. The test method provides information on the following:

— test specimen/construction;

— field of direct application of test results.

Aspects influencing the number of tests to be carried out shall include for example:

a) the range of support conditions to be covered: simply supported/restrained;

b) the range of exposure conditions to be covered: three/four sided exposure;

c) the length of the beam: tests for maximum shear force and/or maximum moment.

7.2.4.3 Performance criterion

The performance criterion shall be the loadbearing capacity. For the purpose of this standard, failure to support the load is deemed to have occurred when both of the following criteria have been exceeded:

a) deflection D = $L^2/400\ d$ (mm); and

b) rate of deflection $dD/dt = L^2/9\ 000\ d$ (mm/min)

where L is the clear span of the test specimen in mm and d is the distance from the extreme fibre of the cold design compression zone to the extreme fibre of the cold design tension zone of the structural section, in mm.

7.2.4.4 Classes

The following classes are defined:

R 15, R 20, R 30, R 45, R 60, R 90, R 120, R 180, R 240 and R 360.

7.2.5 Classification of columns

7.2.5.1 Test method and field of application rules

Columns shall be tested in accordance with EN 1365-4.

7.2.5.2 Tests to be carried out

The design of the specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard.

The test method provides information on the following:

— test specimen/construction;

— field of direct application of test results.

Aspects influencing the number of tests to be carried out shall include for example:

a) the range of exposure conditions to be covered;

b) the range of end conditions to be covered: ends pin-jointed;

c) type of loading and load level;

d) constructional details.

7.2.5.3 Performance criterion

The performance criterion shall be loadbearing capacity. Failure of loadbearing capacity shall be deemed to have occurred when both of the following criteria have been exceeded:

a) axial contraction C = $h/100$ (mm); and

b) rate of axial contraction $dC/dt = 3h/1\ 000$ (mm/min)

where h is the initial height in mm.

7.2.5.4 Classes

The following classes are defined:

R 15, R 20, R 30, R 45, R 60, R 90, R 120, R 180, R 240 and R 360.

7.2.6 Classification of balconies, walkways and stairs

7.2.6.1 Test method and field of application rules

Balconies and walkways shall be tested in accordance with EN 1365-5. Stairs shall be tested in accordance with EN 1365-6.

7.2.6.2 Tests to be carried out

The design of the specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard.

The test method provides information on the following:

— test specimen/construction;

— field of direct application of test results.

Aspects influencing the number of tests to be carried out shall include for example:

a) the range of exposure conditions to be covered;

b) the range of end conditions to be covered: ends pin-jointed;

c) type of loading and load level;

d) constructional details.

7.2.6.3 Performance criterion

The performance criterion shall be the loadbearing capacity. Failure of loadbearing capacity shall be deemed to have occurred when both of the following criteria have been exceeded:

a) deflection $D = L^2/400\,d$ (mm); and

b) rate of deflection $dD/dt = L^2/9\,000\,d$ (mm/min)

where L is the clear span of the test specimen in mm and d is the distance from the extreme fibre of the cold design compression zone to the extreme fibre of the cold design tension zone of the structural section, in mm.

7.2.6.4 Classes

The following classes are defined:

R 15, R 20, R 30, R 45, R 60, R 90, R 120, R 180, R 240 and R 360.

7.3 Classification of loadbearing elements with fire separating function

7.3.1 General

This category of loadbearing elements includes:

— walls with fire separating function (7.3.2);

— floors with fire separating function (7.3.3);

— roofs with fire separating function (7.3.3);

— raised floors (7.3.4).

Relevant performance criteria for loadbearing elements with fire separating function include:

— R, E, I, W and M.

7.3.2 Classification of loadbearing walls with fire separating function

7.3.2.1 Test method and field of application rules

Loadbearing walls shall be tested in accordance with EN 1365-1. Extended application shall be carried out as described in EN 15080-12 and in EN 15725.

7.3.2.2 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard and in EN 15080-12.

The test method provides information on the following:

— test specimen/construction;

— field of direct application of test results;

— guidance on test specimen design.

Aspects influencing the number of tests to be carried out shall include for example:

a) the range of exposure conditions to be covered;

b) side(s) to be tested for asymmetrical elements;

c) the range of loading conditions to be covered: axially or eccentric;

d) constructional variations required such as walls with and/or without perforation, e.g. glazing.

7.3.2.3 Performance criteria

7.3.2.3.1 Loadbearing capacity

Failure of loadbearing capacity shall be deemed to have occurred when both of the following criteria have been exceeded:

a) axial contraction C = h/100 (mm) and

b) rate of axial contraction dC/dt = 3h/1 000 (mm/min)

where h is the initial height in mm.

7.3.2.3.2 Integrity

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

a) cracks or opening in excess of given dimensions;

b) ignition of a cotton pad;

c) sustained flaming on the unexposed side.

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

7.3.2.3.3 Thermal insulation

The performance level used to define thermal insulation shall be the mean temperature rise on the unexposed face, limited to 140 °C above the initial mean temperature, with the maximum temperature rise at any point limited to 180 °C above the initial mean temperature.

The test standard specifies how both for uniform and non-uniform elements the mean temperature shall be determined.

7.3.2.3.4 Radiation

Classification for radiation shall be given by the time for which the maximum value of radiation, measured as specified in the test standard, does not exceed 15 kW/m^2.

7.3.2.3.5 Mechanical action

The element shall resist the impact as described in the test standard, without prejudice to the R, E and/or I performance.

7.3.2.4 Classes

The following classes are defined:

Table 1 — Classes for loadbearing walls with fire separating function

RE		20	30		60	90	120	180	240	360
REI	15	20	30	45	60	90	120	180	240	360
REI-M			30		60	90	120	180	240	360
REW		20	30		60	90	120	180	240	360

7.3.3 Classification of loadbearing floors and roofs with fire separating function

7.3.3.1 Test method and field of application rules

Floors and roofs shall be tested in accordance with EN 1365-2. Floors and roofs shall be tested and classified for the fire applied from below only.

7.3.3.2 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard. The test method provides information on the following:

— test specimen/construction;

— field of direct application of test results;

— guidance on test specimen design.

Aspects influencing the number of tests to be carried out shall include for example:

a) the range of loading conditions to be covered;

b) constructional variations required such as floors and roofs with and/or without glazing, materials and components used, including thermal insulation materials and water proofing layers for roofs;

c) the required validity of the roof test for a range of inclinations;

d) the range of support and restraint conditions to be covered;

e) the ceiling system where it is a part of the floor/roof (if relevant).

7.3.3.3 Performance criteria

7.3.3.3.1 Loadbearing capacity

Failure of loadbearing capacity shall be deemed to have occurred when both of the following criteria have been exceeded:

a) deflection $D = L^2 / 400\ d$ (mm); and

b) rate of deflection $dD/dt = L^2 / 9\ 000\ d$ (mm/min)

where L is the clear span of the test specimen in mm and d is the distance from the extreme fibre of the cold design compression zone to the extreme fibre of the cold design tension zone of the structural section, in mm.

7.3.3.3.2 Integrity

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

a) cracks or opening in excess of given dimensions;

b) ignition of a cotton pad;

c) sustained flaming on the unexposed side.

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

7.3.3.3.3 Thermal insulation

The performance level used to define thermal insulation shall be the mean temperature rise on the unexposed face, limited to 140 °C above the initial mean temperature, with the maximum temperature rise at any point limited to 180 °C above the initial mean temperature.

The test standard specifies how both for uniform and non-uniform elements the mean temperature shall be determined.

7.3.3.4 Classes

The following classes are defined:

Table 2 — Classes for loadbearing floors and roofs with fire separating function

RE		20	30		60	90	120	180	240
REI	15	20	30	45	60	90	120	180	240

7.3.4 Classification of raised floors

7.3.4.1 Test method and field of application rules

Raised floors shall be tested in accordance with EN 1366-6.

7.3.4.2 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard.

The test method provides information on the following:

— test specimen/construction;

— field of direct application of test results;

— guidance on test specimen design.

Aspects influencing the number of tests to be carried out shall include for example:

a) the range of exposure conditions to be covered (standard exposure and/or reduced exposure);

b) the range of loading conditions to be covered;

c) constructional variations required.

7.3.4.3 Performance criteria

7.3.4.3.1 Loadbearing capacity

Failure shall be deemed to have occurred when the floor itself or one of the supporting studs has collapsed.

7.3.4.3.2 Integrity

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

a) cracks or opening in excess of given dimensions;

b) ignition of a cotton pad;

c) sustained flaming on the non-exposed side.

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

7.3.4.3.3 Thermal Insulation

The performance level used to define thermal insulation shall be the mean temperature rise on the unexposed face, limited to 140 °C above the initial mean temperature, with the maximum temperature rise at any point limited to 180 °C above the initial mean temperature.

7.3.4.4 Classes

The following classes are defined:

Table 3 — Classes for raised floors

RE	30	
REI	30	60

The classification shall be made specific depending on the exposure.

The absence of the designation letter r refers to standard temperature/time curve exposure (full fire resistance) whereas its presence refers to the constant temperature attack of 500 °C (reduced exposure), e.g. RE 30, and RE 30-r.

Raised floors satisfying the standard temperature/time curve exposure for a given time are considered to satisfy the reduced exposure conditions for at least the same period.

7.4 Products and systems for protecting elements or parts of works

7.4.1 General

This category of products and systems includes ceilings (horizontal protective membranes), vertical screens or partitions (vertical protective membranes) and fire protective coatings, boards, renderings and claddings.

These products and systems do not necessarily claim nor possess fire resistance on their own. They are intended to increase (or to provide) fire resistance of the structural members they protect.

The test methods characterize the products and systems for protecting elements or parts of works in such a way that the field of application of test results can be extended to other structural members than those included in the standard test(s).

Classification applies to the protected element, including its protection, and not to the protection itself. Classification of protective elements can be reached using the characterisation data as collected from the tests, together with relevant calculation methods, e.g. from published European design code (e.g. EN 1993-1-2 or EN 1994-1-2) but that is outside the scope of this European Standard.

7.4.2 Tests to be carried out

The test(s) to be carried out, the allowed extension of the field of application of the test results and the procedure(s) to be followed for that purpose depends upon:

— the nature of the protective product:

  a) horizontal membranes (ceilings);

  b) vertical membranes (screens);

  c) fire protective coatings, boards, renderings and claddings;

— the nature of the structural elements to be protected:

  d) steel;

  e) concrete;

  f) composite steel/concrete;

  g) timber;

  h) aluminium.

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification for different families of structural members and the field of application of test results as defined in the test standard.

The test methods provide information on the following:

— test specimen;

— field of direct application of test results;

— guidance on test specimen design, including standard configuration for the element(s) to be protected.

Aspects influencing the number of tests to be carried out are, amongst others:

i) the nature of the element(s) to be protected: e.g. timber floor, concrete floor, steel structure;

j) the nature of the protection: e.g. horizontal membrane, coating.

The thermal attack is the standard temperature/time curve.

For reactive or intumescent products additional test(s) against the slow heating curve (see 4.3) may be required.

7.4.3 Test methods

The applicable test methods are EN 13381-1, EN 13381-2, EN 13381-3, EN 13381-4, EN 13381-5, EN 13381-6, EN 13381-8 and ENV 13381-7.

7.4.4 Performance criteria

The criteria for the protected structural members are equivalent to those for the element if tested directly.

The test methods also provide data allowing the extension of the field of application of the test results both for a range of variations of the protection and the protected structural elements. Additionally, the test methods provide data on the protective ability of the product or system(s) in a form appropriate for direct input to structural design codes.

7.4.5 Classes

Coatings, boards, renderings and claddings do not possess fire resistance independently of the structural member they protect. For that reason classification is done for the protected element or is related to that element.

Ceiling partitions used as horizontal or vertical protective membranes may or may not have fire resistance in their own right. However, when used as protective membranes classification is done for the protected element or is related to that element.

The same classes are defined as for the structural member to be protected.

7.4.6 Classification of protected structural members

7.4.6.1 General

If a classification of a protected structural member is required, this shall be carried out in accordance with the prescription of this European Standard.

The same classes exist for the protected element as for the unprotected element. Characterization data may be included in the classification report; an illustration of such data is given in Annex B. These characterization data are made available for their use within the Eurocode - Basis of structural design.

Although products, membranes and systems for protecting elements envisage primarily the R criterion, also the E and I criteria can be deduced as far as allowed for and according to the description in the test standards. R, E and I performance can also be demonstrated in accordance with published Eurocode - Basis of structural design (e.g. EN 1992-1-2, EN 1993-1-2, EN 1994-1-2, EN 1995-1-2, EN 1996-1-2 and EN 1999-1-2) but that is outside the scope of this European Standard.

7.4.6.2 Structural members protected by horizontal membranes

A standard horizontal structural building member, including any supporting construction, which carries a horizontal protective membrane, to be used as a fire resistant barrier against fire from below, shall be subject to a standard temperature/time test under predefined loading, support and restraint conditions according to EN 13381-1.

7.4.6.3 Structural members protected by vertical membranes

Standard vertical structural elements (columns), protected against fire by a vertical protective membrane shall be subject to a standard temperature/time test according to EN 13381-2.

Where performance against mechanical impact is a regulatory requirement such a test, as described in EN 1363-2, shall be carried out.

The following standard vertical structural building members are defined:

— steel columns;

— concrete columns;

— concrete filled hollow steel columns;

— timber columns;

— aluminium columns.

Throughout the test the cavity temperature and the surface temperature of the columns shall be measured. From these data characteristic curves for cavity and surface temperature are calculated for the application within the field of application of test results. These characteristic curves are made available for their use within the Eurocode - Basis of structural design.

Limiting temperatures for specific types of materials of construction, from which loadbearing capacity is obtained, are defined for the characteristic cavity temperature as well as the characteristic surface temperature.

Fire protection products are characterised by test results expressed in terms of the time at which the limiting temperatures are reached. From this information classification of protected structural elements is obtained according to procedures detailed in the test standard.

Protected products successfully submitted to the mechanical impact test are identified by the addition of 'M', e.g. R 30-M.

7.4.6.4 Concrete members protected by coatings, boards, renderings or claddings

Standard concrete elements, protected against fire by the coatings, boards, renderings or claddings to be evaluated, shall be subject to a standard temperature/time test according to EN 13381-3.

The following concrete elements are defined:

a) concrete slabs simulating flat two-dimensional concrete members;

b) concrete beams simulating beams and columns.

Throughout the test, surface and internal temperatures of the concrete and its reinforcement are measured. From these data characteristic temperature curves are defined.

The assessment method details the means whereby the results of temperature measurement and observations made throughout the test(s) are used to provide the following data:

c) the relationship between the concrete temperature at different depths, the time and the thickness of fire protection;

d) the equivalent thickness of concrete, related to thermal insulation criteria;

e) information on stickability.

These data are made available for their use within Structural Eurocode EN 1992-1-2.

7.4.6.5 Steel members protected by coatings, boards, renderings or claddings

A number of short steel sections, protected by the fire protection system, shall be subjected to a standard temperature/time test according to EN 13381-4 for non-reactive protection systems and according to EN 13381-8 for reactive protection systems.

Additionally, loaded and unloaded beams or columns are likewise heated to provide information on the ability of the fire protection system to remain intact and adhered to the steel test section (stickability).

These tests relate to fire protection when used on steel beams or columns of solid I or H section shape, or of circular or rectangular hollow shape.

Additional testing to EN 13381-9 is required to provide information when the fire protection system is used on steel beams that contain openings within their web.

A standard package of short steel test sections is defined as a function of:

a) the range of steel section factors to be covered;

b) the range of thickness of the protective material;

c) the assessment method to be used;

d) the nature of the protective system: passive or reactive.

Throughout the test, a series of steel temperatures shall be measured.

The temperature data from the short steel sections only are used for the evaluation of the fire protection system. However, these data are corrected for stickability and for discrepancy in thickness.

Assessment of thermal performance is carried out on the basis of the corrected mean steel temperature of each short section, using one amongst a series of assessment procedures, e.g.:

e) a differential equation analysis method;

f) a numerical regression analysis method;

g) a graphical analysis method.

These data are made available for their use within the Structural Eurocodes EN 1993-1-2 or EN 1994-1-2.

7.4.6.6 Concrete/profiled sheet steel composite members protected by coatings, boards, renderings or claddings

Standard composite test slabs, protected by the fire protection system, shall be subject to a standard temperature/time test according to EN 13381-5.

Throughout the test, surface and internal temperatures of the concrete/steel slab shall be measured.

The assessment method details the means whereby the results of temperature measurement and observations throughout the test shall be used to provide:

a) the relationship between steel sheet temperature, time and thickness of fire protection material;

b) the equivalent thickness of concrete, related to thermal insulation criteria;

c) information on stickability and limiting exposure times.

A characteristic temperature is defined. This is made available to be used within Structural Eurocode EN 1994-1-2.

The time for the characteristic profiled steel sheet temperature to rise to the design temperatures is plotted on a graph versus thickness of fire protection systems.

The evaluation is done, at least, for minimum and maximum thickness.

7.4.6.7 Concrete filled hollow steel columns protected by coatings or claddings

Standard composite test columns, protected by the fire protection system, shall be subject to a standard temperature/time test according to EN 13381-6.

Throughout the test, surface temperatures on the steel column are measured.

The assessment method details the means whereby the results of temperature measurement and observations throughout the test shall be used to provide:

a) the relationship between steel temperature, time and thickness of fire protection material;

b) information on stickability.

A characteristic temperature is defined. This is made available to be used within Eurocode - Basis of structural design EN 1994-1-2.

The time for the characteristic steel surface temperature to rise to a range of design temperatures is plotted on a graph versus thickness of the fire protection systems.

The evaluation is done, at least, for minimum and maximum thickness.

7.4.6.8 Timber members protected by coatings, boards, renderings or claddings

For a fire protection system to be applied to timber floors, walls, and/or beams and columns, standard floor and/or beam tests shall be performed as well as a series of tests on small elements, according to ENV 13381-7.

Throughout the test, temperatures are measured on the surface and within the timber specimen.

The tests examine:

a) the behaviour of the fire protection system and its stickability;

b) the surface temperature of the timber behind the fire protection system and the temperature evolution inside the timber.

The test method calculates the charring rates and the advancement of the char line through the timber.

The contribution of the protective material is expressed in terms of the time to the start of charring and the charring rate. This is made available to be used within Eurocode - Basis of structural design EN 1995-1-2.

7.5 Classification of non-loadbearing elements

7.5.1 General

This category of elements includes:

— partitions (7.5.2);

— facades (curtain walling) and external walls (7.5.3);

— ceilings with independent fire resistance (7.5.4);

— doors and shutters including their closing devices (7.5.5);

— smoke control doors (7.5.6);

— conveyor systems and their closures (7.5.7);

— penetration seals (7.5.8);

— linear joint seals (7.5.9);

— service ducts and shafts (7.5.10);

— chimneys (7.5.11).

Relevant performance criteria and classes are indicated below separately for each type of element.

7.5.2 Partitions

7.5.2.1 Test method and field of application rules

Partitions (non-loadbearing walls) shall be tested in accordance with EN 1364-1. Extended application shall be carried out as described in EN 15254-2, EN 15254-4, EN 15254-5 and EN 15254-6 and in EN 15725.

7.5.2.2 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard and in EN 15254-2, EN 15254-4, EN 15254-5 and EN 15254-6.

The test method provides information on the following:

— test specimen;

— field of direct application of test results;

— guidance on test specimen design especially for testing glazed elements or non-loadbearing walls incorporating glazings.

Aspects influencing the number of tests to be carried out shall include for example:

a) side(s) to be tested for asymmetrical elements;

b) need for additional thermal exposure: external thermal exposure conditions;

c) constructional variations required, such as walls with and/or without un-insulated portions, e.g. glazing: additional tests shall be undertaken using separate test specimens as a function of the envisaged field of application, including the nature of the supporting construction of glazing.

7.5.2.3 Performance criteria

7.5.2.3.1 Integrity

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

a) cracks or opening in excess of given dimensions;

b) ignition of a cotton pad;

c) sustained flaming on the non-exposed side.

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

7.5.2.3.2 Thermal insulation

The performance level, used to define thermal insulation, shall be the mean temperature rise on the unexposed face, limited to 140 °C above the initial mean temperature, with the maximum temperature rise at any point limited to 180 °C above the initial mean temperature.

The test standard specifies how both for uniform and non-uniform elements the mean temperature shall be determined. For an element incorporating discrete areas of different thermal insulation, compliance with the thermal insulation criteria shall be determined separately for each area.

7.5.2.3.3 Radiation

Classification for radiation shall be given by the time for which the maximum value of radiation, measured as specified in the test standard, does not exceed 15 kW/m^2.

7.5.2.3.4 Mechanical action

The element shall resist the impact as described in the test standard, without prejudice to the E and/or I performance.

7.5.2.4 Classes

The following classes are defined:

Table 4 — Classes for Partitions

E		20	30		60	90	120		
EI	15	20	30	45	60	90	120	180	240
EI-M			30		60	90	120	180	240
EW		20	30		60	90	120		

7.5.3 Classification of facades (curtain walling) and external walls (including glazed elements)

7.5.3.1 Test method and field of application rules

Curtain walls shall be tested in accordance with EN 1364-3. Parts of curtain walls shall be tested in accordance with EN 1364-4. Extended application shall be carried out as described in EN 15254-2, EN 15254-5 and EN 15254-6 and in EN 15725.

EN 1364-4 on its own shall not be used to classify complete facades. When fire resistance glazing is included in the curtain walling it shall be tested according to EN 1364-3.

External walls and parts of external walls shall be tested according to EN 1364-1.

7.5.3.2 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard and in EN 15254-2, EN 15254-5 and EN 15254-6.

The test methods provide information on the following:

— test specimen;

— field of direct application of test results;

— guidance on test specimen design especially for testing glazed elements.

Aspects influencing the number of tests to be carried out shall include for example:

— the sides to be tested;

— facades and external walls shall be tested from both sides or from the inside or outside only.

Constructional variations required such as elements with and/or without un-insulated portions, e.g. glazing: additional tests shall be undertaken using separate test specimens as a function of the envisaged field of application including the nature of the supporting construction of glazing.

7.5.3.3 Performance criteria

7.5.3.3.1 Integrity

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

— cracks or opening in excess of given dimensions;

— ignition of a cotton pad;

— sustained flaming on the unexposed side.

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

7.5.3.3.2 Thermal insulation

The performance level, used to define thermal insulation, shall be the mean temperature rise on the unexposed face, limited to 140 °C above the initial mean temperature, with the maximum temperature rise at any point limited to 180 °C above the initial mean temperature.

The test standards specify how both for uniform and non-uniform elements the mean temperature shall be determined.

For elements which incorporate discrete areas of different thermal insulation, compliance with the thermal insulation criteria shall be determined separately for each area.

When testing in accordance with EN 1364-3 and EN 1364-4 the results for the thermal insulation and integrity shall be presented separately for the external face, the internal face and the linear joint seals, as specified in the test standard.

7.5.3.3.3 Radiation

Classification for radiation shall be given by the time for which the maximum value of radiation, measured as specified in the test standard, does not exceed 15 kW/m^2.

7.5.3.4 Classes

The following classes are defined:

Table 5 — Classes for facades (curtain walling) and external walls (including glazed elements)

E	15		30	60	90	120
EI	15		30	60	90	120
EW		20	30	60	90	120

When the elements are tested from both sides, with standard temperature/time curve from inside and external fire exposure curve from outside, the lowest time determines the classification.

Test and classification may also be performed from one side only. Whichever test(s) is/are performed and classification(s) determined, the classes are identified by:

“i→o” when classification is envisaged from inside to outside;

“o→i” when classification is envisaged from outside to inside;

“o↔i” when classification is envisaged from inside to outside and from outside to inside.

For example, a classification EI 60 (i→o) indicates a wall which is capable of providing 60 min integrity and thermal insulation performance from the inside only, whereas a classification EI 60 (o↔i) indicates a wall with the ability to provide the same level of performance from both inside and outside.

7.5.4 Classification of ceilings with independent fire resistance

7.5.4.1 General

These ceilings possess fire resistance independent of any element above.

7.5.4.2 Test method and field of application rules

Ceilings with independent fire resistance shall be tested in accordance with EN 1364-2. Extended application shall be carried out as described in EN 15254-7 and in EN 15725.

7.5.4.3 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard and in EN 15254-7.

The test method provides information on the following:

— test specimen/construction;

— field of direct application of test results;

— guidance on test specimen design.

Aspects influencing the number of tests to be carried out shall include for example:

a) the sides to be tested: ceilings may be tested from below or from above only or from both sides in consecutive tests depending upon the intended classification;

b) the orientation of the ceiling:

if the longitudinal and transversal direction are constructed differently, and the most onerous condition cannot be identified, two separate tests shall be carried out with the components arranged both parallel and perpendicular to the longitudinal axis;

c) constructional variations required, such as support conditions, and the presence or absence of cables and pipes, giving additional load to the ceiling during fire;

d) light fittings which can create openings in the ceiling.

7.5.4.4 Performance criteria

7.5.4.4.1 Integrity

When tested from below, the assessment of integrity shall be made on the basis of the following three aspects:

a) cracks or opening in excess of given dimensions;

b) ignition of a cotton pad;

c) sustained flaming on the unexposed side.

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

When tested from above, gap gauges shall not be used for the evaluation of the occurrence of cracks or openings in excess of given dimensions. The ceiling shall be deemed to fail the criterion for integrity when visible openings or flames are observed along the unexposed surface of the ceiling. Such openings or deterioration shall be judged as:

d) being when a component of the ceiling has fallen down or where an edge of a component has left its supporting profile element;

e) the formation of gaps visually assessed as being equivalent to those measured by the gap gauges.

7.5.4.4.2 Thermal insulation

The performance level, used to define thermal insulation, shall be the mean temperature rise on the unexposed face, limited to 140 °C above the initial mean temperature, with the maximum temperature rise at any point limited to 180 °C above the initial mean temperature.

7.5.4.5 Classes

The following classes are defined:

EI 15, EI 30, EI 45, EI 60, EI 90, EI 120, EI 180, EI 240.

Where classification is expressed from above, the addition of “a→b” (“a” referring to above and ”b” to below the membrane) shall be used; similarly the addition of “a←b” shall be used for classification from below, and “a↔b” shall be used for classification from both above and below.

For example, a classification EI 30 (a←b) indicates a ceiling membrane which is capable of providing 30 min integrity and thermal insulation performance from the underside only, whereas a classification EI 30 (a↔b) indicates a ceiling membrane with the ability to provide the same level of performance from both the underside and from above the ceiling.

7.5.5 Classification of fire doors and shutters including their closing devices

7.5.5.1 Test method and field of application rules

Fire doors and shutters shall be tested in accordance with EN 1634-1. Extended application shall be carried out as described in EN 15269-1, EN 15269-2, EN 15269-3, EN 15269-5, EN 15269-7, EN 15269-10, EN 15269-20, prEN 15269-6, prEN 15269-11 and in EN 15725.

The ability of closing devices to ensure reliable closing of doors and shutters in case of fire/smoke irrespective of the availability of primary power supply shall be tested in accordance with EN 14600.

7.5.5.2 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard and in EN 15269-1, EN 15269-2, EN 15269-3, EN 15269-5, EN 15269-7, EN 15269-10, EN 15269-20, prEN 15269-6 and prEN 15269-11.

The test method provides information on the following:

— test specimen;

— field of direct application of test results;

— guidance on test specimen design.

Aspects influencing the number of tests to be carried out shall include for example:

a) the types of supporting construction envisaged;

b) the type of door (hinged, pivoted, sliding etc.);

c) the sides to be tested for asymmetrical door assemblies, the test standard provides information on this aspect;

d) constructional variations required, such as:

— accommodation of the frame to the thickness of the supporting construction;

— the inclusion of glazing;

— decorative finishings;

— envisaged size ranges;

— hardware.

7.5.5.3 Performance criteria

7.5.5.3.1 Integrity

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

a) cracks or openings in excess of given dimensions;

b) ignition of a cotton pad;

c) sustained flaming on the unexposed side.

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

7.5.5.3.2 Thermal insulation

In the specific case of doors and shutters two levels of the thermal insulation criterion are defined as specified in 5.2.3.3.

The thermal insulation criterion shall be made specific by the use of the suffixes 1 and 2 corresponding to the two definitions given in 5.2.3.3. The test standard specifies how for uniform and non-uniform elements the mean temperature shall be determined. For doors which incorporate discrete areas of different thermal insulation, compliance with the thermal insulation criteria shall be determined for each area separately.

7.5.5.3.3 Radiation

Classification for radiation shall be given by the time for which the maximum value of radiation, measured as specified in the test standard, does not exceed 15 kW/m^2.

7.5.5.3.4 Self-closing

Self-closing is the ability of an open door or window to close fully into its frame and engage any latching device that might be fitted, without human intervention, by stored energy, or by mains power backed up by stored energy in case of power failure.

7.5.5.4 Classes

The following classes are defined:

Table 6 — Classes for fire doors and shutters including their closing devices

E	15	20	30	45	60	90	120	180	240
EI_1	15	20	30	45	60	90	120	180	240
EI_2	15	20	30	45	60	90	120	180	240
EW		20	30		60	90	120		

Performance requirements for the self-closing classification C0 to C5 are defined in EN 14600. They are dependent on the type of intended use of the door. The self-closing classification shall be handled independently from the E, EI and EW classification.

Doors fitted with a closing device, fulfilling the self-closing criterion, shall be classified as E-C..., EI_1-C..., EI_2-C... or EW-C..., e.g. EI_2 30-C5.

7.5.6 Classification of smoke control doors

7.5.6.1 Test method and field of application rules

Smoke control doors shall be tested in accordance with EN 1634-3. Extended application shall be carried out as described in EN 15269-1, EN 15269-2, EN 15269-3, EN 15269-5, EN 15269-7, EN 15269-10, EN 15269-20, prEN 15269-6, prEN 15269-11 and in EN 15725. The ability of closing devices to ensure reliable closing of doors and shutters in case of fire/smoke and including loss of primary power supply shall be tested in accordance with EN 14600.

7.5.6.2 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard and in EN 15269-1, EN 15269-2, EN 15269-3, EN 15269-5, EN 15269-7, EN 15269-10, EN 15269-20, prEN 15269-6 and prEN 15269-11.

The test method provides information on the following:

— test specimen;

— field of direct application of test results;

— guidance on test specimen design.

Aspects influencing the number of tests to be carried shall include for example:

a) the envisaged classification:

— S_a or S_{200};

— S_a considers leakage at ambient temperature only;

— S_{200} considers leakage at both ambient temperature and 200 °C;

b) the sides to be tested for asymmetrical door assemblies;

c) constructional variation required.

7.5.6.3 Performance criteria

7.5.6.3.1 Smoke leakage

This is the ability of the element to reduce or eliminate the passage of smoke from one side of the door to the other. The following performance levels are defined:

a) smoke leakage S_{200} - when the maximum leakage rate measured at both ambient temperature and 200 °C and up to a pressure of 50 Pa does not exceed 20 m^3/h for a single leaf doorset, or 30 m^3/h for a double leaf doorset;

b) smoke leakage S_a - when the maximum leakage rate measured at ambient temperature, and at a pressure of up to 25 Pa only, does not exceed 3 m^3/h per metre length of gap between the fixed and moveable components of the doorset (e.g. between the door leaf and door frame), excluding leakage at the threshold.

7.5.6.3.2 Self-closing

Self-closing is the ability of an open door or window to close fully into its frame and engage any latching device that might be fitted, without human intervention, by stored energy, or by mains power backed up by stored energy in case of power failure.

7.5.6.4 Classes

The following classes are defined:

S_{200}, S_a.

The classification may be applied in addition to the other classification identifications for fire doors given above, or may be used for doors which have neither an E, W nor an I classification.

Performance requirements for the self-closing classification C0 to C5 are defined in EN 14600. They are dependent on the type of intended use of the door. The self-closing classification shall be handled independently from the S_{200} and S_a classification.

Smoke control doors fitted with a closing device, fulfilling the self-closing criterion, shall be classified as $C0S_a$, $C0S_{200}$, $C1S_a$, $C1S_{200}$, …, $C5S_a$, $C5S_{200}$.

7.5.7 Classification of closure and conveyor system assemblies

7.5.7.1 General

The closure and conveyor system assemblies ensure that, in case of fire, openings in fire-separating elements such as walls and floors penetrated by conveyor systems are closed.

7.5.7.2 Test method and field of application rules

Closure and conveyor system assemblies shall be tested in accordance with EN 1366-7. Extended application shall be carried out as described in the relevant extended application standard and in EN 15725.

7.5.7.3 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard and in the relevant extended application standard.

7.5.7.4 Performance criteria

7.5.7.4.1 Integrity

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

a) cracks or opening in excess of given dimensions;

b) ignition of a cotton pad;

c) sustained flaming on the unexposed side.

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

7.5.7.4.2 Thermal insulation

In the specific case of closure and conveyor system assemblies, three thermal insulation criteria are defined as specified in 5.2.3.4. The additional thermal insulation criteria used for the closure systems are made specific by the use of the suffixes 1 and 2 corresponding to the two definitions given in 5.2.3.4.

For closure systems which incorporate discrete areas of different thermal insulation, compliance with the thermal insulation criteria shall be determined separately for each area as given in EN 1366-7.

7.5.7.4.3 Radiation

Classification for radiation shall be given by the time for which the maximum value of radiation, measured as specified in the test standard, does not exceed 15 kW/m^2.

7.5.7.4.4 Self-closing

Self-closing is the ability of an open closure for conveyor systems to close fully into its frame and engage any latching device that might be fitted, without human intervention, by stored energy, or by mains power backed up by stored energy in case of power failure (see also EN 1366-7).

The sustained operational capability of any clearing device and/or any separating device (see EN 1366-7) for a conveyor system, which is part of the closure and conveyor system assembly, may be required. The performance of these devices, for the conveyor system, are identified using a 'T'. This performance criterion shall be added to the C criterion, if a durability test was carried out in accordance with EN 14600 together with any clearing device and/or separating device indicating the same number of cycles as used for the C-class (0 to 5) like C1-T (see also EN 1366-7).

7.5.7.5 Classes

The following classes are defined:

Table 7 — Classes for closure and conveyor system assemblies

E	15		30	45	60	90	120	180	240
EI_1	15	20	30	45	60	90	120	180	240
EI_2	15	20	30	45	60	90	120	180	240
EI	15	20	30	45	60	90	120	180	240
EW		20	30		60	90	120		

Performance requirements for the self-closing classification C0 to C5 are defined in EN 14600. They are dependent on the type of intended use of the closure for conveyor systems. The self-closing classification shall be handled independently from the E, EI and EW classification.

Closure for conveyor systems fitted with a closing device, fulfilling the self-closing criterion shall be classified as E-C…,

The sustained operational capability of any clearing device and/or any separating device for a conveyor system is identified using a 'T' (see 7.5.7.4.4).

Examples of possible classifications: EI_1 45, EI_2 30-C1, EW 20-C0, or EI_1 60-C2-T.

7.5.8 Classification of penetration seals

7.5.8.1 Test method and field of application rules

Penetration seals shall be tested in accordance with EN 1366-3. Extended application shall be carried out as described in the extended application standard EN 15882-3 and in EN 15725.

7.5.8.2 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard and in the extended application standard EN 15882-3.

The test method provides information on the following:

— test specimen;

— field of direct application of test results;

— guidance on test specimen design and definition of standard service configurations.

Aspects influencing the number of tests to be carried out shall include for example:

a) the type and end-use of services envisaged to pass the penetration, including a blank penetration seal and multiple penetrations;

b) the range of supporting constructions to be covered;

c) the direction of the supporting constructions: horizontal and/or vertical separating elements.

7.5.8.3 Performance criteria

7.5.8.3.1 Integrity

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

a) cracks or opening in excess of given dimensions;

b) ignition of a cotton pad;

c) sustained flaming on the unexposed side.

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

7.5.8.3.2 Thermal insulation

The performance level used to define the thermal insulation criterion shall be the maximum temperature rise at any point, limited to 180 °C above the initial mean temperature.

No mean temperature shall be considered.

7.5.8.4 Classes

The following classes are defined:

Table 8 — Classes for penetration seals

E	15		30	45	60	90	120	180	240
EI	15	20	30	45	60	90	120	180	240

When penetration seals for pipes are to be classified, four pipe end configurations are defined in the test standard, according to Table 9.

Table 9 — Pipe end configuration

	Pipe end configuration		Additional specification for classification
	Inside the furnace	Outside the furnace	
	Uncapped	uncapped	U/U
	Capped	uncapped	C/U
	Uncapped	capped	U/C
	Capped	capped	C/C

The class obtained for the penetration seal is specified by the letter indicating the test condition as given in Table 9, e.g. EI 30-U/U.

7.5.9 Classification of linear joint seals

7.5.9.1 Test method and field of application rules

Linear joint seals shall be tested in accordance with EN 1366-4. Extended application shall be carried out as described in the extended application standard EN 15882-4 and in EN 15725.

However, tests shall be conducted in accordance with EN 1364-4 and EN 1364-3 in the case of perimeter seals for curtain walling (horizontal linear joint seal), and in accordance with EN 1364-3 in the case of vertical linear joints abutting curtains walling.

In the two latter cases the seal is part of the tested element.

7.5.9.2 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results as defined in the test standard and in the extended application standard EN 15882-4.

The test method provides information on the following:

— test specimen;

— field of direct application of test results;

— guidance on test specimen design and definition of standard service configurations.

Aspects influencing the number of tests to be carried out shall include for example:

a) the range of movements envisaged for the adjacent components;

b) the range of support constructions to be covered;

c) the orientations envisaged;

d) the joint widths envisaged;

e) the type of splices to be covered.

7.5.9.3 Performance criteria

7.5.9.3.1 General

If multiple seals are included in a single test, the performance of each linear joint shall be classified separately.

7.5.9.3.2 Integrity

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

a) cracks or openings in excess of given dimensions;

b) ignition of a cotton pad;

c) sustained flaming on the unexposed side.

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

7.5.9.3.3 Thermal insulation

The performance level used to define the thermal insulation criterion shall be the maximum temperature rise at any point, limited to 180 °C above the initial mean temperature. No mean temperature shall be considered.

7.5.9.4 Classes

The following classes are defined:

Table 10 — Classes for linear joint seals

E	15		30	45	60	90	120	180	240
EI	15	20	30	45	60	90	120	180	240

When linear joint seals are to be classified, different test conditions are defined in the test standard, according to Table 11.

Table 11 — Classification of linear joint seals

Test conditions	Designation
Specimen orientation	
• Horizontal supporting construction	H
• Vertical supporting construction – vertical joint	V
• Vertical supporting construction – horizontal joint	T
Movement capability	
No movement	X
Movement induced (in %)	M000
Type of splices	
Manufactured	M
Field	F
Both manufactured and field	B
Joint widths range (in mm)	W w1 to w2[a]
[a] w1 is the lower width limit and w2 is the higher width limit.	

The class obtained for the linear joint seals is specified by the letters indicating the test conditions as given in Table 11; e.g. EI 30 – H – M 100 – B – W 30 to W 90.

7.5.10 Classification of service ducts and shafts

7.5.10.1 Test method and field of application rules

Service ducts and shafts shall be tested in accordance with EN 1366-5. Extended application shall be carried out as described in the relevant extended application standard and in EN 15725.

7.5.10.2 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from a comparison between the envisaged field of application of the classification and the field of application of test results defined in the test standard and in the relevant extended application standard.

The test method provides information on the following:

— test specimen;

— field of direct application of test results;

— guidance on test specimen design;

— the ability of horizontal service ducts to support the weight of services;

— the ability of the service duct to prevent ignition of combustible services.

Aspects influencing the number of tests to be carried out shall include for example:

a) whether fire is outside or inside the service duct;

b) if the service duct is vertical or horizontal.

7.5.10.3 Performance criteria

7.5.10.3.1 Integrity

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

a) cracks or opening in excess of given dimensions;

b) ignition of a cotton pad;

c) sustained flaming on the unexposed side.

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

7.5.10.3.2 Thermal insulation

The performance of the duct outside the furnace shall be judged on the basis of the mean temperature rise on the unexposed face being limited to 140 °C above the initial mean temperature; with the maximum temperature rise at any point on the service duct outside the furnace limited to 180 °C above the initial mean temperature.

In addition, for a judgement to be made on the potential ignition of combustible services, surface thermocouples located inside the duct exposed to an outside fire shall not exceed 180 °C above the initial mean temperature.

The performance criteria can be summarised as given in Table 12:

Table 12 — Performance criteria for service ducts

Furnace Exposure	INTEGRITY		THERMAL INSULATION	
	Part of duct within furnace	Part of duct Outside furnace	Part of duct within furnace	Part of duct Outside furnace
Fire outside duct	-	Cotton pad Openings Flaming	180 °C above the initial mean temperature	140 °C mean above initial mean temperature 180 °C above the initial mean temperature
Fire inside duct	-	Cotton pad Openings Flaming	-	140 °C mean above initial mean temperature 180 °C above the initial mean temperature

7.5.10.4 Classes

The following classes are defined:

Table 13 — Classes for service ducts

E	15	20	30	45	60	90	120	180	240
EI	15	20	30	45	60	90	120	180	240

The classification shall be completed by "(i →o)", "(o → i)" or (i ↔ o) to indicate whether the element has been tested and fulfils the requirements from the inside or outside or both.

In addition the symbols "v_e" and/or "h_o" indicate the suitability for vertical and/or horizontal use.

7.5.11 Classification of chimneys

7.5.11.1 General

This covers chimney products designed to be built into a permanent structure and chimneys and chimney products where one or more external surfaces are within a building.

7.5.11.2 Test method

Chimneys shall be tested in accordance with EN 13216-1.

The thermal exposure shall be a constant temperature attack of 1 000 °C, being maintained for 30 min, after having reached the 1 000 °C level after 10 min.

7.5.11.3 Tests to be carried out

The design of the test specimen and the number of tests to be carried out depends upon the envisaged field of application of the classification.

7.5.11.4 Performance criteria

Flues and other chimney products designed to be built into a surround (e.g. into a brick chimney) need only satisfy a leakage requirement at the end of the test.

Products and elements, where the external surface or surfaces of the chimney are within or adjacent to a building, shall satisfy a thermal insulation requirement, defined as being a maximum temperature of adjacent materials, not exceeding 100 °C when related to an ambient temperature of 20 °C.

7.5.11.5 Classes

Products and elements satisfying the above criteria on a pass/fail basis use the letter G to denote fire resistance, followed by the designation of the necessary distance, expressed in mm, e.g. G 50.

7.6 Classification of wall and ceiling coverings for fire protection ability

7.6.1 General

The term 'covering' refers to the outermost part of vertical building elements (e.g. walls, partitions and external walls) and to the lowermost part of horizontal or sloping elements (e.g. floors, roofs and ceilings).

A covering designated K_1 or K_2 is a covering which for the classification period (10 min, 30 min or 60 min) provides the prescribed protection for the materials behind the covering.

NOTE Reaction to fire requirements can also apply for the products constituting the covering.

Coverings designated K_1

One of the following substrates are used in the test:

- a chipboard (with a density of (680 ± 50) kg/m^3 and a thickness of (19 ± 2) mm; or
- a low density material (with a density of less than 300 kg/m^3 and a thickness of at least 50 mm); or
- any other specific substrate.

Test results obtained with the chipboard substrate apply to the covering used on substrates with a density of at least 300 kg/m^3.

The classification criteria include limitation on temperature rise, burnt material, charred material, melted material and shrunk material.

Coverings designated K_2

One of the following substrates are used in the test:

- a chipboard (with a density of (680 ± 50) kg/m^3 and a thickness of (19 ± 2) mm; or
- any other specific substrate.

Test results obtained with the chipboard substrate apply to the covering used on all substrates (independent of the type and density of the substrate).

The classification criteria include limitations on temperature rise, burnt material and charred material.

7.6.2 Test method

The test method for fire protection ability of coverings shall be as given in EN 14135.

7.6.3 Tests to be carried out

The design of the test specimen and the number of tests to be carried out shall be derived from the envisaged field of application of the classification and the field of application of the test results as defined in the test standard.

7.6.4 Performance criteria for fire protection ability

7.6.4.1 Coverings designated K_1

A covering designated K_1 is considered to give the prescribed protection for materials behind the covering if, during a test in accordance with EN 14135 within the classification period (10 min), there is no collapse of the covering or parts of it and also if the requirements stated in a), and b) are fulfilled.

a) For a covering without a cavity or cavities behind it:

— during the test the mean temperature measured on the lower side of the substrate shall not exceed the initial temperature by more than 250 °C and the maximum temperature measured at any point of this side shall not exceed the initial temperature by more than 270 °C; and

— after the test there shall be no burnt material, charred material, melted material or shrunk material at any point of the substrate.

b) For a covering with a cavity or cavities behind it:

— during the test the mean temperature measured on the lower side of the substrate and the mean temperature measured on the unexposed side of the covering shall not exceed the initial temperature by more than 250 °C and the maximum temperature measured at any point of these sides shall not exceed the initial temperature by more than 270 °C; and

— after the test there shall be no burnt material, charred material, melted material or shrunk material at any point of the substrate and at any point of the unexposed side of the covering.

7.6.4.2 Coverings designated K_2

A covering designated K_2 is considered to give the prescribed protection for materials behind the covering if during a test in accordance with EN 14135 within the classification period (10 min, 30 min or 60 min), there is no collapse of the covering or parts of it and also if the following requirements are fulfilled.

a) For a covering without a cavity or cavities behind it

— during the test the mean temperature measured on the lower side of the substrate shall not exceed the initial temperature by more than 250 °C and the maximum temperature measured at any point of this side shall not exceed the initial temperature by more than 270 °C; and

— after the test there shall be no burnt material or charred material at any point of the substrate.

b) For a covering with a cavity or cavities behind it:

— during the test the mean temperature measured on the lower side of the substrate and the mean temperature measured on the unexposed side of the covering shall not exceed the initial temperature by more than 250 °C and the maximum temperature measured at any point of these sides shall not exceed the initial temperature by more than 270 °C; and

— after the test there shall be no burnt material or charred material at any point of the substrate and at any point of the unexposed side of the covering.

7.6.5 Classes

The following classes are defined (e.g. covering class K_2 60):

Table 14 — Classes for wall and ceiling coverings for fire protection ability

K_1	10		
K_2	10	30	60

The periods are 10, 30 and 60 (in minutes) during which the criteria given in 7.6.4.1 or 7.6.4.2 are satisfied.

Annex A
(normative)

Classification report

A.1 General

The aim of the classification report is to provide a harmonized way of presenting the classification of a construction element and its field of application.

The classification report shall be based on the test results obtained during the necessary tests, in accordance with the relevant resistance to fire test methods, as described in test reports and/or shall be based on the extended application results as described in extended application reports.

One or more tests may be required for the classification of a construction element or product in function of the requirements specified in this classification standard under the title 'Number of tests to be carried out'.

If the field of application of individual tests, e.g. smoke leakage tests and fire resistance tests do not coincide, the field of application of the classification shall be limited to their common part.

A.2 Content and format

The classification report shall have the following content and format illustrated in A.3:

a) nature of the classification report: resistance to fire;

b) identification number and date of the classification report;

c) name and address of the owner of the classification report;

d) name, address and notification number/status when appropriate of the organization issuing the classification report;

e) details of the type and function of the classified element or product under classification, including its commercial name;

f) detailed description of the element.

A full and complete description of the element shall be reproduced in the classification report as well as a clear specification of the field of application of the classification;

g) test(s) carried out:

(i) all test reports used in support of this classification are identified by:

— the name of the laboratory carrying out the tests and its notification status number where appropriate;

— the name and address of the sponsor;

— the test type and test report identification number(s);

(ii) the test standard(s) used;

(iii) detailed test results for each test specimen and each test condition for all relevant criteria involved in the classification as specified in A.3;

h) extended application results:

each extended application report used in support of this classification is identified by:

— the name of the laboratory carrying out the extended application and its notification status number where appropriate;

— the name and address of the sponsor;

— the extended application report identification number;

— the extended application standard(s) used and their date;

— detailed extended application results.

i) classification and field of direct application;

j) reference to the relevant classification procedure in this European Standard, i.e. EN 13501-2:2016 (i.e. clause number);

k) alternatively, for tests according to the different parts of EN 13381: '*Test methods for determining the contribution to the fire resistance of structural members*' include the characterization data in the format as defined in Annex B;

l) detailed description of the field of direct application of this classification or characterization data;

m) additional statements; where applicable include the data for calculation purposes;

n) the warning 'This document does not represent type approval or certification of the product'.

A.3 Classification report format

The following shows the layout and format of the classification report:

Logo of body issuing classification report

(Text/information to be provided by the author of the classification report (Notified Body) is indicated in *italic text*).

CLASSIFICATION OF FIRE RESISTANCE

IN ACCORDANCE WITH EN 13501-2:2016

Sponsor:	*name and address of sponsor*
Prepared by:	*name & address of body issuing classification report*
Notified Body No:	*number of notified body which prepared classification**
Product name:	*as described by the sponsor*
Classification report No.:	*number of classification report*
Issue number:	*issue number*
Date of issue:	*date of issue*

This classification report consists of *number* pages and may only be used or reproduced in its entirety.

* To be used for CE marking only

1 Introduction

This classification report defines the resistance to fire classification assigned to element *product name (as described by the sponsor)* in accordance with the procedures given in EN 13501-2:2016.

2 Details of classified product

2.1 General

The element, *product name (as described by the sponsor)*, is defined as a *type of product (according to relevant European Technical Specification)*.

2.2 Description

The element, *product name (as described by the sponsor)*, is fully described below or is fully described in the test report(s) and/or the extended application report(s) in support of classification listed in 3.1.

3 Test reports/extended application reports and test results in support of the classification

3.1 Test reports/extended application reports

Enter details of test or extended application reports here as applicable.

Name of laboratory	***Name of sponsor***	***Report ref. no***	***Test standard and date/field of extended application standards and dates***
Name of laboratory	*Name of sponsor*	*Report No*	*Test and EXAP standard*
Name of laboratory	*Name of sponsor*	*Report No*	*Test and EXAP standard*
Name of laboratory	*Name of sponsor*	*Report No*	*Test and EXAP standard*

3.2 Results (minimum required relevant information)

Test method, number and date	Parameter [a]	Results
first report	applied load	details of load
	supporting construction	
	loadbearing capacity	result
	integrity	result
	thermal insulation	result
	radiation	result
	mechanical action	result
	self-closing	result
	other parameters as appropriate	result
second report	applied load	details of load
(if appropriate)	supporting construction	
	loadbearing capacity	result
	integrity	result
	thermal insulation	result
	radiation	result
	mechanical action	result
	self-closing	result
	other parameters as appropriate	result

[a] Only include appropriate parameters in the table.

4 Classification and field of application

4.1 Reference of classification

This classification has been carried out in accordance with Clause 7 of EN 13501-2:2016.

4.2 Classification

The element, *product name (as described by the sponsor)* is classified according to the example of the following combinations of performance parameters and classes as appropriate.

R	E	I	W		***t***	***t***	-	M	S	C	IncSlow	sn	ef	r	G	K

Fire resistance classification: *classification*

4.3 Field of application

This classification is valid for the following end use applications:

(include reference to the appropriate European Standard, if available, or other reference source).

5 Limitations

This classification document does not represent type approval or certification of the product.

SIGNED	**APPROVED**
signature and authorised position in the organisation of the person undertaking classification	*signature and authorized position in the organisation of the person authorizing this report*
……	……

Annex B
(informative)

Presentation of characterization data and their field of application for products and systems for protecting elements or parts of work

B.1 General

The classification document is drafted as described in A.2, except for f), g) (iii) and j) items which shall be replaced by the items specified hereafter, depending on the type of protection.

B.2 Characterization data for protective vertical membranes

a) Specification of the standard vertical structural members tested:

- steel test columns;
- concrete test columns;
- concrete filled hollow steel test columns;
- timber test columns;
- aluminium test columns;

b) Presentation of data;

A graph is given of all relevant individual and mean temperature readings, as defined in the test standard, and used for classification and extension of test results.

c) Presentation of characterization data;

The characterization data for vertical protection membranes are presented as shown in Table B.1.

Table B.1 is based on the reference temperature curves as specified in the relevant test standard.

Table B.1 also indicates the corresponding criteria for the protected vertical members.

Table B.1 — Characterisation data for vertical members

Material from Which test Column Constructed	Specified limiting temperature value (cavity) (°C)	Specified limiting temperature value (surface) (°C)	Time to specified temperature value (cavity) (minutes)	Time to specified temperature value (surface) (minutes)	Criteria (minutes)		
					R	*E*	*I*
Concrete	***	***					
Steel	***	***					
Steel/concrete Composite	***	***					
Timber	***	-		-			

d) Limitation of the field of application:

— general limitations;

— type of closure opposite the vertical membrane tested: the application of the results is limited to closures with equal or lower thermal insulation potential;

— minimum depth of the cavity;

— examples of specific limitations:

  — for steel and aluminium columns: maximum section factor;

  — for concrete columns: minimum cross section dimensions;

  — for concrete filled hollow composite columns: minimum cross section dimensions;

  — for all concrete containing elements: type of concrete;

e) Presentation of data for calculation purposes.

B.3 Characterization data for applied protection to concrete members

a) Specification of the standard elements tested:

— tests on large concrete slabs: Minimum and maximum thickness
One thickness only

— tests on concrete beams: Minimum and maximum thickness
One thickness only

— additional tests on small concrete slabs;

b) presentation of data;

A graph is given of all relevant individual and mean temperature readings, as defined in the test standard, and used for classification and extension of test results.

c) Presentation of characterization data for concrete slabs and beams;

For each thickness d_p of fire protection system tested, profiles of measured characteristic temperature vs. depth d within the concrete test member shall be plotted at 30 min intervals, for each set of thermocouples as defined in the test standard, as shown in Figure B.1.

From this information the depth d_θ at which a series of limiting temperatures, θ_{crit}, of e.g. 300 °C, 350 °C, 400 °C, 450 °C, 500 °C, 550 °C, 600 °C and 650 °C is observed, is recorded at 30 min intervals.

The values of d_θ are plotted on a graph against the thickness of fire protection system.

The plotted results are joined with a straight line as shown in Figure B.2.

d) Limitation of the field of application.

Limits of concrete density: ...≤ ρ ≤. ...

The results are limited to the following concrete strength grades: ...

Minimum slab thickness: ...

Minimum beam width: ...

Limitations to the use of mould release agents and/or surface sand blasting cleaning.

e) Presentation of equivalent thickness data for protected concrete slabs and beams.

The values of equivalent thickness for each thickness of fire protection tested are given at 30 min intervals.

D_p	Time	30	60	90	120	240
d_{pmin}						
d_{pmax}						

B.4 Characterization data for applied protection to steelwork

a) Specification of the standard elements tested:

The number of specimens tested depends upon the assessment procedure for thermal performance used.

b) Presentation of data:

A graph is given of all relevant individual and mean temperature readings, as defined in the test standard, and used for classification and extension of test results.

c) Presentation of characterization data:

The thermal analysis produces a series of tables and graphical presentations relating to fire resistance periods of 15 min, 30 min, 45 min, 60 min, 120 min, 180 min and 240 min. Each table or graphical presentation shows the minimum thicknesses of fire protection material required to ensure that design temperatures of 350 °C, 400 °C, 450 °C, 500 ° C, 550 °C, 600 °C, 650 °C, 700 °C, 750 °C and higher if necessary are not exceeded on steel members with section factors (A_m/V values) at intervals of 20 m^{-1} (an example of the presentation of such tabulated information is given in Table B.2).

Table B.2 — Example of tabulated data

Fire resistance classification R-30

Design (C) Temperature	**350**	**400**	**450**	**500**	**550**	**600**	**650**	**700**	**> 700**
A_m/V	**Thickness of fire protection material to maintain temperature below design temperature**								
40									
60									
80									
100									
120									
140									
160									
180									
200									
220									
240									
260									
280									
300									
320									
340									
360									
380									
400									

Further presentation of characterization data depends upon the assessment procedure used:

d) for a differential equation method (where used) the variation of effective thermal conductivity as a function of temperature, together with the values of c_p and $\rho_{protection}$ used as a basis for the calculation of effective thermal conductivity. Values of the modification coefficient (variable λ method) or modified values of C_0 (constant λ method) as specified in the test standard;

e) for a numerical regression analysis (where used) the multiple linear regression equation including the modified regression coefficients;

f) for graphical presentation methods, presentations which include:

— for a given design temperature, the time to reach the design temperature as a function of section factor and for alternative thicknesses of fire protection material (see Figure B.3);

— for specified periods of fire resistance, the design temperature as a function of section factor and for alternative thickness of fire protection material (see Figure B.4).

g) Limits of applicability:

— range of fire protection thickness $d_{pmin} \leq d_p \leq d_{pmax}$;

— the range of steel section factors: ...≥ $A_m/V \geq$ ...;

— the maximum design temperature: ...;

— the maximum fire protection period:

— applicability to other steel sections than “I” or “H” sections;

— any other limitation.

B.5 Characterization data for applied protection to concrete/profiled sheet steel composite members

a) Tests to be carried out:

— one large scale test with maximum protection thickness;

— one small scale test with minimum protection thickness;

— any additional small-scale test.

b) Presentation of data

A graph is given of all relevant individual and mean temperature readings, as defined in the test standard, and used for classification and extension of test results.

c) Presentation of characterisation data

The following data are given:

— the measured time for the characteristic temperature of the profiled steel sheet to rise to 350 °C for each thickness of fire protection material tested;

— the graphical plot of the measured time for the profiled steel sheet to rise to 350 °C against fire protection material thickness between its maximum and minimum thickness and at all intermediate thicknesses by interpolation (see Figure B.5);

— the values and the plot of equivalent thickness h_{eq} of concrete for each thickness of fire protection material between its maximum and minimum thickness (see Figure B.6);

— the values and the plot of limiting exposure time for each thickness of the fire protection material between its maximum and minimum thickness.

d) Limits of applicability:

— Minimum thickness of the profiled steel sheet: ...;

— maximum width of the rib (l_{pt}) on which the fire protection material is directly attached: ...;

— maximum height of the rib (h_2): ...;

— limitations regarding the type of profile;

— minimum concrete density: ...;

— maximum concrete density: ...;

— concrete strength classes: ...;

— concrete type(s): ...;

— minimum effective concrete slab thickness: ...;

— any other limitation: ...

B.6 Characterization data for applied protection to concrete filled hollow steel columns

a) Tests to be carried out:

— one loaded full size composite test column with minimum thickness;

— one unloaded small size test column with maximum thickness;

— any additional unloaded small size column;

b) Presentation of data

A graph is given of all relevant individual and mean temperature readings, as defined in the test standard, and used for classification and extension of test results.

c) Presentation of characterization data:

— the measured time for the characteristic temperature of the steel surface of the concrete filled hollow steel column surface to reach any end point defined in the test standard for each thickness of fire protection material tested.

— the graphical plot of the measured time for the characteristic temperature of the steel surface of the concrete filled hollow steel column to reach any end point defined in the test standard against fire protection material thickness between its maximum and minimum thickness and at all intermediate thicknesses (see Figure B.7);

d) Limits of applicability:

— Minimum steel grade: ...;

— minimum wall thickness: ...;

— minimum cross section:

  — for rectangular section: minimum width: ...;

  — for circular section: minimum diameter: ...;

— minimum concrete density: ...;

— maximum concrete density: ...;

— concrete strength classes: ...;

— type(s) of concrete: ...;

— any other limitation: ...

B.7 Characterization data for applied protection to timber members

a) Specification of the standard elements tested.

Three test series are defined as a function of the intended application of the test results:

— results to be applicable to floors and beams;

— results to be applicable to floors only;

— results to be applicable to beams only;

b) Presentation of data;

c) Presentation of characterization data.

A graph is given of all relevant individual and mean temperature readings, as defined in the test standard, and used for classification and extension of results.

The characteristic values of the time to the start of charring and the charring rate for both loaded and unloaded test specimens, for each thickness of the fire protection system tested are given.

d) Limits of applicability:

— minimum and maximum thickness of the protection: ...;

— orientation of the protection: ...;

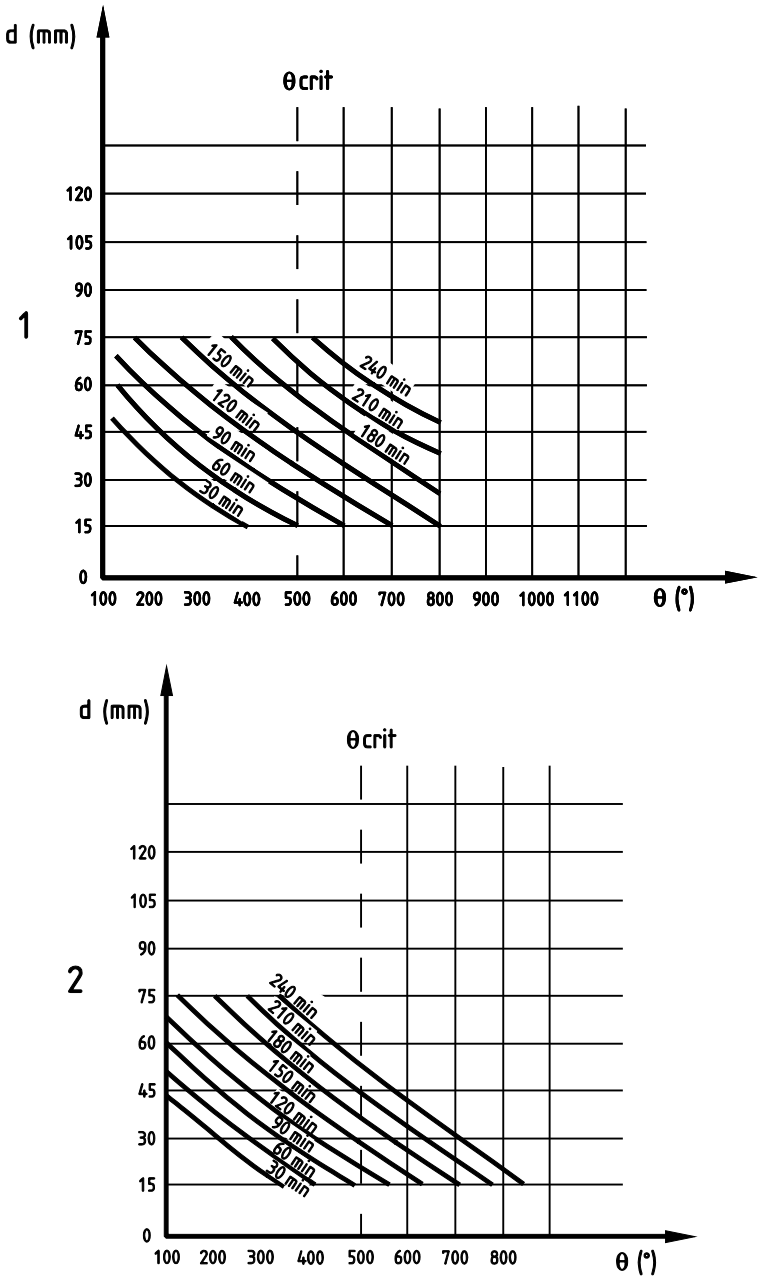
— timber grade: ...;

— minimum timber width: ...;

— minimum timber depth: ...;

— maximum fire duration time: ...;

— any other limitation: ...



Key

1 test with minimum protection thickness d_p (mm)

2 test with maximum protection thickness d_p (mm)

Figure B.1 — Plot of temperature vs. depth in concrete (for minimum and maximum fire protection thickness)

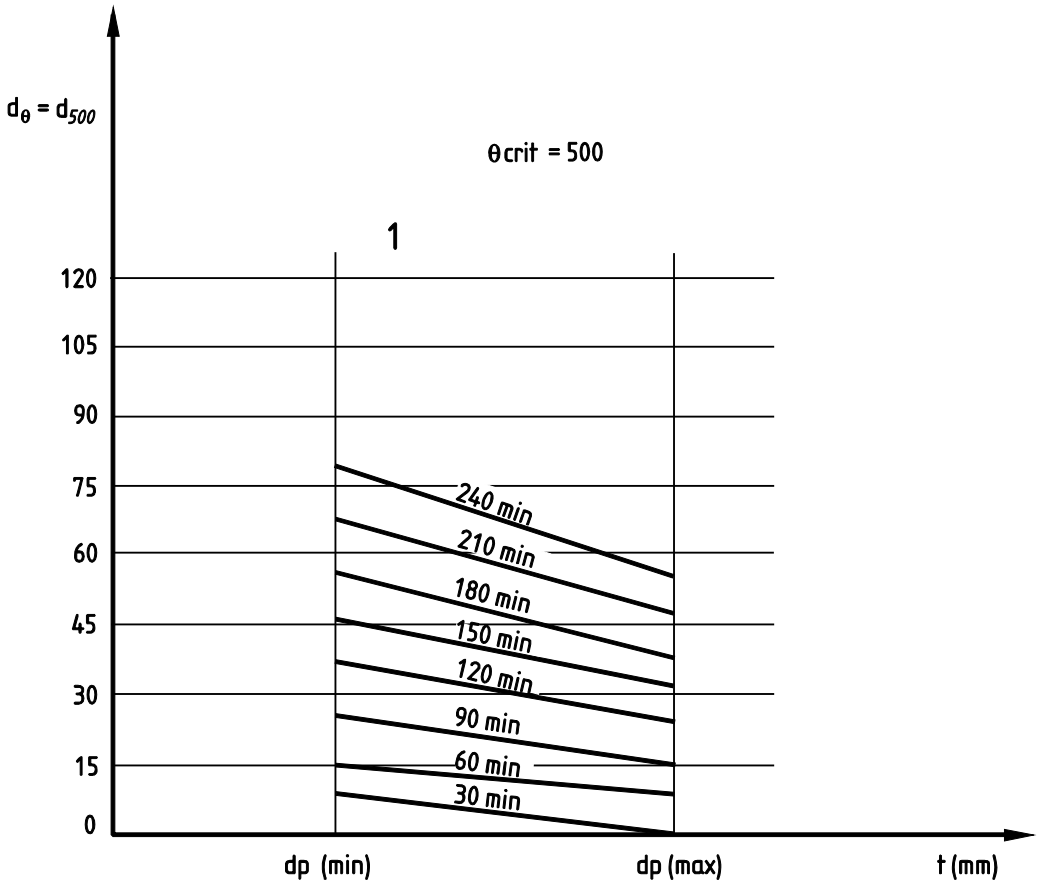
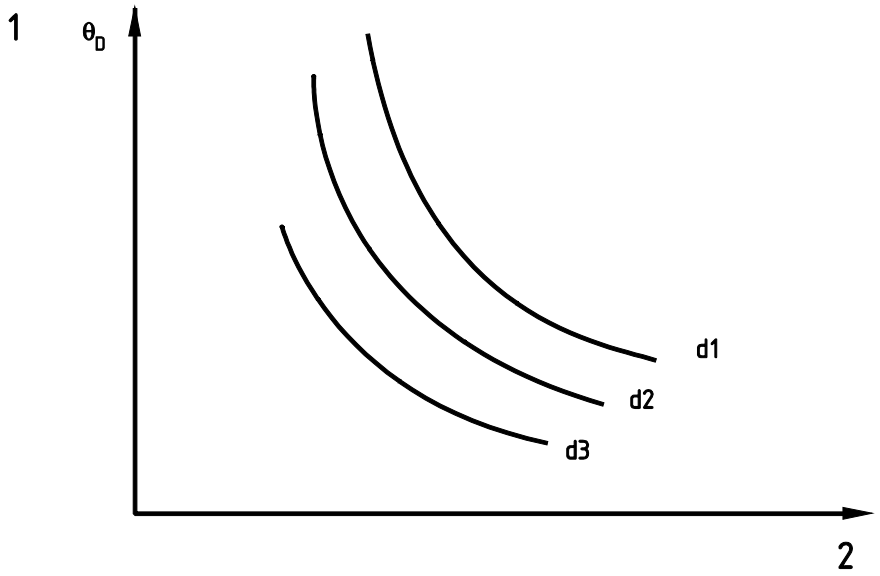


Figure B.2 — Plot of fire protection thickness vs. depth d_p in concrete

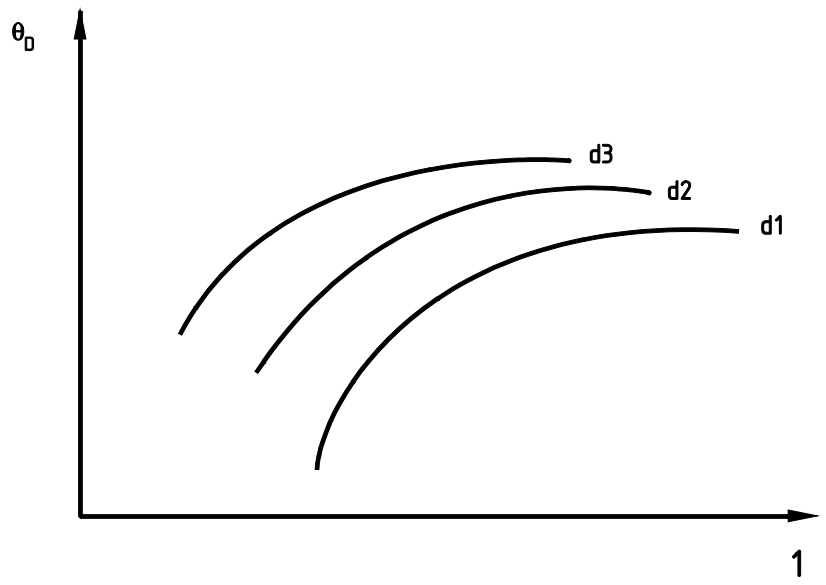


Key

1 section factors

2 time to reach θD

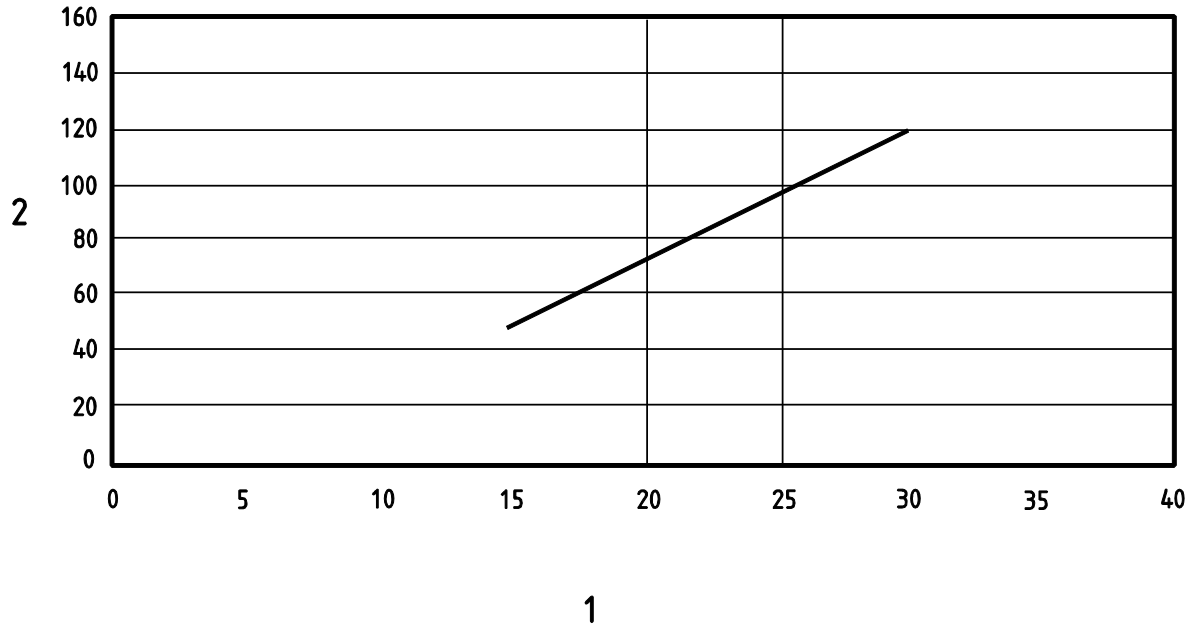
Figure B.3 — Plot of time to reach θ_D (design temperature) vs section factor



Key

1 section factor

Figure B.4 — Plot of θ_D vs. section factor

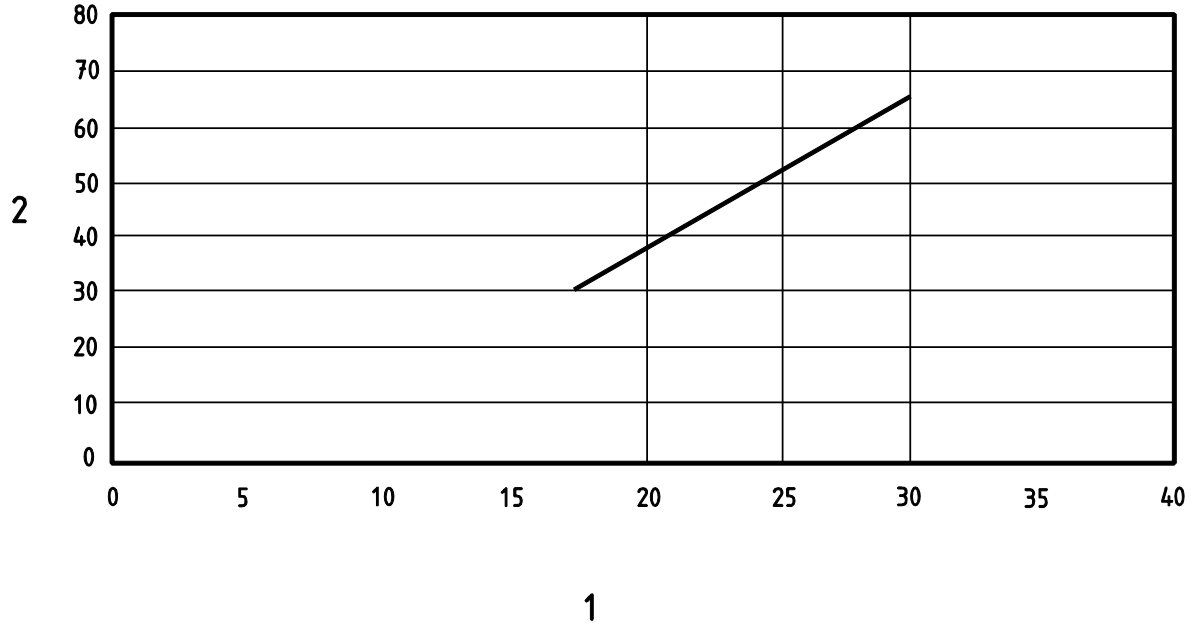


Key

1 thickness of thermal insulation (mm)

2 time to rise to 350 °C (min)

Figure B.5 — Thickness - insulation relationship for profiled steel sheet

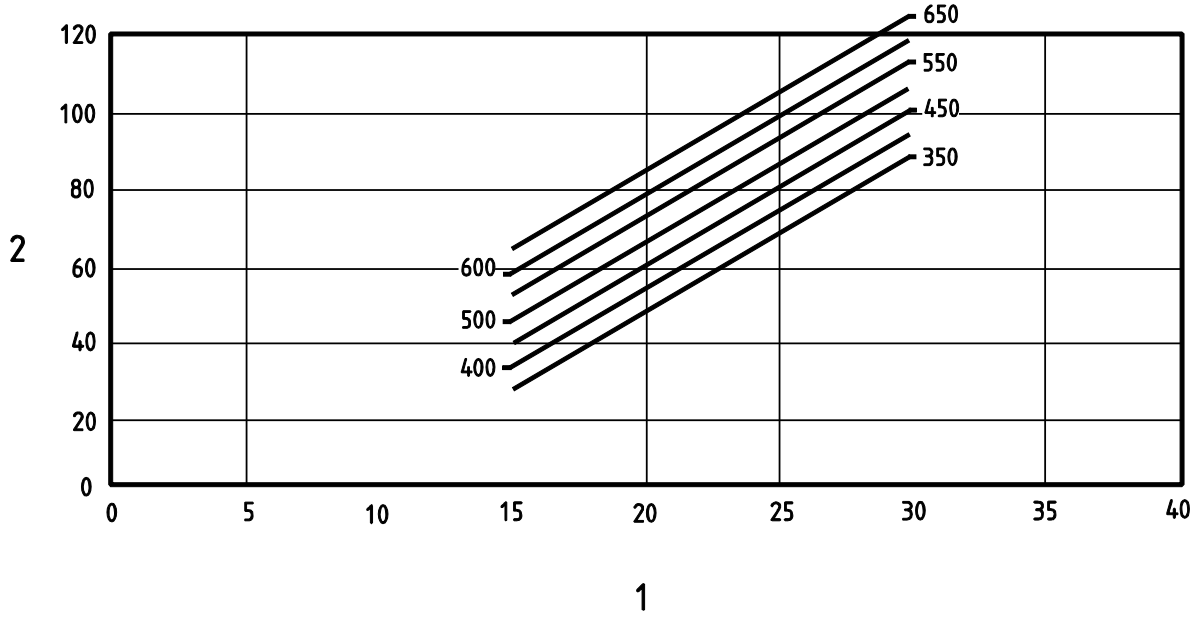


Key

1 thickness of thermal insulation (mm)

2 equivalent thickness of concrete (mm)

Figure B.6 — Determination of equivalent thicknesses of concrete for intermediate fire protection thickness



Key

1 thickness of thermal insulation (mm)

2 time to rise to any end point (min)

Figure B.7 — Concrete filled hollow steel column temperature

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[3] EN 1992-1-2, *Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design*

[4] EN 1993-1-2, *Eurocode 3: Design of steel structures - Part 1-2: General rules - Structural fire design*

[5] EN 1994-1-2, *Eurocode 4 - Design of composite steel and concrete structures - Part 1-2: General rules - Structural fire design*

[6] EN 1995-1-2, *Eurocode 5: Design of timber structures - Part 1-2: General - Structural fire design*

[7] EN 1996-1-2, *Eurocode 6 - Design of masonry structures - Part 1-2: General rules - Structural fire design*

[8] EN 1999-1-2, *Eurocode 9 - Design of aluminium structures - Part 1-2: Structural fire design*