



BSI Standards Publication

Fire classification of construction products and building elements

Part 2: Classification using data from fire resistance and/or smoke control tests, excluding ventilation services

National foreword

This British Standard is the UK implementation of EN 13501-2:2023. It supersedes BS EN 13501-2:2016, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee FSH/22/-/15, EN 13501 Co-ordination Panel.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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English Version

Fire classification of construction products and building
elements - Part 2: Classification using data from fire
resistance and/or smoke control 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 et/ou de contrôle
des fumées à l'exclusion des produits utilisés dans les
systèmes de ventilation

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

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European foreword

This document (EN 13501-2:2023) has been prepared by Technical Committee CEN/TC 127 “Fire safety in buildings”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2023 and conflicting national standards shall be withdrawn at the latest by November 2023.

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

This document supersedes EN 13501-2:2016.

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 of the first edition. In comparison with the previous edition, the following technical modifications have been made:

- in 7.5.2.1: adding reference to new EXAP standards;
- in all paragraphs concerned: introduction of proposal from CEN/TC 166 for chimney;
- in all paragraphs concerned: introduction of proposal for air transfer grilles;
- in all paragraphs concerned: introduction of EN 15882-5;
- in all paragraphs concerned: update on criterion description for load bearing elements (EN 1363-1):
- in 7.3.2: modification related to EN 1365-1;
- in 7.5.2.1: introduction of EN 15254-3;
- in 7.3.4.4: modification of classification table;
- in 7.5.9.4: modification of classification table.
- in 7.5.5.3.4: improvement and clarification on S_a to answer concerns/request from different national standardisation bodies.

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 and/or smoke control tests, excluding ventilation services*
- *Part 3: Classification using data from fire resistance tests on products and elements used in building service installations: fire resisting ventilation ducts and fire dampers and/or power, control and communication cables (under revision)*
- *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 power, control and communication cables*

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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

Introduction

The aim of this document is to define a harmonized procedure for the classification for fire resistance 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 document is prepared in support of the second basic requirement for construction works, in the REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 and is detailed in the Interpretative Document number 2 (ID2): Safety in case of fire (OJC62 Vol 37). It reflects the Commission Decision (EU) 2000/367/EC of 3 May 2000 amended by 2003/629/EC of 27 August 2003 and 2011/232/EC of 11 April 2011 as regards the classification of the resistance to fire performance of construction products, construction works and parts thereof.

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

This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association.

This document 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 (Direct field of application) 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 document specifies the procedure for classification of construction products and building elements using data from fire resistance and/or smoke leakage/control tests and/or mechanical 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 document.

This document 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 resisting doorsets, shutter assemblies and openable windows and their closing devices;

- smoke control doorsets and shutter assemblies and their closing devices;
 - conveyor systems and their closures;
 - penetration seals;
 - linear joint seals;
 - combined penetration seals;
 - service ducts and shafts;
 - air transfer grilles;
 - 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 document. 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 construction products are listed in Clauses 2 and 7.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1191, *Windows and doors — Resistance to repeated opening and closing — Test method*

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

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

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

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

EN 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 1364-5, *Fire resistance tests for non-loadbearing elements — Part 5: Air transfer grilles*

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

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

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

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

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

EN 1366-13, *Fire resistance tests for service installations — Part 13: Chimneys*

EN 1443:2019, *Chimneys — General requirements*

EN 1634-1, *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, *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 12604, *Industrial, commercial and garage doors and gates — Mechanical aspects — Requirements and test methods*

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*

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

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 — Non-loadbearing walls — Part 4: Glazed constructions*

EN 15254-3, *Extended application of results from fire resistance tests — Non-loadbearing walls — Part 3: Lightweight partitions*

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 (all parts)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*

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 15882-5, *Extended application of results from fire resistance tests for service installations — Part 5: Combined penetration seals*

EN 16034, *Pedestrian doorsets, industrial, commercial, garage doors and openable windows — Product standard, performance characteristics — Fire resisting and/or smoke control characteristics*

EN 17020 (all parts), *Extended application of test results on durability of self-closing for fire resistance and/or smoke control doorsets and openable windows*

EN ISO 13943, *Fire safety — Vocabulary (ISO 13943)*

¹ EN 15269-4 and EN 15269-6 are under preparation.

3 Terms and definitions

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

3.2

ceiling

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

3.3

self-supporting ceiling

ceiling with a span from wall to wall, without any additional suspension devices

3.4

doorset or shutter assembly

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

3.5

floor

horizontal separating element of building construction which is loadbearing

3.6

roof

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

3.7

suspended ceiling

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

3.8

ceiling system

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

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

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

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

3.13**insulated wall**

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

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.

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

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

3.18**insulated glazing**

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

3.19**un-insulated glazing**

fire resistant 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

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

3.21

test specimen

element (or part) of building construction provided for the purpose of determining either its performance related to safety in case of fire (e.g. fire resistance classification) or its contribution to the performance of another building element

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

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

3.24

smoke leakage/smoke control

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 longer than 10 s

3.26

load level

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

Note 1 to entry: The loadbearing capacity of the member at ambient 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

DIAP

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

EXAP

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

Note 1 to entry: 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.

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

3.33**air transfer grille**

device consisting of an active/reactive part which could include a decorative cover as to be used in practice, allowing movement of air at ambient temperature and pressure and providing fire resistance in case of fire

3.34**chimney**

structure consisting of a wall or walls enclosing a flue or flues conveying the products of combustion into the outside atmosphere

4 Fire scenarios**4.1 General**

The second basic requirement for construction work of the Construction Products Regulation addresses e.g. 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 document 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 document.

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 $t > 21$

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

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 realized 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:

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

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.
- Test temperatures depending on declared temperature class according EN 1443:2019, Table 2 for evaluating thermal resistance of chimneys and chimney related products or the relevant product standard and for chimney components according to the appropriate dependent product standard. The nominal working temperature shall be tested according to EN 13216-1:2019, 5.7.3.2.

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 building 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 building construction that has a separating function, to withstand fire exposure on the exposed side only (not from both sides simultaneously), 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 (only if insulation is to be considered as well);
- 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 if insulation is to be considered as well. 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, I₁ or I₂). 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 building construction to withstand fire exposure on the exposed side only (not from both sides simultaneously), 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 building 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.

The classification of thermal insulation shall always be given in combination with integrity, i.e. EI.

5.2.3.2 Thermal insulation of elements except doorsets, shutter assemblies, openable windows, and closures for conveyor systems

For all separating elements except doorsets and shutter assemblies, openable windows and closures for conveyor systems 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 temperature (as defined in EN 1363-1), with the maximum temperature rise at any point limited to 180 °C above the initial temperature (as defined in EN 1363-1). 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 doorsets, shutters assemblies and openable windows

In the specific case of doorsets, shutter assemblies and openable windows, one out of two options of the thermal insulation criterion shall be used. Wherever doorsets and door leaves are mentioned in this section, the information applies in the same way for openable windows and window casements:

— 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 temperature (as defined in EN 1363-1), with the maximum temperature rise at any point of the door leaf limited to 180 °C above the initial temperature (as defined in EN 1363-1). 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 door 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 door frame is wider than 100 mm, otherwise it shall be measured with the centre of the disc 15 mm from the junction between the door 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 temperature (as defined in EN 1363-1), with the maximum temperature rise at any point of the door leaf limited to 180 °C above the initial temperature (as defined in EN 1363-1). 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 door 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 door frame is wider than 100 mm, otherwise it shall be measured at the door 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 suffixes shall be used only for fire resisting doorsests 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 building construction to withstand fire exposure on the exposed side only (not from both sides simultaneously), 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 .

The classification of thermal insulation shall always be given in combination with integrity, i.e. EW.

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 and durability of self-closing

Self-closing C is the ability of an open doorset or window to close fully 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. The C classification may be declared where a self-closing device is fitted and the doorset/window was not manually closed for the purpose of the test. The test shall be a pass/fail one. The test shall be in accordance with EN 16034.

Optionally, for durability of self-closing, the C classification in Table 1 may be complemented by the digits 0 to 5 according to the use category where cycle testing has been carried out.

Table 1 — Durability of self-closing

Use category (C)	Number of cycles
5	≥ 200 000
4	≥ 100 000
3	≥ 50 000
2	≥ 10 000
1	≥ 500
0	≥ 1

5.2.7 S - Smoke control

Smoke control S is the ability of the element to reduce below a certain value the passage of gases or smoke from one side of the element to the other.

S_a considers smoke leakage at ambient temperature only.

S₂₀₀ considers smoke leakage at both ambient temperature and at 200 °C.

NOTE S₂₀₀ has the same meaning as previously used S_m classification in compliance with the previous version EN 13501-2.

5.2.8 O - Normal operating conditions

Non-soot fire resistance classification for chimneys and chimney related products stands for the ability of the element(s) to be resistant at normal operating conditions. This includes aspects of leakage and thermal insulation.

The maximum temperature of products with a reaction to fire classification different from A1 in a declared minimum distance shall not exceed 85 °C when tested in accordance with EN 13216-1 or in the appropriate material dependent test standard at a test temperature given in according EN 1443:2019, Table 2 appropriate to the product designation related to an ambient temperature of 20 °C.

The O classification shall be followed by the designation of the necessary minimum distance XX to combustible material as well as the temperature class TXXX.

5.2.9 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.

The maximum temperature of products with a reaction to fire classification different from A1 in a declared minimum distance shall not exceed 100°C when tested in accordance with EN 13216-1 for soot fire conditions the appropriate material dependent test standard at a test temperature given in EN 1443:2019, Table 2 appropriate to the product designation related to an ambient temperature of 20 °C.

The G classification shall be followed by the designation of the necessary minimum distance XX to combustible material as well as the temperature class TXXX out of 5.2.8.

This document 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.

5.2.10 K - Fire protection ability

5.2.10.1 General

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 elements of building construction, such as walls, floors and roofs.

5.2.10.2 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 $(680 \pm 50) \text{ kg/m}^3$ and a thickness of $(19 \pm 2) \text{ mm}$, 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.

5.2.10.3 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 $(680 \pm 50) \text{ kg/m}^3$, and a thickness of $(19 \pm 2) \text{ mm}$ which represents all materials behind the covering or
- any other specific substrate, which represents a material of the same composition behind the covering.

6 Classification of characteristics related to 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 elements of building construction use shall be made of the designatory letters shown in 5.2.

6.3 Declaration of classification

Combinations of these designatory letters, as appropriate, shall be used as part of the declaration 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 if appropriate.

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 specified:

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, an element of building construction 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 Doorsets, shutter assemblies and openable windows

In the specific case of doorsets, shutters assemblies and openable windows for the thermal insulation criterion, two different levels are specified. Hence, the classification shall be made specific by the use of one of the suffixes 1 and 2, to indicate the subclass (see 5.2.3.3).

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 doorset failing the first thermal insulation criterion after 50 min and the second criterion after 70 min (failing E after 95 min) shall be classified E 90/EI₁ 45/EI₂ 60.

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 doorset satisfies also the second thermal insulation criterion. For example, a doorset failing the first thermal insulation criterion after 50 min and the second criterion after 55 min (failing E after 70 min) shall be classed E 60/EI₁ 45.

See 7.5.5 for the full classification.

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 specified (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: E 120, EI 90, EI₁ 45, EI₂ 60.

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. EI₂ 60-S₂₀₀). 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 S₂₀₀ as a function of the classification envisaged;
- C for doorsets and shutters and closures for conveyor systems equipped with a self-closing device, e.g. EI₂ 30-C3. Where no fire resistance or smoke control classification is relevant, the element shall simply be classified C (C0 to C5);
- 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.