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BSI Standards Publication

Fire classification of construction products and building elements

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

National foreword

This British Standard is the UK implementation of EN 13501-4:2016. It supersedes BS EN 13501-4:2007+A1:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee FSH/22/-/9, Fire resistance tests for ducts, including smoke extract ducts.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Fire classification of construction products and building elements - Part 4: Classification using data from fire resistance tests on components of smoke control systems

Classement au feu des produits et éléments de construction - Partie 4: Classement à partir des données d'essais de résistance au feu des composants de dispositifs de contrôle de fumée

Klassifizierung von Bauprodukten und Bauarten zu ihrem Brandverhalten - Teil 4: Klassifizierung mit den Ergebnissen aus den Feuerwiderstandsprüfungen von Anlagen zur Rauchfreihaltung

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European foreword

This document (EN 13501-4:2016) 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 13501-4:2007+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of an identical text or by endorsement, at the latest by December 2016, and conflicting national standards shall be withdrawn at the latest by March 2018.

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 document 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 fire resistance tests can make reference to the fire resistance classification given in this European Standard and not refer directly to any specific fire test method.

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 products and elements used in 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

This European Standard defines a harmonized procedure for the classification for resistance to fire of construction products. This classification is based on the test procedures sited in the relevant documents 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 3 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 products/elements and explains the method for deriving their classification on the basis of test results and/or extended application results for individual products/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 components of smoke control systems, using data from fire resistance tests which are within the field of application of the relevant test methods. Classification on the basis of extended application of test results is also included in the scope of this European Standard.

Products covered by this European Standard are:

— smoke control ducts;

— smoke control dampers;

— smoke barriers;

— powered smoke and heat control ventilators (fans), including connectors;

— natural smoke and heat exhaust ventilators.

Relevant documents which include the relevant test methods which have been prepared for these products are listed in Clause 2.

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 1363-1, *Fire resistance tests - Part 1: General Requirements*

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

EN 1366-1, *Fire resistance tests for service installations - Part 1: Ventilation ducts*

EN 1366-2, *Fire resistance tests for service installations - Part 2: Fire dampers*

EN 1366-8, *Fire resistance tests for service installations - Part 8: Smoke extraction ducts*

EN 1366-9, *Fire resistance tests for service installations - Part 9: Single compartment smoke extraction ducts*

EN 1366-10, *Fire resistance tests for service installations - Part 10: Smoke control dampers*

EN 12101-1:2005, *Smoke and heat control systems - Part 1: Specification for smoke barriers*

EN 12101-2, *Smoke and heat control systems - Part 2: Specification for natural smoke and heat exhaust ventilators*

EN 12101-3, *Smoke and heat control systems - Part 3: Specification for powered smoke and heat control ventilators (Fans)*

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

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
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

3.2
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

3.3
test specimen
product provided for test purposes

3.4
smoke control duct
duct used in a system to control the movement and/or containment of smoke and heat

3.4.1
single compartment smoke control duct
smoke control duct designed to provide a degree of fire resistance for use within single fire compartment application

3.4.2
multi compartment smoke control duct
smoke control duct designed to provide a degree of fire resistance for use in multicompartment applications

3.5
smoke control dampers
device, open or closed in its operational position to control the flow of smoke and hot gasses, which is automatically or manually activated

3.5.1
single-compartment smoke control damper
device for use within a single compartment, associated with a single compartment smoke extraction duct conforming to EN 1366-9

3.5.2
multi-compartment fire resisting smoke control damper
smoke control damper for use in multi-compartment applications, associated with a smoke extraction duct conforming to EN 1366-8

3.6
smoke barrier
device to channel, contain and/or prevent the migration of smoke (fire effluent)

Note1 to entry: Smoke barriers are also referred to as smoke curtains, smoke blinds or smoke screens.

3.7
smoke and heat exhaust ventilator
device specially designed to move smoke and hot gasses out of a construction works under conditions of fire

3.8
powered smoke and heat exhaust ventilator
powered device (usually a fan) that is suitable for exhausting hot gasses from a building under fire conditions

Note 1to entry: Such devices are often able to function under fire conditions for a limited period only.

3.9
natural smoke and heat exhaust ventilator
device specifically designed to move smoke and hot gasses out of the construction works by buoyancy forces

3.10
extended application result
predicted result for performance parameter obtained following the process of extended field of application

3.11
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

NOTE 1 The essential requirement 'safety in case of fire' of the Construction Products Regulation addresses the spread of fire and smoke in a building. To demonstrate satisfaction of this requirement, the fire resistance performance of these components is addressed in this European Standard.

Fire resistance shall be assessed using one or more of the levels of thermal attack given in 4.2 to 4.5.

NOTE 2 Later clauses of this European Standard identify which attack(s) shall be used for which products.

NOTE 3 The various levels of thermal action given in 4.2 to 4.5 reflect different fire scenarios and the standards which specify their translation into practical tests give tolerances for their application.

NOTE 4 Other heating curves exist, for example the hydrocarbon curve. Also, for extreme fire scenarios (e.g. traffic tunnels, nuclear plants), more severe conventional curves are specified. These are not, however, used for the classification of products according to this European Standard.

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

The 'post flash-over' fire test utilizes the 'standard temperature/time relationship' which is a model of a fully developed fire in a compartment and is given by the following relationship:

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

where

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

T is the mean furnace temperature in degrees Celsius (°C).

The post flash-over fire curve shall be applied in accordance with EN 1363-1.

When applied as a basis for testing, the relationship shall be applied for the full duration of the test.

4.3 The slow heating curve (smouldering fire)

The 'smouldering' fire test shall only used if the fire resistance performance of the product is expected to be reduced by exposure to temperatures associated with the growth stage of a fire.

NOTE It is, therefore, particularly relevant to products whose performance can be dependent upon high heating rates below approximately 500 °C (defined in 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 $0 < t \leq 21$

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

for $t > 21$

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

where

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

T is the mean furnace temperature in degrees Celsius (°C).

The smouldering fire curve shall be applied in accordance with EN 1363-2.

4.4 Constant temperature attack

In addition to the heating regimes given above, the evaluation of smoke barriers and smoke and heat exhaust ventilators shall be made using a notional constant temperature attack. The specified temperature and the rate at which the temperature is reached, is specified in the relevant test method.

4.5 Specific thermal actions

4.5.1 Smoke control ducts

Multicompartment ducts – standard temperature/time curve.

Single compartment ducts – a constant temperature of either 300 °C or 600 °C, following the standard temperature/time curve up to the specified constant temperature.

NOTE EN 1366-9 does not include a test for assessing integrity at 300 °C.

4.5.2 Smoke control dampers

Multi-compartment dampers – standard temperature/time curve.

Single compartment dampers – a constant temperature of either 300 °C or 600 °C, following the standard temperature/time curve up to the specified constant temperature.

NOTE EN 1366-10 does not include a test for assessing integrity at 300 °C.

4.5.3 Smoke barriers

A constant temperature of 600 °C, following the standard temperature/time curve up to the specified constant temperature.

4.5.4 Powered smoke and heat control ventilators

A constant temperature of:

200 °C, reached within 5 min to 10 min, or

300 °C, reached within 5 min to 10 min, or

400 °C, reached within 5 min to 10 min, or

600 °C, reached within 5 min to 10 min, or

842 °C following the standard temperature/time curve up to the specified constant temperature.

4.5.5 Natural smoke and heat exhaust ventilators

A constant temperature of 300 °C, increasing the furnace temperature following a gradient as specified in EN 12101-2.

A constant temperature of 600 °C, increasing the furnace temperature following a gradient as specified in EN 12101-2.

A constant temperature of θ °C, increasing the furnace temperature following a gradient as specified in EN 12101-2.

NOTE θ °C is an open class for special applications.

5 Resistance to fire performance characteristics

5.1 General

NOTE 1 The basic requirement 'safety in case of fire' of the Construction Products Regulation requires the products covered in this standard to be assessed against specified characteristics. These include integrity, insulation, stability, smoke leakage and reliability. This clause provides the necessary details of each of the above characteristics.

NOTE 2 Where a characteristic may have more than one different definition or type of performance, later clauses identify which specific definition applies to which products.

5.2 Performance characteristics

5.2.1 E – Integrity

Integrity E is the ability of a component of a smoke control system to prevent the transmission of fire as a result of the passage of significant quantities of flames or hot gases from the fire to the unexposed side, thereby causing ignition either of the non-fire exposed surface or of any material adjacent to that surface.

The assessment of integrity shall be made on the basis of one or more of the following aspects simultaneously:

— cracks or openings in excess of given dimensions;

— ignition of a cotton pad;

— sustained flaming on the non-exposed side;

— leakage measurements;

— maintenance cross section and mechanical stability.

The integrity shall be determined by all methods during the test. The cotton pad procedure shall be applied until the pad ignites and once it has ignited, it shall be withdrawn and the test continued until all 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 shall be recorded.

Classification of integrity is according to whether or not the component is also classified for insulation. Where a component is classified both for integrity E and insulation I, the integrity value shall be that determined by whichever of the four criteria fails first. Where a component is classified E but without an I classification, failure of the cotton pad shall not be taken into account.

Where leakage rate is a performance characteristic for integrity, the limit value for different products is given in the relevant clause.

Conformity to the requirements for criterion, E, is required for:

— multi-compartment smoke control ducts;

— single compartment smoke control ducts;

— multi-compartment smoke control dampers;

— single compartment smoke control dampers.

5.2.2 I – Insulation

Insulation I is the ability of a component of a service installation to withstand fire exposure without the transmission of fire as a result of significant transfer of heat.

Heat transfer shall be limited so that non-exposed surfaces or any material in close proximity to that surface is not ignited. The product shall also provide a barrier to heat sufficient to protect people near to it.

Conformity to the requirements for criterion, I, is required for:

— multi-compartment smoke control ducts;

— multi-compartment smoke control dampers.

Conformity to the requirements for criterion, I is also required for powered smoke and heat ventilators outside the burning room inside the building.

5.2.3 S – Smoke leakage

Smoke leakage S is the ability of a product to resist the passage of smoke under defined temperature and pressure conditions. Conformity to the requirements for criterion, S, is required for:

— multi-compartment smoke control ducts;

— single compartment smoke control ducts;

— multi-compartment smoke control dampers;

— single compartment smoke control dampers.

5.2.4 D – Stability duration under constant temperature

Stability duration under constant temperature is the ability of a product to resist the passage of gasses or smoke under a constant temperature attack of 600 °C. It includes:

— penetration of gap gauges;

— sustained flaming;

— collapse.

Conformity to the requirements for criterion D, is required for smoke barriers.

5.2.5 DH – Stability duration under the standard time-temperature curve

Stability duration under the standard time-temperature curve is the ability of a product to resist the passage of gasses or smoke when subjected to the standard temperature/ time curve. It includes:

— penetration of gap gauges;

— sustained flaming;

— collapse.

Conformity to the requirements for criterion, DH, is required for smoke barriers.

5.2.6 F – Functionality of powered smoke and heat ventilators

Functionality of powered smoke and heat ventilators is the ability of a powered smoke and heat ventilator to function as prescribed under the defined test conditions. Conformity to the requirements for criterion F, is required for

— powered smoke and heat ventilators.

5.2.7 B – Functionality of natural smoke and heat ventilators

Functionality of natural smoke and heat ventilators is the ability of a natural smoke and heat ventilator to function as prescribed under the defined test conditions. Conformity to the requirements for criterion B, is required for

— natural smoke and heat ventilators.

6 Declaration of performance

6.1 Classification periods

All classification periods against any of the characteristics are declared in minutes. Not all periods apply to all products, and later clauses show which classification periods apply to which products.

6.2 Designatory letters

For the classification of components of smoke and heat control systems use is made of the designatory letters explained in 5.2.

6.3 Declaration of performance

Combinations of these designatory letters, as appropriate, are used as part of the classification of performance. They are supplemented by the time, in elapsed completed minutes, during which the functional requirements are satisfied.

Test results and extended application results are always rounded down to the nearest lower class. When characteristics are combined, the time declared is that for the characteristic having the shortest time.

6.4 Declaration of classes in product standards

Product standards including descriptive product specifications and claiming a given fire resistance classification in accordance with this European Standard are expected to have their classification justified 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.

6.5 Number of tests required for classification

6.5.1 No tests are duplicated for aspects of repeatability, but for classification purposes more than one test may be needed. If, however, a wider field of application is envisaged, all relevant

aspects may not be covered by a single test and additional tests are then required. Also the influence of different boundary conditions may require evaluation of additional test specimens.

6.5.2 Asymmetrical products may have a different performance depending on the side from which they are tested. An asymmetrical product tested from one side only is classified for fire attack from that side only. Where a classification from both sides is required for such a product, a test on each side is carried out, except where provided for in the direct field of application, and the classification is based on the fire exposure from the side demonstrated as giving the lower fire resistance time. Classification for exposure from one side only is also possible.

NOTE A damper construction with the blade in the middle of the damper case, but the actuator motor on one side, is asymmetric.

6.5.3 The number of tests required may further depend on:

— the required classifications;

— the combination of performance criteria envisaged;

— the need to apply more than one thermal attack.

6.5.4 Information on the number of tests required for classification for the different types of construction products is given in Clause 7.

A higher number of tests may be required for extended application.

6.6 Presentation of classification

The combination of classes and times for E, I and S 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 products/elements are satisfied.

7 Classification procedure for fire resistance

7.1 General

7.1.1 Procedure

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

— exposure conditions: the side(s) to be exposed e.g. ducts (fire inside/outside);

— dimensions of the component: height, width;

— boundary and support conditions: restraint, free movement, distance between supports;

— 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 extended application results, the number of tests, standard temperature/time tests and other exposures, and the specimen to be tested are deduced.

c) The standard fire tests are carried out and for each test the times are determined, in elapsed minutes, for which the test specimen continues to satisfy the different aspects of the performance criteria.

d) If more than one test has to be carried out because of the envisaged field of application, the lowest result determines the classification for the entire field of application. Results of individual tests may lead to higher ranking for a limited field of application. The classification is dependent on the field of application.

e) Classification reports are prepared as shown in normative Annex A. A report may be issued for any combination of performance parameters and times that are covered by test results and/or extended application results.

7.1.2 General rules for deducing the number of fire resistance tests

Products 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 product.

The extent to which a tested product may or may not be changed under the field of application is given in rules or guidelines which limit the permitted variation away from the test specimen without further evaluation or calculation. The field of direct application clause in each specific test method relates to the common forms of construction for which experience of testing has provided the knowledge that such variations can be safely accepted. The field of extended application for each product family is defined in the relevant extended application standards.

Dimensions:

The test specimen shall be normally 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 given dimensions, span, height, width, are also valid for smaller dimensions. For applicability to larger dimensions, the relevant test methods and the relevant extended application rules shall be consulted.

Variation of constructional details:

In general the field of application of a test result is limited to components 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 for example, describe the role of extended application in the classification process.

7.2 Classification of smoke control ducts

7.2.1 General

Smoke control ducts are differentiated from fire resistant ventilation ducts by virtue of their need only to be able to withstand high temperatures whilst conducting their function, i.e. exhausting smoke and hot gasses from a fire compartment. If they remain within the compartment of fire origin and exhaust to the exterior of the building without passing through another fire compartment, then they need only remain stable, integral, have a known leakage rate and maintain the majority of their cross sectional opening whilst exposed to those temperatures associated with the pre-flashover stage.

If a duct passes from one fire compartment to another to exhaust from the building, however, it shall also be capable of maintaining the fire compartmentation and will, therefore, have the additional need of fire resistance performance as well as maintaining the majority of cross sectional opening (area) and fulfil leakage criteria in the post-flashover stage (standard curve).

Two categories of smoke control ducts are, therefore, provided: multi-compartment ducts and single compartment ducts.

7.2.2 Test methods and field of application rules

The test method for multi-compartment ducts shall be as given in EN 1366-8 (duct C) and that for single compartment ducts in EN 1366-9. The method in EN 1366-8 is applicable to vertical and horizontal four sided ducts with fire exposure from the outside and/or inside. The method in EN 1366-9 is applicable to horizontal ducts only.

7.2.3 Tests to be performed

7.2.3.1 Ducts for multi-compartment smoke control systems

The design of the test specimen and the number of tests to be performed shall be derived from a comparison between the intended field of application of the classification and the field of application of test results as defined in EN 1366-8. The same design – in the limits of the field of direct application of EN 1366-1 – shall be tested according to EN 1366-1. Duct A and duct B shall be tested in horizontal and/or vertical orientation. Duct A shall be tested with a minimum under-pressure of 500 Pa.

These tests involve the following exposure / action:

a) standard temperature/time curve from the inside;

b) standard temperature/time curve from the outside;

c) pressure difference inside to outside;

d) vertical and horizontal orientations, unless only one is to be provided for in the intended field of application.

7.2.3.2 Ducts for single compartment smoke control systems

The design of the test specimen and the number of tests to be performed shall be derived from a comparison between the intended field of application of the classification and the field of application of test results as defined in EN 1366-9.

The test involves the following exposure / action:

a) from the inside and outside of the duct to a constant temperature of 300 °C or 600 °C, following the standard temperature/time curve up to the specified constant temperature;

NOTE EN 1366-9 does not include a test for assessing integrity at 300 °C.

b) pressure difference inside to outside;

c) horizontal orientations.

7.2.4 Performance criteria

7.2.4.1 Ducts for multi-compartment smoke control systems

E – Integrity

Integrity is assessed during the test as the time at which integrity failure for the duct C occurs at the seal / penetration between the duct and supporting construction.

This includes assessment of leakage (at 10 $m^3/(h \cdot m^2)$[1], maintenance of cross-section and mechanical stability of the duct itself.

I – Insulation

Insulation is assessed during the test as the time at which the criteria given in 5.2.2 apply, as specified in EN 1366-1.

S – Smoke leakage

Failure of this criterion occurs if the flow rate in a duct during the test exceeds 5 $m^3/(h \cdot m^2)$ both, at ambient temperature and under fire conditions as described in the test standard.

[1] $m^3/(h \cdot m^2)$ means Leakage rate in m^3 per hour and m^2 inner surface area of the duct.

Table 1 — Summary of classification criteria

Duct	Integrity		Insulation	Smoke leakage
	Within Furnace	**Outside Furnace**		
Duct A (Fire outside duct)	Volume flow rate	Volume Flow Rate Cotton Pad Openings Flaming	Average and maximum Temperature	Volume Flow Rate
Duct B (Fire inside duct)	_____	Cotton Pad Openings Flaming	Average and maximum Temperature	_____
Duct C	Mechanical stability	Cotton Pad Openings Flaming Volume flow rate Mechanical stability Maintenance of cross-section	_____	Volume Flow Rate

7.2.4.2 Ducts for single compartment smoke control systems

E – Integrity

This includes assessment of leakage at 10 $m^3/(h \cdot m^2)$, maintenance of cross section and mechanical stability.

S – Smoke leakage

Failure of this criterion occurs if the flow rate in a duct during the test exceeds 5 $m^3/(h \cdot m^2)$ both, at ambient temperature and under fire conditions as described in the test standard.

7.2.5 Classes

7.2.5.1 Ducts for multi-compartment smoke control systems

EI 30 60 90 120

The classification is completed by the suffix 'multi' to indicate suitability for multi-compartment use. In addition, the symbols 've' and/or 'ho' indicate the suitability for vertical and/or horizontal use.

'S' indicates a leakage rate of less than 5 $m^3/(h \cdot m^2)$.

‘500’, ‘1 000’ or ‘1 500’ indicates that when tested at these negative pressures the duct is suitable for use over the range from the tested negative pressure up to a positive pressure of 500 Pa, at ambient.

7.2.5.2 Ducts for single compartment smoke control systems

E_{300} 30 60 90 120

E_{600} 30 60 90 120

The classification is completed by the suffix 'single' to indicate suitability for single compartment use only. In addition, the symbols, 'ho' indicate the suitability for horizontal use.

'S' indicates a leakage rate of less than 5 $m^3/(h \cdot m^2)$.

‘500’, ‘1 000’ or ‘1 500’ indicates that when tested at these negative pressures the duct is suitable for use over the range from the tested negative pressure up to a positive pressure of 500 Pa, at ambient temperature.

The classification E_{600} covers the classification E_{300} for the same time period.

NOTE 1 In the current standard EN 1366-9 horizontal ducts only are addressed.

NOTE 2 The current test standard EN 1366-9 does not yet address testing to 300 °C.

7.3 Classification of smoke control dampers

7.3.1 General

As described in 7.2.1 (for smoke ducts) there are two types of smoke control dampers: multi-compartment and single compartment smoke control dampers.

7.3.2 Test method and field of application rules

The test method for multi and single compartment smoke control dampers shall be as given in EN 1366-10. The method is applicable to smoke dampers installed in a duct or in fire separating elements designed to withstand the standard temperature time curve for multi compartment dampers and a constant temperature of either 300 °C or 600 °C for single compartment dampers. Extended application shall be carried out as specified in EN 15725.

NOTE EN 1366-10 does not include a test for assessing integrity at 300 °C.

7.3.3 Tests to be performed

7.3.3.1 Multi-compartment fire resisting smoke control dampers

The design of the test specimen and the number of tests to be performed is 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. Full details of the number of tests are given in EN 1366-10. Extended application rules may be taken into account.

The test involves the following exposure / action:

a) standard temperature/time curve;

b) pressure difference;

c) vertical and horizontal orientations, unless only one is to be provided for in the field of direct application.

Multi-compartment fire resisting smoke control dampers claiming the HOT 400/30 classification shall be tested according to the HOT 400/30 test described in EN 1366-10 and additionally according to EN 1366-2 (300 Pa) instead of the other fire tests specified in EN 1366-10 (500 Pa).

7.3.3.2 Single compartment smoke control dampers

The design of the test specimen and the number of tests to be performed is 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. Full details of the number of tests are given in EN 1366-10. Extended application rules may be taken into account.

The test involves the following exposure / action:

a) constant temperature of 300 °C or 600 °C;

b) pressure differential;

c) vertical and horizontal orientations, unless only one is to be provided for in the field of direct application.

7.3.4 Performance criteria

7.3.4.1 Multi compartment fire resisting smoke control dampers

— E – Integrity

Integrity is assessed by:

a) leakage through the damper at ambient temperature and when closed after 5 min from the start of the fire test;

b) the ability of the damper to maintain its opening when subjected to the fire test,

c) cracks or openings in excess of given dimensions and ignition of a cotton pad and sustained flaming on the non-exposed side at the perimeter of the damper junction with the wall or floor or duct (the penetration);

d) the suitability of the use of the damper at an under pressure, measured at ambient;

e) the ability of the damper to maintain its function as determined by the open and closing cycle test.

— I – Insulation

The performance level used to define insulation is 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.

— S – Smoke leakage

The maximum leakage permitted for smoke control dampers is 360 $m^3/(h\ m^2)$, corrected to 20 °C. For dampers for which the S class is envisaged, the leakage through the smoke control damper shall not exceed 200 $m^3/(h \cdot m^2)$, corrected to 20 °C.

Leakage shall be recorded at ambient temperature and at elevated temperature. At elevated temperature, the leakage shall be measured after the first 5 min of the test and shall then be measured for the rest of the test duration, while dampers are closed.

The performance criteria shall be in accordance with Table 2.

HOT – HOT 400/30

The damper succeeds in being opened and closed during the test described in EN 1366-10.

Table 2 — Multi compartment fire resisting smoke control dampers test performance criteria

Classification	Sizes to be tested	Leakage limit at ambient temperature $m^3/(h \cdot m^2)$	Fire test	
			Leakage limit $m^3/(h \cdot m^2)$	Temperature rise limit °C mean/max.
E	Maximum	360	360*	Not required
	Minimum	360	No test	No test
E S	Maximum	200	200 [a]	Not required
	Minimum	200	No test	No test
EI	Maximum	360	360 [a]	140/180
	Minimum	360	No test	No test
EI S	Maximum	200	200 [a]	140/180
	Minimum	200	No test	No test
[a] Leakage limit application.				

7.3.4.2 Single compartment smoke control dampers

— E – Integrity

Integrity is assessed by:

a) leakage through the damper when closed after 5 min from the start of the fire test;

b) the ability of the damper to maintain its opening when subjected to the fire test (300 °C or 600 °C);

c) the suitability of the use of a damper at an under pressure, measured at ambient;

d) the ability of the damper to maintain its function over the life of the system as determined by the open and closing cycle test.

— S – Smoke leakage

The maximum leakage permitted for smoke control dampers is 360 $m^3/(h \cdot m^2)$, corrected to 20 °C. For dampers for which the S class is envisaged, the leakage through the smoke control damper shall not exceed 200 $m^3/(h \cdot m^2)$, corrected to 20 °C.

Leakage shall be recorded at ambient temperature and at elevated temperature. At elevated temperature, the leakage shall be measured after the first 5 min of the test and shall then be measured for the rest of the test duration, while dampers are closed.

The performance criteria shall be in accordance with Table 3.

Table 3 — Elevated temperature test performance criteria for single compartment smoke control dampers

Classification	Sizes to be tested	Leakage limit at ambient temperature $m^3/(h \cdot m^2)$	Elevated temperature test	
			Leakage limit $m^3/(h \cdot m^2)$	Temperature rise limit °C mean/max.
E_{600}	Maximum	360	360 [a]	Not required
	Minimum	360	No test	No test
E_{600} S	Maximum	200	200 [a]	Not required
	Minimum	200	No test	No test
NOTE As EN 1366-10 does not include a test for 300 °C, this table only covers the 600 °C test.				
[a] Leakage limit applies.				

7.3.5 Classes

7.3.5.1 Multi compartment fire resisting smoke control dampers

EI 30 60 90 120

E 30 60 90 120

The classification is completed by the suffix 'multi' to indicate suitability for multi compartment use.

"HOT 400/30" (High Operational Temperature) indicates that the damper has the ability to be opened or closed during a period of 30 minutes under temperature conditions below 400 °C.

"v_{ed}", "v_{ew}" or "v_{edw}" and/or "h_{od}", "h_{ow}" or "h_{odw}" indicate the suitability for vertical and/or horizontal use, together with mounting in a duct or in a wall or both respectively.

NOTE .

- Vertical, ve, indicates the damper is placed in a vertical plane
- Horizontal, ho, indicates the damper is placed in a horizontal plane
- w indicates the damper is mounted in a wall or floor
- d indicates the damper is mounted in a duct

"S" indicates a leakage rate of less than 200 $m^3/(h \cdot m^2)$ as an additional leakage restriction to the defined performance requirement.

"500", "1 000" or "1 500" indicates that when tested at these negative pressures the damper is suitable for use over the range from the tested negative pressure up to a positive pressure of 500 Pa.

"AA" or "MA" indicates automatic activation or manual intervention.

"i→o", "i ←o" and "i ↔o", indicates that the performance criteria are satisfied from inside to outside (fire inside), outside to inside (fire outside) or both, respectively.

"C_{300}", "C_{10000}" or "C_{mod}" indicates the suitability of the damper for use in smoke control only systems, combined smoke control and environmental systems, or modulating dampers used in combined smoke control and environmental systems, respectively.

7.3.5.2 Single compartment smoke control dampers

E_{300} 30 60 90 120

E_{600} 30 60 90 120

The classification is completed by the suffix 'single' to indicate suitability for single compartment use.

"HOT 400/30" (High Operational Temperature) indicates that the damper has the ability to be opened or closed during a period of 30 min under temperature conditions below 400 °C (to be used only with E_{600} classification)."v_{ed}", "v_{ew}" or "v_{edw}" and/or "h_{od}", "h_{ow}" or "h_{odw}" indicate the suitability for vertical and/or horizontal use, together with mounting in a duct or in a wall or both respectively.

NOTE Vertical, v_e, indicates a damper mounted within a duct passing through a wall or mounted directly in a wall. Horizontal, h_o, indicates a damper mounted in a duct passing through a floor or mounted directly in a floor. It will preferably not be taken to imply the direction of operation, nor the orientation of the axis of the damper blade.

"S" indicates a leakage rate of less than 200 $m^3/(h \cdot m^2)$ as an additional leakage restriction to the defined performance requirement.

"500", "1 000" or "1 500" indicates that when tested at these negative pressures the damper is suitable for use over the range from the tested negative pressure up to a positive pressure of 500 Pa.

"AA" or "MA" indicates automatic activation or manual intervention.

"i→o", "i ←o" and "i ↔o", indicates that the performance criteria are satisfied from inside to outside (fire inside), outside to inside (fire outside) or both, respectively.

"C_{300}", "C_{10000}" or "C_{mod}" indicates the suitability of the damper for use in smoke control only systems, combined smoke control and environmental systems, or modulating dampers used in combined smoke control and environmental systems, respectively.

7.4 Classification of smoke barriers

7.4.1 General

Smoke barriers which are used for the restriction of the movement of fire gasses within buildings can be formed as fixed smoke barrier panels (SSB) or as automatic smoke barriers (ASB).

7.4.2 Test method

The test method for smoke barriers shall be as given in EN 12101-1. The test procedure applies to static and automatic barriers.

7.4.3 Tests to be performed

The tests to be performed in function of the envisaged classification and field of application are defined taking into account the specifications in EN 12101-1:2005, Annexes B, C and D. Smoke

barriers shall be tested in the orientation representative of their intended use indicated by the manufacturer for their application and installation.

7.4.4 Performance criteria

— D – Stability duration

When tested as described in the test method test specimens shall maintain stability, without:

a) cracks or openings in excess of given dimensions as specified in EN 12101-1;

b) sustained flaming;

c) collapse.

Any smoke barrier shall resist smoke penetration.

Additionally test specimens shall not release flaming droplets or particles within the first 600 s of the test.

— DH – Stability duration

The classification DH indicates performance at higher temperature ranges.

The same criteria apply as for the D class.

7.4.5 Classes

D_{600}	30	60	90	120	A
DH	30	60	90	120	A

where A indicates any time over 120 min.

7.5 Classification of powered smoke and heat control ventilators

7.5.1 Test method

The test method for powered smoke and heat control ventilators shall be as given in EN 12101-3. The ventilator is tested as a complete assembly, with, for example, dampers or deflectors if fitted.

7.5.2 Tests to be performed

The ventilator is tested in a furnace at the specified temperature. The performance is determined by testing the ventilator so that at normal ambient temperature and pressure the power output is 80 % to 100 % of the maximum absorbed power of the ventilator and it is operating anywhere on its volume pressure curve, provided that the volume or pressure reading are stable.

7.5.3 Performance criteria

The ventilator is shown to be functioning satisfactorily by its continued ability to provide the initial volume or pressure, within the defined limits in the test method.

7.5.4 Classes

F_{200}		120
F_{300}		60
F_{400}	90	120
F_{600}		60
F_{842}		30

7.6 Classification of natural smoke and heat exhaust ventilators

7.6.1 Test method

The test method for natural smoke and heat exhaust ventilators shall be as given in EN 12101-2.

7.6.2 Tests to be performed

The ventilator is tested in a furnace at the specified temperature.

7.6.3 Performance criteria

The performance is determined by testing the ability of the installed ventilator to open under exposure to heat and to remain in the fire open position with not more than 10 % reduction of the throat area.

7.6.4 Classes

B_{300}	30
B_{600}	30
B_{θ}	30

where θ indicates the exposure condition in °C.

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 or product when classified, based on results obtained during tests in accordance with the resistance to fire test methods and/or through extended application process.

A classification report is expected to detail the basis and the results of the classification process.

A.2 Content and format

The classification report shall have the following content and format illustrated below:

a) identification number and date of the classification document;

b) identification of the owner of the classification document;

c) identification of the organization issuing the classification document;

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

e) detailed description of the element, either:

— reference is made to a detailed description of the product as available in one of the test reports and/or the extended application report(s) in support of this classification, or

— a detailed description is reproduced in this classification document. The detailed description will include a full description and identification of all relevant components, the method of assembly etc. It will also list all relevant harmonized technical specifications applicable to the whole or parts of the classified product;

f) test(s) and extended application(s) carried out:

   i) each test report and extended application report used in support of this classification is identified by:

   - the name of the laboratory carrying out the tests or preparing the extended application report;
   - the name of the sponsor;
   - the test report and/or the extended application report identification number;

   ii) identification of the tests performed in accordance with this standard and the envisaged field of application;

iii) detailed test results and/or extended application results for each test condition for all relevant criteria involved in the classification.

g) Classification and field of application:

— reference to the relevant classification procedure in this document;

— classification of the product;

— detailed description of the field of application of this classification document;

h) additional statements:

— any restrictions on the duration of the validity of this classification report;

— a warning 'This document does not represent type approval or certification of the product'.

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

LOGO/Letterhead of organization undertaking classification

CLASSIFICATION REPORT OF PRODUCT XYZ

IDENTIFICATION NUMBER OF THIS REPORT

On behalf of

OWNER OF CLASSIFICATION DOCUMENT

Address 1

Address 2

Address 3

Address 4

1 Introduction

This classification report defines the classification assigned to product XYZ in accordance with the procedures given in EN 13501-4:2016.

2 Details of element

2.1 Type of function

The product xyz is defined as a 'component of a smoke control system'. Its function, alongside other components of the system, is to control the movement and/or containment of smoke and heat.

2.2 Description

either

The product xyz is fully described in the test report(s) and/or the extended application report(s) in support of this classification listed in Clause 3 of the classification report.

or

— The product xyz comprises:

— Detailed description of product

— This product complies with the following harmonized technical specifications: list of relevant specifications.

3 Reports and results in support of this classification

3.1 For multi-compartment smoke control ducts

Information in support of this classification report.

Name of laboratory	Name of sponsor	Unique ref no	E min	I min	Orientation	S min.	Underpressure Pa

3.2 For single compartment smoke control ducts

Name of laboratory	Name of sponsor	Unique ref no	E min	Temp °C	Orientation	S min	Underpressure Pa

3.3 For multi-compartment dampers

Name of laboratory	Name of sponsor	Unique ref no.	E min	I min	Orientation	Direction	S min	Δp Pa	Opening capability	Automatic/ manual

Δp – pressure difference

3.4 For single compartment dampers

Name of laboratory	Name of sponsor	Unique ref no	E min	Temp °C	Orientation	Direction	S min.	Δp Pa	Opening capability	Automatic/ manual

Δp – pressure difference

3.5 For smoke barriers

Name of laboratory	Name of sponsor	Unique ref no	D_{600} min	DH min

3.6 For powered ventilators

NAME OF LABORATORY	NAME OF SPONSOR	UNIQUE REF No.	F min.	TEMP. °C

3.7 For natural ventilators

NAME OF LABORATORY	NAME OF SPONSOR	UNIQUE REF No.	B min.	TEMP. °C

4 Classification and field of application

4.1 Reference of classification

This classification has been carried out in accordance with EN 13501-4:2016.

4.2 Classification

In the tables below the following symbols are used:

* 500 or 1 000 or 1 500

** v_{ed}, v_{ew}, v_{edw} or h_{od}, h_{ow}, h_{odw}

*** → or ← or ↔

**** yy = 300 or 10 000 or mod

4.2.1 Duct for multi-compartment smoke control systems

E	**I**		**t**	**t**		**(**	**v_e**	**-**	**h_o**	**)**		**S**	*****	**multi**	

Example EI 60 (v_e) S1000multi, EI 30 (v_e-h_o) 500multi

4.2.2 Ducts for single compartment smoke control systems

E_{300} or E_{600}		**t**	**t**		**(**	**v_e**	**-**	**h_o**	**)**		**S**	*****	**single**

Example E_{600} 60 (h_o) S500single

4.2.3 For multi-compartment fire resisting smoke control dampers

E	**I**		**t**	**t**		**(**	****v_{ed}**	**-**	****h_{od}**	**-**	**i**	*******	**o**	**)**		**S**	*****	******C_{yy}**	**HOT 400/30**	**AA or MA**	**multi**

Example EI 60 (v_{edw}-i→o) S500C_{300}AAmulti E120 (h_{od}-i↔o) 500C_{10000}MAmulti

4.2.4 For single compartment smoke control dampers

E_{300} or E_{600}		**t**	**t**		**(**	**v_e**	**-**	**h_o**	**-**	**i**	*******	**o**	**)**		**S**	*****	******C_{yy}**	**HOT 400/30**	**AA or MA**	**single**

Example E_{300} 60 (v_e-i↔o) S1500C_{10000}MAsingle

4.2.5 For smoke barriers

D_{600}		t	t

Example D_{600} 90

or

D	H		t	t

Example DH 60

4.2.6 For powered ventilators

F_{200} / F_{300} / F_{400} / F_{600} / F_{842}		t	t

Example F_{600} 60

4.2.7 For natural ventilators

B_{300} / B_{600} / B_{θ}		t	t

where θ indicates the exposure condition in °C

Example B_{600} 30

4.3 Field of application

The product xyz has the following field of application in accordance with EN xxxx:XXXX.

— field of application

5 Limitations

5.1 Restrictions

Statements concerning any restrictions on the duration of the validity of this classification document.

5.2 Warning

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

Report	**Name**	**Signature** [a]	**Date**
Prepared by			
Review by			
[a] for and on behalf of.			

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