EUROPEAN COMMISSION
DIRECTORATE-GENERAL III
INDUSTRY
Industrial affairs II: Capital goods industries
Construction

M 117

HORIZONTAL COMPLEMENT TO THE MANDATES
TO CEN/CENELEC

CONCERNING THE EXECUTION OF STANDARDISATION WORK FOR

THE EVALUATION OF CONSTRUCTION PRODUCTS AND ELEMENTS IN RESPECT OF THEIR RESISTANCE TO FIRE

A. DESCRIPTION OF THE SPECIFIC MANDATE

I. FOREWORD

This mandate details the scope of one of the standardisation mandates issued by the Commission to CEN/CENELEC within the context of the Council Directive 89/106/EEC of December 21, 1988 concerning construction products, hereafter referred to as "the Directive" or CPD.

The main aim of the Directive is the removal of technical barriers to trade in the construction field, to the extent that they cannot be removed by mutual recognition of equivalence among all the Member States. Therefore, in a first phase, the standardisation mandates will refer to products for which all of the two following conditions are fulfilled :

a) the products are subject to technical barriers to trade;
b) the characteristics of the products influence the satisfaction by the construction works, in which they are to be incorporated in a permanent manner, of the essential requirements set out in article 3 of the Directive. These works are subject to legislative, regulatory or administrative regulations of Member States covering such essential requirements[1].

The present mandate is intended to provide for the European standards that are needed in order to make possible the "approximation" of national laws, regulations and administrative provisions, hereafter referred to as "regulations". This approximation is expected to be done by adapting the national regulations to take full account of the mandated standards.

[1] Any other type of barrier to trade falls within Articles 30/36 of the Treaty and must be directly eliminated by the Member States.

In this respect, the standardisers will refer to the basic principles prevailing in the regulations of Member States as described in interpretative document N°2 (ID2), particularly in chapter 3 and, where applicable, to the more detailed descriptions given in chapters 4.2 and 4.3.

As stated by the Directive, the responsibility Member States have for construction works on their territory remains unchanged, except in so far as, in relation to resistance to fire, they are constrained to make reference to the harmonised characteristics and classes of performance set out in Annex 2 of this mandate.

The essential requirements being expressed in terms of performance of the works, the characteristics of the products should be also expressed in terms of performance so that, in referring to the harmonised European standards, the regulations may "approximate" evolving in terms of "performance requirement".

Regulations that directly influence the nature of products will then be justified only in those cases in which a classification system is identified as the means of expressing the range of requirement levels of performance of the works (ID2 point 1.2.1). Thus the standards covered by the present mandate should focus on the relevant methods of determination of these characteristics (by testing, including methods for providing for extended application of results) and the classification system of characteristics. In the case of resistance to fire, articles 3.2 and 6.3 of the Directive apply. Harmonised standards will take into account all the current intended uses of the product, the evaluation of conformity and the labelling accompanying the CE marking, which will contain the values of the characteristics of the product on the basis of the technical specifications.

The CEN/CENELEC programme in response to this mandate should consist of a compact, simple package of items that are manageable and user-friendly for regulators, producers, notified bodies and users. In general one harmonised standard should be sufficient to cover the resistance to fire performance of a given family of products.

II. GROUNDS

1. This mandate falls within the framework of the general policy of the Commission with respect to technical harmonisation and standardisation, as well as within the scope of the Directive.

2. This mandate is based on article 7 of the Directive and has regard to ID2[2] which is the reference for the establishment of the standards in relation to resistance to fire (see article 12 of the Directive). It serves to support the quality of the standards, always with reference to the state of the art, with particular reference to:

   - the evaluation and classification of products and elements (hereafter referred to as elements) listed in annex 1 intended to be used in situations where fire resistance is a requirement**,** enabling the works to satisfy this essential requirement as set out in annex 1 of the Directive, provided that barriers to trade in these elements exist and that the elements fall within the scope of article 2.1 of the Directive.

3. With regard to levels and classes of requirements, these are determined in ID2 (section 4.3.1.3). This mandate gives further guidance, in annex 2, for the application of these levels and classes, which are regulatory classes in the meaning of CPD articles 3.2 and 6.3.

4. Standards, including classifications, should permit construction elements which allow works to meet the essential requirements and which are produced and used lawfully in accordance with technical traditions warranted by local climatological and other conditions to continue to be placed on the market.

5. The purpose of the Directive being to remove barriers to trade, the standards deriving from it will therefore be expressed, as far as practicable, in performance terms (art. 7.2 of the Directive), having regard to ID2. Where this is not practicable, justification will be made in the Work Programme when it is presented to the Commission (see IV.1, IV.2).

6. The work programme that CEN/CENELEC will develop in response to this mandate shall be a comprehensive one covering the complete package of test standards needed for the CE marking, in respect of resistance to fire, of the elements listed in annex 1. It will include the time scale for the publication of the complete package of standards.

7. This horizontal mandate expands, but does not seek to modify, the specifications given in ID2. It is complementary to, and should be read in conjunction with, mandates for products and product families where resistance to fire is a requirement. It provides the necessary details in relation to resistance to fire where these are not given in the product mandates.

[2] OJ No C 62, 28.02.1994

8. In some cases, no regulatory classes for resistance to fire, nor provisions for test conditions, are given in ID2. For elements where this is the case, this mandate makes the required proposals.

III. STANDARDISATION MANDATE

With reference to the grounds given in section II and further provisions of the Directive, the European standards set up under this mandate shall take account of the following:

1. Test standards shall be prepared to allow the evaluation of the resistance to fire performance of those elements listed in Annex 1. Further specific mandates will cover other characteristics of the elements given in the list of annex 1.

2. Testing and/or assessment methods shall have, whenever possible, a horizontal character covering the widest possible range of elements. The test standards will contain:

   - a detailed scope and field of application,
   - a detailed description of the procedures for the resistance to fire tests, of the test equipment and test conditions (temperature/time, pressure and/or loading),
   - specifications for (or reference to a standard containing specifications for) the calibration and control of test equipment, including permissible deviations from the prescribed heating curve(s),
   - a detailed description of the preparation of the specimen (including the number of specimens), the measurements to be made and the expression of results,
   - rules or other methods for determining the scope of the direct application of test results.

3. Other European standards (unless included in the relevant harmonised standard for the element concerned) shall be prepared covering:

   - the classification system(s), as required by this mandate, and the number of tests needed for classification (no duplication of tests for repeatability reasons),
   - harmonised rules for the extended application of test results,
   - guidance on the characteristics that have to be stated within the labelling that will accompany the CE marking (depending on the intended use of the element),
   - if relevant (where indicated in a specific product mandate), the methods, or reference to a standard containing methods, for assessing the durability of resistance to fire performance of the elements during their working life.

4. The technical terms of reference of this mandate are given in Annex 2. In particular they cover:

   - the definition of fire resistance terms,
   - the different levels of exposure and methods of test (where relevant),
   - the characteristics, and their related classification, applicable to each type of element.

5. This mandate replaces any earlier mandate on the same subject area formerly issued on a provisional base by the Commission.

6. CEN/CENELEC shall ensure consistency within the whole package of standards in the field concerned.

7. CEN/CENELEC must adhere to the classification systems given in annex 2 of this mandate. Any request for a modification to these systems would need to be submitted to the Standing Committee for Construction for consideration under CPD article 20.2(a).

IV. EXECUTION OF THE MANDATE

1. CEN/CENELEC will present the Commission with a detailed proposal for the work programme, at the latest, by the end of **September 1997**.

2. This programme will include the list of test standards considered necessary to cover the resistance to fire performance of all the elements covered by this mandate. In this programme the title of each standard will be followed by:

   - a detailed description of the scope,

   - the list of reference documents (national standards, ISO standards, prENs, ENs, research results, etc.),

   - the timetable for the development and the publication of each standard,

   - the identification of the CEN Technical Committee(s) responsible.

3. When a test method is common to a number of elements it will, as far as possible, be dealt with in a standard referring to a group or a family of elements.

4. Within the programme, CEN/CENELEC will identify any aspects (characteristics, elements, specific intended uses, ...) among those indicated by the mandate which are not yet covered by the programme and the relevant reasons. Elements, characteristics and/or specific intended end uses not specifically mentioned in the mandate but relevant to the family referred to may be also included in the programme.

5. After examination of the programme and consultations with CEN/CENELEC, the Commission will endorse the timetable and the list of standards or parts of standards which meet the terms of this mandate.

6. When considered appropriate, the list of existing standards or standards under development that do not come directly under, but are relevant to the subject area covered by, the mandate, may be annexed to the work programme.

7. Acceptance of this mandate by CEN/CENELEC is intended only after the work programme mentioned at point IV.1 has been endorsed by the Commission. The terms of reference of the mandate may be subject to modification or addition, if necessary.

8. Representatives of the authorities responsible for national regulations will be able to participate in the activities of CEN/CENELEC through their national delegations and to present their points of view at all stages of the drafting process.

9. The Commission may participate in standardisation activities as an observer and has the right to receive all relevant documents.

10. CEN/CENELEC will immediately inform the Commission of any problem relating to the carrying out of the mandate from within the Technical Committees and will present an annual progress report on work within the framework of the mandate.

11. The progress report will include a description of work carried out, and information on any difficulties being met, whether political or technical, with particular reference to those that might lead the authorities of a Member State to raise objections or to resort to article 5.1 of the Directive.

12. The progress report will be accompanied by the latest drafts of each standard under the mandate and by updated reports on any subcontracted work.

13. Acceptance of this mandate by CEN/CENELEC will initiate the standstill procedure referred to in article 7 of Council Directive 83/189/EEC of 28 March 1983 modified by Council Directive 88/182/EEC of 22 March 1988 and the European Parliament and the Council Directive 94/10/EC of 23 March 1994.

14. CEN/CENELEC will develop the draft European standards (prENs) in accordance with the appropriate work programme and will inform the Commission in good time that the drafts are being circulated for public comment.

15. CEN/CENELEC will present the final drafts of the European standards to the Commission for confirmation of compliance with this mandate at the latest in accordance with the timetable agreed between CEN/CENELEC and the Commission and referred to in point IV.5.

16. CEN/CENELEC members will publish the standards transposing the European standards at the latest 6 months after a positive vote in CEN/CENELEC. National standards covering the same scope will continue to be applicable until the date agreed between CEN/CENELEC and the Commission in accordance with point IV.5.

ANNEX 1

HORIZONTAL COMPLEMENT COVERING THE EVALUATION OF THE RESISTANCE TO FIRE OF CONSTRUCTION PRODUCTS AND ELEMENTS

LIST OF PRODUCTS AND ELEMENTS FOR WHICH RESISTANCE TO FIRE EVALUATION METHODS ARE TO BE INCLUDED IN THE MANDATE:

FORM	MATERIALS	PRODUCTS FOR CONSIDERATION
Elements	All construction materials	Loadbearing elements without a fire separating function: walls floors roofs beams columns balconies stairs walkways Loadbearing elements with a fire-separating function [3]: walls floors roofs Products and systems for protecting elements or parts of the works: ceilings with no independent fire resistance fire protective coatings, claddings and screens Products for non-loadbearing elements or parts of works[3]: partitions facades (curtain walls) and external walls ceilings with independent fire resistance raised floors fire doors and shutters and their closing devices smoke control doors closures for conveyors and trackbound transportation systems penetration seals linear gap seals service ducts and shafts chimneys Products for use in ventilation systems (excluding smoke and heat exhaust ventilation): ventilation ducts dampers

[3] With or without glazing, services and fixtures.

FORM	MATERIALS	PRODUCTS FOR CONSIDERATION
		Products to be used within services: electrical and fibre-optic cables and accessories, conduits and fire protective systems for cables Products to be used in smoke and heat exhaust ventilation systems: smoke and heat exhaust ducts smoke and heat exhaust dampers smoke curtains powered smoke and heat ventilators (fans) natural smoke and heat ventilators

ANNEX 2

HORIZONTAL COMPLEMENT COVERING THE EVALUATION OF THE RESISTANCE TO FIRE OF CONSTRUCTION PRODUCTS AND ELEMENTS

I. FIRE TEST CONDITIONS

The Essential Requirement requires that fire and smoke spread is limited and that the loadbearing capacity of the construction is adequate for a specific period of time. These requirements can be satisfied by proving fire resistance of loadbearing and/or separating elements. As far as national regulatory requirements are concerned, this is assessed using one or more of the levels of thermal action given below. Later sections of this annex identify which attack(s) should be used for which elements.

Some unsymmetrical fire-separating elements may have a different performance depending on the side from which they are tested. In such cases the fire resistance classification is based on fire exposure from the side considered as giving the lowest fire resistance, except if the direction of the fire exposure occurring in end use conditions is known in advance.

The various levels of thermal action given below reflect different fire scenarios, and the standards which prescribe their translation into practical tests give tolerances for their application.

I.A **The standard temperature/time curve**

A.1. The "standard temperature/time curve" is a model for a fully developed fire. It shall be based on the relationship given in ISO 834 Part 1, which relates to the measuring devices specified in that standard, and is given as follows :

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

where T = the average furnace temperature, °C

t = the duration of the thermal exposure during the fire test, minutes.

This prescription, in itself, is insufficient to provide consistency in the thermal exposure provided by different designs of furnaces. The thermal exposure shall be harmonised to a “European mean value”, which is representative of the different severities of exposure currently found within Europe and should facilitate minimum change.

A.2. When applied as a basis for testing the relationship shall be applied for the full duration of the test.

I.B **The “smouldering” fire**

B.1. The “smouldering” fire test is only used if the fire resistance performance of the product/ element is expected to be reduced by exposure to temperatures associated with the growth stage of a fire. It is, therefore, particularly relevant to products/ elements whose performance may be dependant upon high heating rates below approximately 500°C (as provided during the “standard temperature/ time” curve) for achievement of their classifications (ie mainly reactive or intumescent products).

B.2 The “smouldering” fire curve is given by the following relationship :

For $t \leq 21$

$$T = 154\, t^{0.25} + 20$$

For $t > 21$

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

where: t is the time from start of test, in minutes;
T is the required furnace temperature in °C

B.3 For products which need to be evaluated against the “smouldering fire” test, specific testing protocols shall be provided. These will demonstrate, by direct comparison with results from the classification test, that the reduction in performance caused by exposure to the additional “20 minute pre-heating”, representing the growth stage, does not result in a reduction in the period for which all the appropriate criteria are satisfied.

B.4 It is for national regulators to judge on the appropriateness of this optional testing requirement in relation to any particular product type, having regard to experience of the product and available relevant information.

B.5 Where the response of a product to the smouldering curve has been evaluated, this shall be indicated by a supplement to the classification designation, eg EI30(IncSlow).

I.C **The "semi-natural" fire**

C.1. The "semi-natural" fire is a fire which produces direct flame impingement with a high convective heat transfer content which is not realised in furnace tests using the standard temperature/time curve. The term "semi-natural" fire corresponds to the Single Burning Item exposure required for ceilings in section 4.3.1.3.4 (a) of ID2 (not to be confused with the Single Burning Item test for reaction to fire). It is relevant only for lightweight suspended ceiling systems having a low thermal inertia.

C.2. Because of the difficulties in achieving the necessary thermal attack in a conventional furnace, the attack is provided by fire from wooden cribs made from softwood. A temperature of the fire gases of not less than 1000°C adjacent to the soffit of the ceiling shall be achieved within 10-20 minutes of the start of the test.

I.D **The external fire exposure curve**

D.1 A temperature/time relationship which represents the exposure of the external face of a wall from fire which may emerge from a window of a building, or from a free-burning external fire.

D.2 The curve is defined by the relationship :

$$T = 660 (1 - 0.687 e^{-0.32t} - 0.313 e^{-3.8t}) + 20$$

where: t is the time from start of test, in minutes;
T is the required furnace temperature in °C

I.E **Constant temperature attack**

E.1 In addition to the heating regimes given above, the evaluation of some elements of components of buildings is made using a notional constant value of temperature. The specified temperature and the rate at which the temperature is reached depends upon the type of element/component.

E.2 The following temperatures are used for the products indicated :

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

300°C for evaluating the performance of heat and smoke ventilators

400°C for evaluating the performance of heat and smoke ventilators

500°C for evaluating the fire performance of raised floors

600°C for evaluating powered and natural smoke ventilators, smoke extraction ducts, smoke control dampers, and smoke curtains

842°C for small diameter electrical and fibre optic cables with intrinsic fire resistance

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

I.F **Other heating curves**

F.1 Other heating curves exist, for example the hydro-carbon curve. Also, for extreme fire scenarios (eg traffic tunnels, nuclear plants etc), more severe conventional curves may be specified. These are not, however, used for the classification of elements according to this mandate.

II DEFINITIONS OF RESISTANCE TO FIRE PERFORMANCE CHARACTERISTICS

1. Interpretative Document 2 requires the characteristics load bearing capacity, integrity and insulation. Further characteristics, namely radiation, mechanical aspects, self-closing ability and smoke leakage may be specified under certain conditions for certain elements. This section provides the necessary definitions of each of the above characteristics.

2. Where a characteristic may have more than one different definition or type of performance, later sections of this annex identify which specific definition applies to which elements. Section III deals with the classification of each characteristic.

II.A **Loadbearing capacity R**

A.1. Loadbearing capacity R is defined as the ability of the element to withstand fire exposure, 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 may be either:

- a rate of deformation and a limit state for the actual deformation of a flexural element (e.g. floors and roofs),
- a rate of deformation and a limit state for the actual deformation of a compression or tension member (e.g. columns and walls).

A.2. In identifying loadbearing capacity, there is no need to specify the nature of failure (i.e. flexural, compression or tension).

II.B **Integrity E**

B.1. Integrity E is defined as the ability of an element with a separating function to withstand fire exposure on one side only, without the transmission of fire to the non-fire side as a result of the passage of significant quantities of flames or hot gases from the fire to the non-fire side, thereby causing ignition either of the non-exposed surface or of any material adjacent to that surface.

B.2. Subject to the provisions of B.7, the assessment of integrity is made on the basis of the following three aspects simultaneously:

- cracks or openings in excess of given dimensions,
- ignition of a cotton pad,
- persistent flaming on the non-exposed side.

B.3. The integrity for all elements will be determined by all three methods during the test. The cotton pad will be applied until it ignites and, once it has ignited it will be withdrawn and the test continued until all criteria have been exceeded (the sponsor has the option, however, of stopping the test once the desired integrity level has been reached). The times of each mode of integrity failure will be recorded.

B.4. Classification of integrity will be according to whether or not the element is also classified for insulation. Where an element is classified both for integrity E and insulation I, the integrity value is that determined by whichever of the three criteria fails first. Where an element is classified E but without an I classification, the integrity value is defined as the time to failure of only the cracks/openings or persistent flaming criteria, whichever fails first.

B.5 In stating the integrity classification, the mode of failure need not be identified. Failure of any integrity criterion will also mean failure of insulation, whether or not the specific insulation temperature limits (see below) have been exceeded.

B.6. The standards to be developed will specify how the different areas of elements which have some insulated and some non-insulated parts are to be tested.

B.7. For some products the determination of integrity performance may require additional measurement or may not be determined by any of the three criteria given here. In those cases the relevant methodology will be given in the specific test standard (e.g. for fire resisting ducts and dampers integrity is judged additionally by taking leakage measurements).

II.C **Insulation I**

C.1. Insulation I is defined as the ability of an element to withstand fire exposure on one side only, without the transmission of fire as a result of significant transfer of heat from the exposed to the unexposed side. Transmission must be limited so that neither the non-exposed surface nor any material in close proximity to that surface is ignited. The element must also provide a barrier to heat sufficient to protect people near to it.

II.C1 Insulation of elements except for doors

C1.1. For all separating elements except doors, shutters and closures for conveyors (see below) the performance level used to define insulation is:

- the average temperature rise on the unexposed face is limited to 140°C above the initial average temperature, with the maximum temperature rise at any point limited to 180°C above the initial average temperature.

(In the case of elements with small surface areas (such as gap seals) the concept of average temperature rise is irrelevant and insulation is assessed on the basis of the maximum only).

II.C2 Insulation of doors, shutters and closures for conveyors

C2.1. In the specific case of doors, shutters and closures for conveyors, two possible definitions of insulation are used :

- the average temperature rise on the unexposed face of the door leaf is limited to 140°C above the initial average temperature, with the maximum temperature rise at any point of the door leaf limited to 180°C. No temperature measurements are

made on the door leaf within 25 mm from the visible edge of the door leaf. The temperature rise at any point on the frame is limited to 180°C, measured at 100 mm from the visible edge (on the unexposed face) of the door leaf, if the frame is wider than 100 mm, otherwise measured at the frame/supporting construction boundary.

- the average temperature rise on the unexposed face of the door leaf is limited to 140°C above the initial average temperature, with the maximum temperature rise at any point of the door leaf limited to 180°C. No temperature measurements are made on the door leaf within 100 mm from the visible edge of the door leaf. The temperature rise at any point on the frame is limited to 360°C, measured at 100 mm from the visible edge (on the unexposed face) of the door leaf, if the frame is wider than 100 mm, otherwise measured at the frame/supporting construction boundary.

C2.2 The insulation classification shall be made specific by the use of the suffices 1 and 2 corresponding, respectively, to the two definitions above (for example I_1). These suffices are used only for doors, shutters and closures and not for any other element with an I classification.

II.D **Radiation W**

D.1. Radiation W is defined as the ability of the element to withstand fire exposure on one side only, so as to reduce the probability of the transmission of fire as a result of significant radiated heat either through the element or from the non-exposed surface to adjacent materials. The element may also need to protect people in the vicinity. An element which satisfies the I criterion is also deemed to satisfy the W requirement for the same time period.

D.2. Radiation will be measured for any element (whether insulated or not) for which such measurement is needed to satisfy national regulatory requirements. Measurement will be made at a point in a plane parallel to the test specimen and at a distance of 1.0 m from the nearest point on the specimen, and which is at the geometric centre of the specimen. The relevant standard(s) will say how this point is to be determined, as well as how to treat elements having more than one separate radiating surface. Surface(s) totalling less than 0.1 m^2 can be ignored for the determination of radiant flux.

D.3. Elements for which radiation is measured will be identified by the addition of a W to the classification (eg EW, REW). For such elements, the classification will be given by the time for which the average value of radiation, measured as in D.2 above. does not exceed a value of 15 kW/m^2 : the full radiation/time history shall be provided in the test report until failure occurs under the “cracks or openings in excess of given dimensions” or the “persistent flaming on the non-exposed side” integrity criteria occurs, which shall automatically mean a failure of the radiation criterion.

D.4. The full time history of the test will be given in the test report and will accompany the CE marking.

II.E **Mechanical actions M**

E.1. 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 must resist the impact without prejudice to the R, E, and/or I performance to have the classification supplemented by M.

II.F **Self-closing C**

F.1. Self-closing C is the ability of a product to close automatically, thereby shutting an opening. It applies to elements usually kept closed and which must close automatically after every opening, to elements usually kept open which must close in the event of a fire, and to mechanically operated elements which also must close in the event of a fire. Tests of self-closing ability are made under ambient conditions (and may be subject to a durability assessment if relevant) and the test is a pass/fail one.

F.2. The ability of an element to be closed at the start of a resistance to fire test is a prerequisite for starting such as test.

II.G **Smoke leakage S**

G.1. The S classification indicates the ability of an element to reduce or eliminate the passage of gases or smoke from one side of the element to another. The method of measurement and the associated limiting conditions associated with different types of products is given in the appropriate later sections to this annex.

II.H **Continuity of power and/or signal supply P/PH**

H.1. Continuity of power or signal supply is the ability of cables, plus components of their installation (connectors, glands, junctions, mountings etc.), to maintain a reliable communication of power or signal to safety installation(s) whilst exposed to fire. This may be assured by either cables and associated components which have intrinsic resistance to fire (i.e. the ability to provide the required performance without the need for any added protection) or by protection of the cables and associated components by enclosing them in a suitable conduit, trunking or other protective system.

H.2. For cables and cable systems with intrinsic fire resistance, or for any cables which are fire protected or contained in conduit/trunking etc., the P classification shall be based on the test of a representative installation exposed within a furnace to the standard temperature/time curve.

H.3. Only for small cables of up to 20 mm diameter and including conductors of less than 2.5 mm^2 and used e.g. for emergency lighting or fire alarm system signal cables, a PH classification can be used, indicating intrinsic fire resistance. The classification shall be

based on exposure to the standard temperature/time curve for a period of 30 minutes after which a constant temperature attack shall be maintained at a notional 842°C.

II.I **Heat resistance V**

In the specific case of powered and natural smoke and heat ventilators, the requirement is that they continue to operate under fire conditions. Such ventilators are therefore classified V followed by the temperature at which they are tested. To achieve the V classification, ventilators must remain operational for a specified period of time (e.g. 30 minutes), given in the appropriate later sections of this annex.

II.J **Soot fire resistance G**

For chimneys and chimney related products (such as flue blocks and connectors) designed to be resistant to soot fires, the classification G is used. The test is undertaken with a constant temperature attack of 1000°C, applied under appropriate test conditions, this being maintained for 30 minutes (after 10 minutes to reach the maximum temperature). Flues and other chimney products designed to be built into a surround (e.g. a brick chimney) need only satisfy a leakage requirement at the end of the test. Products and elements where the external surface or surfaces of the chimney are within a building must satisfy an insulation requirement, defined as being a maximum temperature rise not exceeding 140°C at any point on the surface.

This mandate 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 covered by the specific product mandate for chimneys.

II.K **Other characteristics**

The use of the **B** and **F** classifications for smoke and heat ventilators, and the **D** classification for smoke curtains is explained in section IV of this annex.

III DECLARATION OF FIRE RESISTANCE PERFORMANCE

III.1 All classification periods against any of the characteristics are declared in minutes, using one of the periods: 15, 20, 30, 45, 60, 90, 120, 180 or 240. Not all periods apply to all elements, however, and later sections of this annex show which classification periods apply to which elements.

III.2 In general the classes shall be expressed as follows:

For loadbearing elements:
R E I - time : Minimum time during which all criteria (loadbearing capacity, integrity and insulation) are satisfied,
R E - time : Minimum time during which the two criteria loadbearing capacity and integrity are satisfied.
R - time : Minimum time during which the criterion of loadbearing capacity is satisfied.

For non loadbearing elements:
E I - time : Minimum time during which the criteria integrity and insulation are satisfied,
E - time : Minimum time during which the criterion integrity is satisfied.

III.3 Thus the following example classes may be defined:

REI 15, RE 20 ...
EI 45, E 30, E 60 ...
EW 30 ...

Except where there are additional means of determining integrity, where an element has both an E and an I classification (e.g. REI 15, EI 45), integrity is determined using all three possible measurement criteria. Where an element is classified E without I (e.g. E 60, EW 30), only the cracks and flaming criteria are used.

III.4 Test 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. So a building element with a loadbearing capacity of 155 minutes, an integrity by the cotton pad of 80 minutes, integrity by cracks/flaming of 85 minutes and a thermal insulation of 42 minutes would be classified R 120/ RE 60/ REI 30.

III.5 Taking a partition as another example, ID2 allows E 20, 30, 60, 90 and 120 and EI 15, 20, 30, 45, 60, 90, 120, 180 and 240. So a partition with a cotton pad performance of 50 minutes, failure by flaming after 55 minutes and I of 47 minutes would be classified EI 45, E 30.

III.6 In the specific case of doors, shutters and closures for conveyors, integrity is determined in exactly the same way as for other elements. The insulation classification, however, is made specific by the use of one or both of the suffices 1 and 2.

III.7 Where the test results lead to a difference in classification depending on the criterion chosen, the element may have more than one classification. For example, a door failing the first insulation criterion after 50 minutes and the second criterion after 70 minutes (failing E after 95 minutes) may be classed EI_1 45, EI_2 60, E 90.

III.8 Where the difference in performance does not lead to in difference in classification, the element is classed with the suffix of the most strict requirement. For example, a door failing the first insulation criterion after 50 minutes and the second criterion after 55 minutes (failing E after 70 minutes) would be classed EI_1 45, E 60. The suffix 1 here also indicates that the door satisfies also the second insulation criterion.

III.9 The classification can be expanded by:

- M when particular mechanical actions are considered,
- C for doors equipped with an self-closing device,
- S for elements with particular limitations on smoke leakage.

C and M are both pass/fail tests and therefore not subject to classes of performance. In relation to S, for fire resistant elements the S is added to the fire resistance classification (e.g. REI-S). Where no fire resistance classification is relevant, the element shall simply be classified S. The S classification is determined under ambient and, if relevant, medium temperature conditions.

III.10 The use of the **B** and **F** classifications for smoke and heat ventilators, and the **D** classification for smoke curtains is explained in section IV of this annex.

IV CHARACTERISTICS AND CLASSES APPLICABLE TO SPECIFIC ELEMENTS

In all the sections that follow, except in the case of doors, shutters and closures for conveyors, the I definition is that given in section II.C1.

IV.A **Loadbearing elements without a fire separating function**

- Exposure/action: Standard temperature/time curve and mechanical loading. Elements are subjected to the heating conditions in a way which is appropriate to their intended end use(s) (for example beams to be heated either on three sides from underneath or on all four sides, columns to be heated on all sides).

- Performance criterion: loadbearing capacity R

- Classification: R 15 20 30 45 60 90 120 180 240

In some specific cases, the upper limit may be extended, subject to normal rules relating to barriers to trade. It is expected that any higher limit would typically be for a one-off case, and would need to be fully justified.

IV.B **Loadbearing elements with a fire-separating function**

Classification of walls

- Exposure/action:
  (a) standard temperature/time curve,
  (b) impact, representing structural failure of other components in case of fire.

- Performance criteria:

(a) loadbearing capacity and integrity	RE
(b) loadbearing capacity, integrity and insulation	REI
(c) loadbearing capacity, integrity, insulation and impact resistance	REI-M
(d) for parts with insufficient I, loadbearing capacity, integrity and radiation	REW

- Classification:

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

Classification of floors and roofs

- Exposure/action: standard temperature/time curve.

- Performance criteria:

(a) loadbearing capacity and integrity	RE
(b) loadbearing capacity, integrity and insulation	REI

- Classification:

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

Floors and roofs are tested and classified according to the standard temperature/time curve applied from below only. See below for floors and roofs protected by suspended ceilings.

The aspect of the external fire exposure of roof coverings does not fall within the scope of this mandate but will be dealt with separately.

IV.C **Products and systems for protecting elements or parts of the works**

Classification of ceilings with no independent fire resistance

These ceilings (unlike ceiling with independent fire resistance) do not possess fire resistance independently of the element above. They are therefore always tested together with the floor or roof above, of which they will form a part. Classification of such a ceiling would be as a part of the whole assembly, being accompanied by a description of the end use conditions (i.e. the type(s) of element above) for which the classification of the ceiling is valid.

- Possible exposure/action:
    (a) standard temperature/time curve (from below the ceiling),
    (b) the "semi-natural" fire (from below the ceiling - see section I.C).

Where performance against the "semi-natural" fire is a regulatory requirement (only relevant for lightweight ceilings having a low thermal inertia and not mandatory for all ceilings), after testing to the "semi-natural" fire, the classifications below will be identified by the addition - sn, for example RE - sn 20.

- Performance criteria:
    (a) loadbearing capacity and integrity RE
    (b) loadbearing capacity, integrity and insulation REI
    (c) loadbearing capacity R

- Classification:	RE		20	30		60	90	120	180	240
	REI	15	20	30	45	60	90	120	180	240
	R	15	20	30	45	60	90	120	180	240

Classification of elements protected by fire protective coatings, claddings and screens

Coatings, claddings and screens are intended to increase (or provide) fire resistance performance of the loadbearing elements they protect. Therefore, they should always be tested together with the element they are to protect, or there shall be particular testing protocols devised for their evaluation when used with particular elements made of specific structural materials. Classification of a protective product or system shall be a part of the whole element or shall be related to that element. It shall be accompanied by a description of the end use condition(s) (i.e. the type(s) of element protected) for which the classification of the product or system is valid.

- Possible exposure/action:
    (a) “standard temperature/time” curve,
    (b) impact, representing structural failure of other components in case of fire (screens only).

- Performance criteria: Shall be appropriate to the determination of the loadbearing capacity of the element to be protected such that the classification of that protected element can be expressed in terms equivalent to that appropriate to the element if tested directly.

- Classification: Expressed in the same terms as for the loadbearing element being protected.

The testing methodology shall provide data on the protective ability of the product or system in a form appropriate for direct input to structural design codes.

IV.D **Products for non-loadbearing elements or parts of works**

Classification of partitions (including those incorporating uninsulated portions)

- Possible exposure/action:
    (a) standard temperature/time curve,
    (b) impact, representing structural failure of other components in case of fire.

- Performance criteria:

(a) integrity	E
(b) integrity and insulation	EI
(c) integrity, insulation and impact resistance	EI-M
(d) integrity and radiation (for elements with insufficient I)	EW

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

<u>Classification of facades (curtain walls) and external walls (including glazed elements)</u>

- Exposure/action:
    (a) standard temperature/time curve (from the inside),
    (b) external fire exposure curve.

Facades and external walls may be tested from both sides or from the inside or outside only. The classification is identified by the addition of "i → o", "o → i", or "i ↔ o" according to the direction tested, for example EI30(i → o).

- Performance criteria:

(a) integrity	E
(b) integrity and insulation	EI
(c) mechanical stability	

- Classification:	E	15	30	60	90
	EI	15	30	60	90

The aspect of fire propagation to upper levels inside walls or along exterior facades is to be dealt with through reaction to fire classification according to Commission Decision 94/611/EC.

Where required, mechanical stability means that there are no falling parts liable to cause personal injury during the time for the E or EI classification.

<u>Classification of ceilings membranes with independent fire resistance</u>

These ceilings possess fire resistance independent of any element above (unlike ceilings without independent fire resistance described above).

- Exposure/action: “standard temperature/time” curve:
  (a) from above the ceiling,
  (b) from below the ceiling.

- Performance criterion: integrity / insulation EI

- Classification: EI 15 30 45 60 90 120 180 240

Where classification is expressed from above, the addition of “a → b” (“a” referring to above and “b” to below the membrane) should be used; similarly the addition of “a ← b” should used for classification from below, and “a ↔ b” should be used for classification from both above and below. For example, a classification EI30(a ← b) indicates a ceiling membrane which is capable of providing 30 minutes integrity and insulation performance from the underside only, whereas a classification EI30(a ↔ b) indicates a ceiling membrane with the ability to provide the same level of performance from both the underside and from above the membrane.

Classification of raised floors

These are floors, including their maintenance openings, which are used to provide a void between themselves and the upper surface of the structural floor for the purpose of routing services. They do not, therefore, contribute to the structural stability of the works but must, when subject to fire from below (i.e. to a fire within the void) continue to support the superimposed loads from above.

- Exposure/action:
  - “standard temperature/time curve”; or
  - constant temperature exposure to a temperature of 500°C

- Performance criteria:
  (a) loadbearing capacity R
  (b) loadbearing capacity and integrity RE
  (c) loadbearing capacity, integrity and insulation REI

- Classification: R 15 30
  RE 30
  REI 30

The classification will be made specific depending on the exposure, using suffices “f” and “r” respectively (“f” referring to the full fire resistance, and “r” referring to the reduced constant temperature exposure), e.g. a floor classified as RE_r is tested to the reduced curve only. Floors satisfying the “standard temperature/time” curve can be used to satisfy the reduced curve for the same period.

Classification of fire doors and shutters and their closing devices (including those that incorporate glazing and hardware)

(i) Fire doors and shutters

- Exposure/action: standard temperature/time curve.

- Performance criteria:

(a) integrity	E
(b) integrity and insulation	EI
(c) integrity and radiation	EW
(d) self-closing	C

Insulation classification is to be made explicit by using one or both of the definitions and suffices 1 and 2 given in section II.C2.

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

For doors fitted with a closing device, the ability to close the door, possibly after a number of open-close cycles, is a prerequisite for starting a resistance to fire test.

(ii) Closing devices

Doors and shutters may be closed by closing mechanisms either after each opening or only when fire occurs. Installations with closing mechanisms used only when fire occurs are either hold open systems or free swing door closers. They have to ensure closure reliability even when the power supply fails.

A hold open system may comprise a fire detector (e.g. heat and/or smoke detector), a release device, a hold open mechanism and a power supply. Response of the release device in case of fire or by any other causes of release (e.g. manual), should ensure the leaves are closed by their closing mechanism. The functioning of the hold open system is dependent on the reliability of its detection and release systems and the compatibility of the components.

A free swing door closer allows the door to swing freely in normal use but in case of fire a closing device operates to close the door. Included in this category are devices which normally close doors after each opening (mechanically or by rising hinge).

- Exposure/action: ambient climate.
- Performance criteria: Ability to release "hold open" installations for doors and shutters and to ensure reliable closing of doors and shutters in case of fire or failure of the power supply. Ability to close a door or shutter from a defined position and maybe overcome resistance e.g. latch. Durability of the closing device is a requirement in certain cases.
- Classification: pass/fail.

<u>Classification of smoke control doors</u>

This covers doors (including those which incorporate glazing) which have special smoke control properties at ambient and medium temperatures. The classification may be applied in addition to the other parameters for fire control doors given above, or may be used for doors which have neither an E nor an I classification.

- Exposure/action:
  (a) ambient temperature and pressure differentials of 10, 25 and 50 Pa,
  (b) medium temperature (200°C) and pressure differentials of 10, 25 and 50 Pa,

- Performance criterion: smoke leakage S

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

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

Classification of closures for conveyors and trackbound transportation systems

These closures ensure that, in case of fire, openings in fire-separating elements, such as walls and floors, penetrated by conveyor systems are closed. The ability to close a closure, possibly after a number of open-close cycles, is a prerequisite for starting a resistance to fire test.

Special devices are needed to ensure that moving items on the conveyor do not damage the closure or prevent the closure from being fully effective in closing the opening, especially in the event of power failure. Safe and effective closing can only be achieved if the mechanical and electrical operations of the closure of the conveyor system and the components are carefully co-ordinated. These aspects, however, are outside the scope of this mandate.

- Exposure/action: standard temperature/time curve.

- Performance criteria:

(a) integrity	E
(b) integrity and insulation	EI
(c) self-closing	C

- Classification:

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

Insulation classification is to be made explicit by using one or both of the definitions and suffices 1 and 2 given in section II.C2.

Classification of penetration seals and linear gap seals

- Exposure/action: standard temperature/time curve.

- Performance criterion:	integrity					E				
	integrity and insulation					EI				
- Classification:	E	15		30	45	60	90	120	180	240
	EI	15	20	30	45	60	90	120	180	240

As stated in section II.C1.1 only the maximum temperature rise at any point (180°C) is used as the criterion for insulation.

Classification of service ducts and shafts

This section covers service ducts (horizontal) and shafts (vertical) including their maintenance openings and suspension devices. Ducts and shafts are building components which are separate from the rest of the structure and serve to accommodate all kinds of services and installations (see below for ventilation ducts). The test arrangement has to reflect the installations which occur in practice.

- Exposure/action:
  (a) standard temperature/time curve (from outside); and/or
  (b) standard temperature/time curve (at the inlet to the duct or shaft).

- Performance criterion: integrity and insulation EI

- Classification:	EI	15	20	30	45	60	90	120	180	240

The two exposures are to be applied separately in two different tests. Classification should indicate if performance criteria are satisfied by fire from inside or fire from outside or both, using the additions (i $\rightarrow$ o), (o $\rightarrow$ i) or (i $\leftrightarrow$ o) respectively (the latter being used if the same classification is obtained from both sides).

Failure of the suspension device(s), if this leads to failure of EI, shall indicate failure of the test.

Classification of chimneys

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

- Exposure/action: constant 1000°C reached after 10 minutes, for a total test time of 40 minutes.

- Performance criteria: soot fire resistance defined as:
  (a) for built in products, leak resistance under pressure after the 40 minutes

exposure,

(b) for other elements and products, satisfaction of insulation defined in section II.J.

- Classification:

No classification is used. Products and elements satisfying the above criteria on a pass/fail basis may use the letter G to denote soot fire resistance.

IV.E Products for use in ventilation systems (excluding smoke and heat exhaust ventilation)

Classification of ventilation ducts

The requirements for components of ventilation ducts relate to their use both vertically and horizontally, and include branches, joints, air supply and exhaust openings and suspension devices. Test methods should cover typical end use situations.

- Exposure/action:

(a) "standard temperature/time" curve from the inside (at inlet to the duct), unless fire from the inside can be excluded,

(b) "standard temperature/time" curve from the outside, unless fire from the outside can be excluded,

(c) for both the above conditions, vertical and horizontal orientations, unless only one is to be provided in practice,

(d) pressure conditions.

- Performance criteria:

(a) integrityand insulation	EI
(b) integrity	E
(c) leakage (if necessary)	S

Integrity, in this case, is subject to the additional requirement for high temperature leakage rate.

- Classification:	EI	15	20	30	45	60	90	120	180	240
	E			30		60				

If the leakage must be restricted further, S is added to the classification as a pass/fail test for a given leakage rate under defined temperature and pressure conditions.

The classification should indicate if the performance criteria are satisfied by fire from inside or fire from outside or both, and whether it applies to vertical or horizontal orientations or both. The additions - "i $\rightarrow$ o", "o $\rightarrow$ i" or "i $\leftrightarrow$ o" should be used respectively together with "v_e" and/or "h_o" to indicate orientation. For example, a classification EI30(v_e h_o i $\leftrightarrow$ o) indicates a ventilation duct capable of satisfying 30 minutes integrity and insulation, from inside to outside and vice-versa in both vertical and horizontal applications.

The classification S is added, based on satisfaction of an additional restriction on the leakage rate. This shall be based on a pass/fail test for the leakage. For example, a classification EI30(v_e h_o i ↔ o)S indicates a duct with the same performance as above but additionally satisfying the leakage criteria.

Failure of the suspension devices, if this leads to failure of either E or EI, shall indicate failure of the test.

Classification of dampers

This section covers dampers in air conditioning systems but excludes those used in smoke and heat ventilation systems (see below). The requirements for fire dampers relate to both vertical and horizontal installations. Test conditions have to be chosen according to the operating conditions, i.e. dampers with or without connected ducts, whether fire resistant or not.

- Exposure/action:
  - (a) "standard temperature/time" curve from each side separately (at inlet to the damper), unless fire from one side can be excluded,
  - (b) vertical and horizontal orientations, unless only one is to be provided in practice,
  - (c) pressure conditions.

- Performance criteria:

(a) integrityand insulation	EI	
(b) integrity		E
(c) leakage (if necessary)	S	

Integrity, in this case, is subject to the additional requirement for high temperature leakage rate.

- Classification:	EI	15	20	30	45	60	90	120	180	240
	E			30		60	90	120		

If the leakage must be restricted further, S is added to the classification as a pass/fail test for a given leakage rate under defined temperature and pressure conditions.

The classification should indicate if the performance criteria are satisfied by fire from one side only or from both sides, and whether it applies to vertical or horizontal orientations or both. The additions - "i → o", "o → i" or "i ↔ o" should be used respectively together with "v_e" and/or "h_o" to indicate orientation. For example, a classification EI30(v_e h_o i ↔ o) indicates a damper capable of satisfying 30 minutes integrity and insulation, from both sides in both vertical and horizontal applications.

The classification S is added, based on satisfaction of an additional restriction on the leakage rate. This shall be based on a pass/fail test for the leakage. For example, a classification EI30(v_e h_o i ↔ o)S indicates a damper with the same performance as above but additionally satisfying the leakage criteria.

The reliability of the closing device of fire dampers has also to be assessed, with any damper failing the closing test being ineligible for fire resistance classification.

Failure of the suspension device(s), if this leads to failure of any of the performance criteria, shall indicate failure of the test.

IV.F Products to be used within services

Classification of fire resistant electrical and fibre-optic cables, accessories, and cable systems, or fire protected cable systems

A reliable power supply needs to be maintained from the power source to safety installation(s), such as alarm, way guidance and fire fighting installations. For this reason, either cables are protected from fire, or cables with intrinsic resistance to fire are used. The requirements for cables relate to their use in practice and therefore apply to their supporting/suspension devices as well.

The classification of cables and cabling systems, or those cables and cabling systems provided with a fire protection system, shall be tested in a representative manner in a furnace test:

- Exposure/action: "standard temperature/time" curve

- Performance criterion: continuity of supply P

- Classification: P 15 30 60 90

F.1 Exception for small diameter power or signal cables or systems

Electrical or fibre optic cables of overall diameter of less than 20mm and with conductors of less than 2,5mm^2, may be classified as having intrinsic fire resistance (i.e. achieved without the need for any fire protection).

- Exposure/action: constant temperature attack of a notional 842°C.

- Performance criteria: continuity of supply PH

- Classification: PH 15 30 60 90

IV.G Products to be used in smoke and heat exhaust ventilation systems

Classification of smoke and heat exhaust ducts

Smoke and heat exhaust ducts are differentiated from fire resistant ventilation ducts by virtue of their need only to be able to withstand moderately high temperatures whilst

conducting their function, i.e. exhausting smoke and hot gases 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 and maintaining 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 must also be capable of maintaining the fire resistance separation and will, therefore, have the additional need of fire resistance performance. Two categories of smoke and heat exhaust ducts are, therefore, provided.

The requirements for components of smoke exhaust ducts relate to their use in vertical and horizontal applications, and includes branches, joints, air supply and exhaust openings and suspension devices. Test methods should cover typical end use conditions.

i) Multi-compartment fire resistant heat exhaust ducts

- 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 in practice

- Performance criteria:

(a) integrity and insulation	EI
(b) integrity	E
(c) maintenance of cross section	
(d) mechanical stability	
(e) leakage (if necessary)	S

Integrity, in this case, is subject to the additional requirement for high temperature leakage rate.

- Classification:	EI	30	60	90	120
	E	30	60	90	120

The classification should indicate that the duct is suitable for multi-compartment application by use of the addition of a suffix ”multi”, and should indicate whether the duct is suitable for vertical or horizontal orientation or both by use of the suffixes v_e and h_o as appropriate. For example, EI30multi(v_e h_o) indicates satisfaction of the integrity and insulation criteria for 30 minutes in both vertical and horizontal orientations.

If the leakage must be restricted further, S is added to the classification as a pass/fail test for a given leakage rate under defined temperature and pressure conditions.

ii) Single compartment smoke and heat exhaust ducts

- Exposure/action:

(a) from the inside and outside of the duct to a constant temperature of 600°C,
(b) pressure difference inside to outside
(c) vertical and horizontal orientations, unless only one is to be provided in practice

- Performance criteria:
(a) integrity E
(b) maintenance of cross section
(c) mechanical stability

Integrity, in this case, is subject to the additional requirement for high temperature leakage rate.

- Classification: E_{600} 30 60 90 120

The classification should indicate that the duct is only suitable for single compartment application by use of the addition of a suffix “single”, and should indicate whether the duct is suitable for vertical or horizontal orientation or both by use of the suffixes v_e and h_o as appropriate. In addition, the suffix “600” will be used for these products, to indicate use of the constant temperature attack. For example, E_{600}30single(v_e h_o) indicates satisfaction of the integrity criterion for 30 minutes in both vertical and horizontal orientations.

Maintenance of cross section means that the internal dimensions of the ductwork will not decrease by more than 10%. Mechanical stability requires that no complete part of the duct will collapse during the test.

<u>Classification of smoke and heat exhaust dampers</u>

Smoke and heat exhaust dampers are differentiated from fire dampers by virtue of their need only to be able to withstand moderately high temperatures whilst conducting their function, i.e. providing for control of the exhaust of smoke and hot gases from a fire compartment. Test conditions have to be chosen according to the operating and possible heat exposure conditions.

- Exposure/action:
(a) to a constant temperature of 600°C,
(b) pressure difference
(c) vertical and horizontal orientations, unless only one is to be provided in practice

- Performance criteria:
(a) integrity and insulation EI
(b) integrity E
(c) ability to open and/close reliably

- Classification: EI_{600} 30 60 90 120
E_{600} 30 60 90 120

The classification should indicate if the performance criteria are satisfied for vertical or horizontal orientations or both using the suffix v_e and h_o as appropriate. In addition, the suffix "600" will be used for these products, to indicate use of the constant temperature attack. For example, an $EI_{600}30(v_e\ h_o)$ classification indicates satisfaction of integrity and insulation criteria for 30 minutes in both vertical and horizontal orientations.

The reliability of the opening and/or closing of smoke and heat exhaust dampers shall be assessed and satisfaction in this respect is a precondition of the evaluation by the heat exposure test

Classification of smoke curtains

Both fixed and automatically actuated smoke curtains, which are designed to contain or direct the movement of smoke and heat, must be made of materials which do not produce unacceptable droplets (in a SBI-type reaction to fire test) or flames exceeding specified dimensions, and which remain functionally unimpaired during the test [4].

- Exposure/action:
  (a) to a constant temperature of 600°C
  (b) pressure difference

- Performance criteria:
  mechanical stability/deformation and integrity under fire exposure

- Classification: D, completed by the time for which the performance requirements are satisfied.

The reliability of the opening and/or closing of automatically operated smoke curtains shall be assessed and satisfaction in this respect is a precondition of the evaluation by the heat exposure test.

Classification of powered smoke and heat ventilators (fans)

Powered smoke and heat ventilators are evaluated for their ability to function whilst exposed to smoke and heat from a fire. They are classified on the basis of tests conducted during their operation at any point on their volume/pressure curve, provided that the power consumption is at least 80% of the maximum rated power and that the volume or pressure readings are stable.

- Exposure/action:
  (a) to a constant temperature of 200°C, 300°C, 400°C, 600°C, or 842°C, and/or
  (b) to the "standard temperature/time" curve for a period of 30 minutes

- Performance criteria:
  (a) reliability of the actuation system

[4] CEN are asked to verify the practicalities of this classification in their answer to the mandate.

(b) ventilators must satisfy certain performance limits with regard to temperature rise and their ability to maintain the extraction flow rate for the periods indicated below depending on the fire test exposure condition :

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

- Classification: F (As illustrated above the classification F is qualified by a suffix which indicates the exposure condition.)

All ventilators positioned as the outside termination of a system must demonstrate their ability to open against a defined pressure condition and/or imposed snow loads. The ability to demonstrate this, and the reliability of the actuation system (including a durability/reliability requirement) is a prerequisite to the evaluation of performance under the heat exposure test.

Classification of natural smoke and heat ventilators

Natural smoke and heat ventilators are evaluated for their ability to open and provide for the ventilation of smoke and heat driven only by the buoyancy of hot gases from the fire.

- Exposure/action: to a constant temperature of 300°C and/or 600°C

- Performance criteria:

(a) reliability of the actuation system

(b) ventilators must be able to withstand the fire exposure condition without suffering a reduction in their throat area for ventilation of more than 10% for a period of 30 minutes.

- Classification: B_{300} , B_{600}

All ventilators must demonstrate their ability to open against defined pressure conditions (representing wind) and/or imposed snow loads, and must be capable of opening under defined conditions of low ambient temperature. The ability to demonstrate this, and the reliability of any actuation system (including a durability/reliability requirement) is a prerequisite to the evaluation of performance under the heat exposure test.
