British Standard

BRITISH STANDARD

BS 476-10: 1983

Fire tests on building materials and structures —

Part 10: Guide to the principles and application of fire testing

UDC 614.841.332:620.1:69.01

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Fire Standards Committee (FSM/-) to Technical Committee FSM/1 upon which the following bodies were represented:

Aluminium Federation
Asbestos Cement Manufacturers' Association Limited
Association of British Roofing Felt Manufacturers
Association of Building Component Manufacturers Limited
Association of Structural Fire Protection Contractors and Manufacturers
British Fire Services Association
British Floor Covering Manufacturers' Association
British Plastics Federation
British Railways Board
British Rigid Urethane Foam Manufacturers' Association
British Rubber Manufacturers' Association
British Wood Preserving Association
British Woodworking Federation
Cement and Concrete Association
Chemical Industries Association
Chief and Assistant Chief Fire Officers' Association
Concrete Society
Constructional Steel Research and Development Organisation
Department of Education and Science
Department of the Environment (Building Research Establishment, Fire Research Station)
Department of the Environment (Construction Industry Directorate)
Department of the Environment (Property Services Agency)
Department of Trade (Marine Division)
Electricity Supply Industry in England and Wales
Engineering Equipment and Materials Users' Association
Eurisol (UK) Association of Manufacturers of Mineral Fibre Insulation
Felt Roofing Contractors' Advisory Board
Fibre Building Board Development Organization Ltd.
Fire Insurers' Research and Testing Organization (FIRTO)
Fire Offices Committee
Fire Protection Association
Flat Glass Manufacturers' Association
Greater London Council
Gypsum Products Development Association
Health and Safety Executive
Home Office
Institution of Fire Engineers
Mastic Asphalt Council and Employers' Federation
National Association of Plumbing, Heating and Mechanical Services Contractors
National Coal Board
National Council of Building Materials Producers
National GRP Cladding Federation
Royal Institute of British Architects
Rubber and Plastics Research Association of Great Britain
Timber Research and Development Association
United Kingdom Antimony Oxide Manufacturers' Association
United Kingdom Atomic Energy Authority
Warrington Research Centre
Wood Wool Slab Manufacturers' Association

This British Standard, having been prepared under the direction of the Fire Standards Committee, was published under the authority of the Board of BSI and comes into effect on
30 November 1983

The following BSI references relate to the work on this standard:
Committee reference FSM/1
Draft for comment 82/11518

ISBN 0 580 13403 2

Amendments issued since publication

Amd. No.	Date of issue	Comments

Contents

Foreword

This Part of this British Standard has been prepared under the direction of the Fire Standards Committee and describes the general principles and application of the methods in this series of standards for fire testing.

Because of an increasing interest in fire testing in relation to reducing fire hazard and controlling the products and elements of construction used in buildings, and because of a desire to move away from the present approach based largely on experience and limited technical data, towards a more rational approach, the committee responsible for the methods described in this series of standards has undertaken the revision of existing methods, and the preparation of new methods.

Part numbers for the methods have been allocated in advance so that the new standards are published in a coherent manner.

The methods specific to assessment of the response to fire of building products have been allocated Part numbers 11 to 19, and those for elements of building construction from 20 to 29, with provision for miscellaneous methods from 30 onwards. The provisional titles of the Parts are as follows.

a) *Fire tests for products*

— Part 11[1]*: Method for assessing the heat emission from building materials;*

— Part 12[2]*: Method for measuring the ignitability of products using direct flame impingement;*

— Part 13[2]*: Method for measuring the ignitability of products subjected to thermal irradiance;*

— Part 14[2]*: Method for measuring the rate of flame spread on surfaces of products;*

— Part 15[2]*: Method for measuring the rate of heat release of products;*

— Part 16[2]*: Method for measuring the smoke release (obscuration) of products;*

— Parts 17 to 19: Other methods of test relating to products;

b) *Fire tests for elements of building construction*

— Part 20[2]*: General principles and requirements for the determination of the fire resistance of elements of building construction;*

— Part 21[2]*: Methods for the determination of the fire resistance of load bearing elements of building construction;*

— Part 22[2]*: Methods for the determination of the fire resistance of non-load bearing elements of building construction;*

— Part 23[2]*: Methods for the determination of the contribution provided by components and elements to the fire resistance of a structure;*

— Part 24: Methods for the determination of the fire resistance of elements of construction penetrated by building services;

— Parts 25 to 29: Other methods related to the determination of fire resistance;

c) *Miscellaneous fire tests*

— Part 30[1]*: Methods for measuring the performance of flat and sloping roofs exposed to an external fire;*

— Part 31[3]*: Methods for measuring smoke penetration through door sets and shutter assemblies.*

[1] Published

[2] In course of preparation.

[3] Being issued in separately published Sections.

In order to provide continuity with the new methods, the present published series (Parts 3 to 8) will be retained for as long as is necessary, but will eventually be phased out.

Following current practice, those methods that are entirely new will normally first be issued as Drafts for Development. This provides a two year period for general assessment before the method is transformed into a standard in the new series. The first method has been issued under this policy as DD 70. Where appropriate the detailed drawings for the apparatus specified in the methods will be made available.

The methods under preparation for this series of standards, take account of work being carried out in the International Organization for Standardization (ISO), Technical Committee TC 92 "Fire tests for building materials, components and structures" and that being carried out by the EEC (Commission DG III) with a view to reducing barriers to trade between its member states. This programme includes a number of methods for fire testing, with work on fire resistance being given the first consideration. The committee responsible for this series of standards is being kept informed of progress in these matters, and an analysis of the current requirements of BS 476-8, the ISO standards and the draft EEC Directive has been published as PD 6496.

Whilst it is the intention of the Committee responsible for this series of standards to reduce and, where possible, eliminate the use of asbestos-based products in the specified methods, it is not always possible to achieve this, especially where a revision of an existing method is being prepared. In such cases, attention is drawn to the following safety warning.

CAUTION. The mechanical sawing and drilling of asbestos cement components attracts the provisions of the Asbestos Regulations 1969. Adequate methods exist to control levels of dust during such operations and these are detailed in the Control and Safety Guides issued by the Asbestos Research Council[4)].

Similarly, in preparing a new method, every effort is made to remove by design possible situations which might cause hazard to the operator. However, situations can exist that are unforeseen and therefore attention is drawn to the Health and Safety at Work etc. Act 1974, and the need to ensure that the methods described in this series of standards are carried out under suitable environmental conditions to provide adequate protection to personnel against the risk of fire, inhalation of smoke and/or toxic products of combustion.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This documents comprises a front cover, an inside front cover, pages i to iv, pages 1 to 8, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

[4)] Available from the Asbestos Information Centre, Sackville House, Piccadilly, London W1.

blank

0 Introduction

Fire produces environments which endanger people and property, be it buildings or their contents. These hazardous environments can occur because many materials used in buildings, especially organic ones, hydrocarbon fuels, wood and many plastics, can be ignited by common energy sources and cause chemical reactions, usually with atmospheric oxygen, to produce heat and combustion products. The rate of heat production generally becomes more than that which would cause ignition and so leads to self-sustaining combustion. This in turn can cause the burning zone to spread and to cause combustible products to give rise to temperatures high enough to cause all building products either to lose strength or to fracture by inducing stresses when expansion is restrained (such as concrete). Fires also produce quantities of unburnt liquid condensates and solid residues (soot) that, even when diluted with fresh air, can produce toxic, irritant and corrosive atmospheres and reduce visibility sufficiently to impede escape and cause loss of orientation.

When building products, components and elements of construction are to be specified, it is necessary to consider whether they will ignite so easily that it can significantly increase the chance of a fire occurring and, given that a fire has started and recognizing that usually the contents of a building form the prime source of fuel for the fire, whether the product significantly increases the speed and extent of fire spread and/or contributes significantly to the heat and smoke generated by a fire. It is also necessary to consider whether, once a fire has become established, the elements of construction remain stable and barriers such as floors, walls and doors, successfully contain the heat and smoke. The methods of fire testing in this series are designed to provide some of the information to be taken into account when considering such matters. Thus the methods can assist in the control of hazard to people and property. The hazard has a number of aspects and each method usually measures only one aspect. Therefore, the results of more than one test together with information on the nature and application of the product or component and the performance of the element of construction are normally needed to assess a hazard. For example, in assessing the hazard due to smoke, a method for measuring smoke obscuration will offer an estimate of the visibility and a method for measuring flame spread will indicate how rapidly a fire will grow and therefore, between them, how much smoke obscuration might be produced. Most methods of test have been used directly to control what is manufactured and sold and so indirectly reduce the hazard. It is unlikely that all methods of test can be replaced by methods based on real fire performance criteria and related directly to hazard.

1 Scope

This Part of this standard describes the general principles and applications of the methods in this series of standards, for fire testing of building products, components and elements of construction, deriving general philosophy on fire testing from BS 6336 and employing terminology from BS 4422 in addition to terminology specially defined here.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of this standard, the definitions given in BS 4422 apply, together with the following.

2.1
fire

a process of combustion characterized by heat or smoke or flame or any combination of these

NOTE This definition is taken from BS 4422-1.

2.2
fire hazard

a physical situation with a potential for harm to life or limb, or damage to property, or both, from the effects of fire

2.3
fire risk

the probability that damage by fire will occur as the result of the existence of a fire hazard

2.4
flashover

a stage in the development of a contained fire at which fire spreads rapidly to give large merged flames throughout the space

NOTE 1 As a scientific term "flashover" is applicable only to enclosed compartments.
NOTE 2 This definition is taken from BS 4422-1.

2.5
fire test

a procedure designed to measure or assess the response of a product, component or element of construction and any combination of these, to one or more aspects of fire

2.6
product

the material, composite or assembly about which information is required

2.7
material

a basic single substance or uniformly dispersed mixture

2.8
component

the product manufactured as a distinct unit to serve a specific function in the building or structure about which information is required

2.9
element of construction

the part of a building or structure having its own functional identity about which information is required

NOTE Attention is drawn to the fact that this term, and the similar term "element of structure" have particular meanings for regulatory purposes.

3 Fire test terminology

Fire terms have a precise meaning, often associated with a particular method of test, and users of this series of standards are advised to exercise caution when making reference to them. Misuse of fire terms can result in false claims being made about the real fire performance of products, components or elements of construction that may lead to serious or even disastrous consequences (see clause **8**).

NOTE A more detailed discussion of fire test terminology can be found in clause **7** of BS 6336:1982.

4 Fire hazard and safety

4.1 Limitation and control of fire hazard will enable people to be confident in the safety of buildings, in that a fire is unlikely to occur and that if one does, escape will be possible. It is emphasized that testing is only one of the processes by which hazard from fire is limited and controlled. Other processes include the use of codes of practice, legal prohibitions, inspection and education, fire detection and fire fighting equipment.

Fire hazards can result from the activities carried out in a building, failure of equipment and the misuse of ignition sources. The nature and potential of fire hazards can be changed by the use of new products, development of new designs and new social habits. Where such changes increase the fire hazard, there may be a need to modify the existing fire standards or to develop new ones.

4.2 By its nature, fire is a complex phenomenon, with its growth and ultimate severity depending upon a number of interrelated factors. For the purposes of this guide the uncontrolled development of most fires can be divided into the following stages.

a) *Initiation.* The process of heating some material to ignition and thereby establishing a fire.

b) *Growth (or spread, or propagation).* The continued release of flammable vapours leading to combustion which continues until there are no further supplies of immediately accessible fuel (combustibles) or air to become involved.

c) *A "steady" state.* The stage at which the fire may be said to be "fully developed" and all combustible materials are burning steadily.

d) *Decay.* The final stage during which the fire is burning itself out.

The temperatures of the gases produced by a typical uncontrolled fire in a compartment change with time (see Figure 1) and are affected by the design of the compartment and the flow of air[5)]. Figure 1 also shows the four stages of development of the fire[6)] and the flashover point. The nature and degree of risk to people and property as a result of a fire, varies markedly with the stage to which the fire has progressed. The contribution of different products, components and elements of construction to those risks may also change considerably from one stage to another.

4.3 Although both the contents and the fabric of the building may present a fire hazard, more often than not it is the contents of the building which are the first to be ignited. Hence the development of a fire is influenced by the contents, decoration and fittings as well as by the products used in the construction of the building.

4.4 A realistic determination of fire performance of product, component or element of construction can only be obtained from testing, when the specimen under test is in the form in which it is to be used in the building. This means that the specimen should be in a form which takes account of such features as surface finish, orientation, type of substrate (or air gap), method of fixing and appropriate loading conditions and should be representative of use in practice.

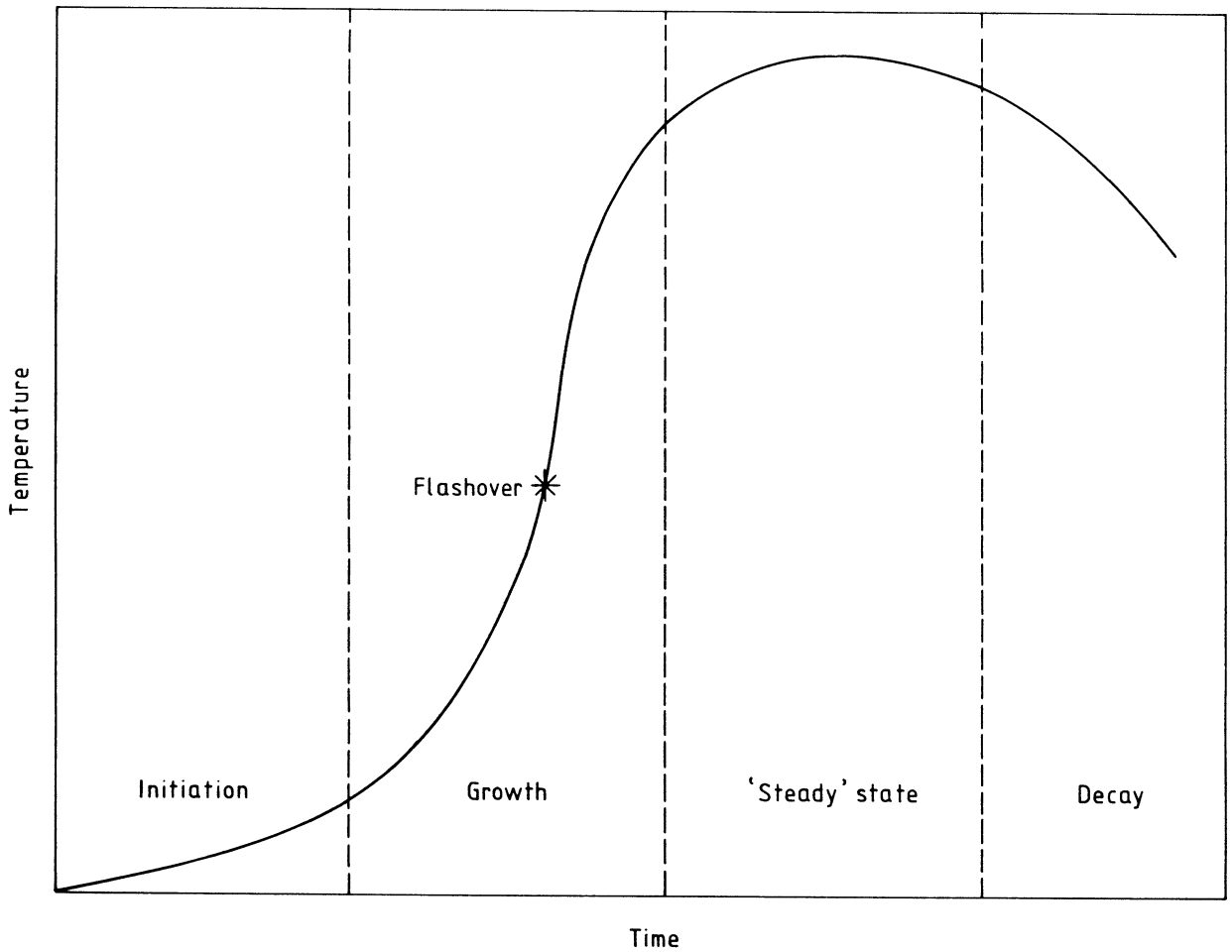
5) See ISO/TR 3956-1975 "Principles of structural fire-engineering design with special regard to the connection between real fire exposure and the heating conditions of the standard fire-resistance test (ISO 834)".

6) See ISO/TR 5657-1982 "Fire tests — Reaction to fire — Ignitability of building products".

4.5 However, a fire test itself cannot normally measure fire hazard, nor can the results of a fire test alone guarantee a particular degree of safety. Such results provide information to assist the determination and control of fire hazards and they form only one of a number of factors that need to be taken into account (see **4.1**). The results obtained from tests in this series of standards, e.g. fire resistance tests, and performance of products and elements of construction in a real fire situation are far from synonymous. For example, an expression of fire resistance related to a standard method of test is merely a measure of relative performance, and the requirements of building regulations for graded periods of fire resistance are based on building use and size, reflect fire loadings and expected severity of fire rather than an indication that the product, component or element of construction will have that performance for that period in a real fire situation.

4.6 If a product (though not a component or element of construction because of the nature of the tests involved), behaves poorly under test, it does not necessarily mean that it will present a fire hazard when used in a building. Any such hazard depends upon the quantity of product used in relationship to its environment, its position in the building structure, the design and use of the building and on any fire precautions that may have been taken.

4.7 Similarly, fire tests usually take no account of any variation in workmanship during the installation of a product, component or element of construction on site or of its durability. Poor installation and/or workmanship, and the effects of wear and tear can significantly affect the intended fire performance of the product.



NOTE The scales from the two axes of the graph have been deliberately omitted because the rate of development and the severity of fires differ greatly although the general relationship varies very much less.

Figure 1 — Relationship between temperature and time and the stages of a typical uncontrolled fire in a compartment

5 Methods of fire testing

5.1 Although no two fires are the same, it is necessary that the conditions used to determine responses are standardized to resemble closely certain features of one or more of the stages of fire behaviour given in **4.2**, in order to assist in assessing and/or controlling an identified hazard. Although it is unlikely that any simple or single test will predict the actual fire performance of the product or structure in a real fire, in certain cases it is possible to relate the fire performance under a given method to a fire scenario, i.e. a planned representative scale test carried out under known limitations, which is nevertheless typical of a specific real fire situation. In this way the validity of the standard method and applicability of its results can be established (see **6.3**).

5.2 The methods described in this series of standards fall into two broad categories.

a) Those methods that are concerned with the initiation and development of a fire, particularly in fire compartments. This involves the use of methods to assess properties such as ignitability, spread of flame, heat release, smoke obscuration and toxicity. These properties of combustible products determine their involvement in fire and their ability to spread flame, their propensity to transfer and extend fire, and their contribution to the development of adverse environments.

b) Those methods that are concerned with the ability of an element of construction to protect one or more compartments within a building from a developing or fully developed fire in an adjacent compartment. In simple terms, a fully developed fire in a compartment exhibits two types of behaviour.

1) In one, the combustion during the flame phase is controlled by the ventilation of the compartment, with the rate of combustion being approximately proportional to the air supply through openings of the compartment and not in any decisive way being dependent on the amount, porosity and particle shape of the fuel.

2) In the other, the combustion during the flame phase is controlled by the properties of the fuel bed, the rate of combustion being determined by the amount, porosity and particle shape of the fuel and being largely independent of the air supply through the openings.

The boundary between the two types of fire behaviour is not sharply defined. However, information concerning ventilation controlled fires is sufficient to allow a temperature/time relationship to be established, thus defining the heat exposure conditions for constructions under test.

5.3 Examples of methods of test (with the Part numbers of this standard in which they are specified) are shown in Figure 2, against the background of Figure 1 to illustrate the relationship between the fire phenomena they are designed to assess and the stages of development of an uncontrolled fire.

6 Validation of methods of fire testing

6.1 General. Validation of any method of fire testing is a major part of any consideration of its role and nature and its use in connection with fire hazard assessment. In the development and use of fire tests, validation is taken as a demonstration that a given method is soundly based, adequate and effective. The three aspects under which validation is usually considered are given in **6.2** to **6.4**.

6.2 Apparatus and procedure

6.2.1 It is important that the design and specification of the apparatus and the test procedure used are such that the method has an acceptable level of repeatability and reproducibility, can be used for the range of products or structures for which it is intended and is sufficiently sensitive to give adequate discrimination in fire performance of the product or element of construction. In those cases where the method cannot be made sensitive to small changes in specimen behaviour, the application of the test has been limited.

6.2.2 It is possible to identify, in broad terms, the factors which affect variability in the method, and apart from sampling errors and specimen variability, these arise from operator errors, differences in instruments and equipment, calibration procedures and test environment. Although with care it is possible to reduce some of these factors, in practice it has proved extremely difficult to isolate and correct for specific causes of variability and it has to be recognized that unavoidable random errors exist in all methods of fire testing. It is possible to estimate repeatability within a laboratory and reproducibility between laboratories by undertaking comparison studies. The range of variation between any two laboratories can be as little as 5 % with some well defined methods but can be as high as 25 % with other methods.

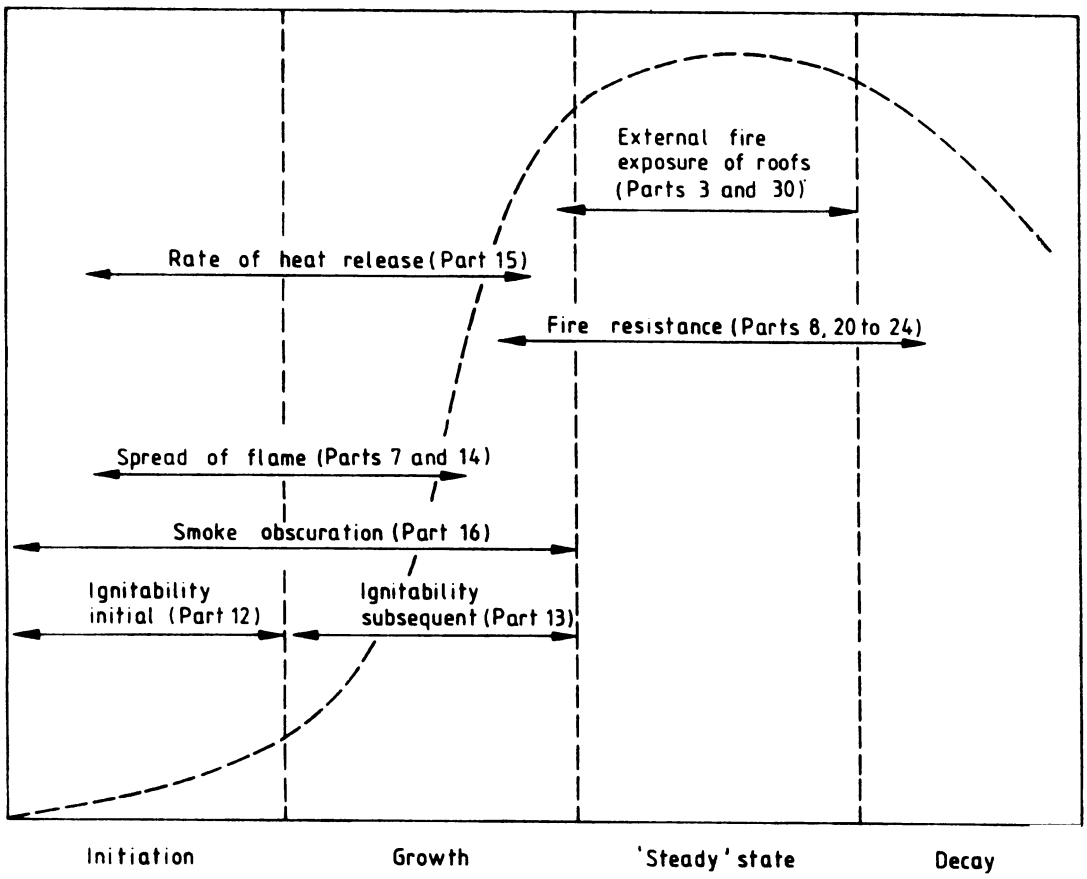


Figure 2 — Fire phenomena and the Part numbers of this standard describing methods to examine them, related to the stages of an uncontrolled fire in the compartment of origin

6.2.3 There is also a need to maintain instruments used in fire testing so that their accuracy does not deteriorate significantly and to calibrate them at recognized intervals against the approved reference standards as specified in BS 5781-1. Existing facilities may be adopted, and it is envisaged that, where specialized services are required for calibrating apparatus for fire testing, the preparation of additional documents may need to be considered.

6.3 Fire simulation

6.3.1 In order to establish the validity of standard methods of test it often becomes necessary to undertake experimental investigations to study the correlation between information given by the standard test and the events of a real fire. It has been customary to refer to such ad hoc investigations as real fire tests. This is not strictly correct since real fires are random, uncontrolled and unpredictable occurrences which can only be studied afterwards. The experimental fires developed in laboratories or under laboratory conditions to study fire behaviour in a realistic environment should be considered as fire simulation methods.

6.3.2 Fire simulation methods are designed to simulate one or more aspects of a typical fire progression, generally by selecting a source of heat and/or heating environment. The concept consists of selecting a particular type of fire and representing it in a fire scenario (see **5.1**) with some realism while maintaining the ability to control the exposure conditions. These methods range in complexity from studies of burning behaviour in a small room, a corridor or corner arrangement to studies of fires in full size buildings. They have three important common factors, in that they are instrumented, have an agreed fire load and method of ignition. The observed behaviour of the particular products can be compared with that obtained from the relevant standardized tests. It is sometimes possible to compare the results obtained from the fire scenario with data from a real fire, and the direct relevance of the data obtained from the standardized method can then be established. This may provide more useful information than studies of real fires after they have occurred.

6.4 Application. When considering the application of the data derived from the methods, whether they are simple physical or chemical properties or complex phenomena simplified into some graded index, many problems will arise because the level of acceptance of a product, component or element of construction does not depend solely on the response of the specimens to one method or a range of methods. The application of the data is also influenced by the different ways in which the product, component or element of construction may be used in practice and consequently levels of risk it may create are variable. It is not intended that acceptance criteria will be given for any of the methods in this series of standards. Levels of acceptance are normally established by those specifiers and legislative authorities wishing to make use of the results of the method. Due to the random, and sometimes systematic variability in all these methods, such products, components and elements of construction will sometimes meet and sometimes not meet the levels of acceptance established in this way.

6.5 Laboratory approval scheme. Laboratories undertaking fire testing may seek approval of their equipment and operations for conducting tests to this series of standards under national schemes such as the National Testing Laboratory Accreditation Scheme for fire test laboratories undertaking routine testing of products, components and elements used in construction. The results obtained at laboratories approved to carry out the work have an established credibility because of the strict requirements to which the laboratories conform and because of the interchange of technical experience in interpreting the requirements of the relevant methods when applied to new or unusual applications.

7 Test results

7.1 Reports. The reports given for any of the methods in this series of standards require that full information on the product or structure tested be given together with the results and observations made. It is not intended that acceptance criteria will be established, but guidance on the use of the test results will normally be given for each method.

In addition to the full reports, provision is made for the use of summary reports that require that the essential product identification and results are given and that sufficient information is included to support a claim made by the manufacturer.

NOTE Full reports can be made available when required, but only through the sponsor.

7.2 Use of results. It should be understood that the report only gives information on the performance of the specimen(s) as tested, and is only applicable to other products or structures which are genuinely representative of the original tested. In cases where, for example, raw materials used in the manufacture of the product or structure as tested have changed or the design has been modified, the results may be invalidated. In such cases it will generally be necessary to retest or, under certain conditions, seek an assessment from an appropriate authority (such as the laboratory which carried out the original test).

7.3 Assessments. A fire assessment is an evaluation, given on the basis of information available to the assessor at the time, on the likely performance of a product or element of construction if it were subjected to a particular fire test condition (usually defined by a fire test specification). Assessments usually comprise limited extrapolations of existing results, or are forecasts on the effect of limited modifications to a product or element of construction that has previously been tested.

Where an assessment is the basis of the performance claimed for a product, component or element of construction, it is essential that this should be made clear by the inclusion of the word "assessed" in the statement e.g. 30 min fire resistance to BS 476-8:1972 (assessed). An assessment should indicate the basis on which it was made and what limitations are placed on the conclusions reached.

NOTE The term assessment is used in a special context when referred to in Building Regulations.

7.4 Product performance. Information required on the performance of individual products, component or structural designs when evaluated under this series of standards should be obtained directly from the manufacturer/designer or agent. Such information is not available from BSI or the testing laboratories but appropriate references are included in Appendix A.

8 Fire performance claims

NOTE Attention is drawn to the Misrepresentation Act 1967, the Trades Descriptions Act 1968 and 1972, the Supply of Goods (Implied Terms) Act 1973 and the Health and Safety at Work etc. Act 1974.

8.1 The following guidance is given to help those who prepare information for technical publications, trade literature, advertising copy or the labelling of goods that contain a description of fire performance of building products, components or elements of construction:

a) avoid using terminology that makes claims that cannot be substantiated, gives a misleading impression of performance or implies a judgement of performance in a real fire;

b) be familiar with the definitions of terms associated with fire in BS 4422 and in the relevant methods of test and use the correct terms;

c) avoid coining brand or trade names for products, components or structures that may imply fire safety misleadingly;

d) support all statements on fire properties by quoting the relevant performance and the methods of test concerned;

e) ensure that the method cited is strictly relevant to the statements made;

f) avoid vague unsubstantiated implications that the product, component or element of construction complies with British Standards, Building Regulations etc.;

g) if there are recognized fire hazards in the use or installation of a product always warn the user and give advice on its correct usage to minimize fire risks.

NOTE This is a legal requirement under the Health and Safety at Work etc. Act 1974.

8.2 To maintain the validity of any claim for fire performance, it is important to ensure that no changes are made to a product, component or to an element of construction that will adversely affect the fire performance claimed.

Appendix A Bibliography

NOTE For a list of standards publications referred to in this Part, see the inside back cover.

Fire safety data OR6, Test facilities[7]. Fire Protection Association.

Fire safety data NB2, Ignition, growth and development of fire[7]. Fire Protection Association.

Fire terminology. *Building Research Establishment Digest 225,* HMSO, 1981.

FISHER R W. Fire test results on building products, fire propagation[7]. Fire Protection Association, October 1980.

FISHER R W. Fire test results on building products, surface spread of flame. Fire Protection Association,[7] December 1979 (updated 1981).

FISHER R W and ROGOWSKI B F W. Results of fire propagation tests on building products. *Building Research Establishment report.* HMSO, 1976.

FISHER R W and SMART P M T. Results of fire resistance tests on elements of building construction. *Building Research Establishment Reports,* HMSO, vol. 1. 1975 vol. 2. 1976.

FISHER R W and ROGOWSKI B F W. Results of surface spread of flame tests on building products. *Building Research Establishment report.* HMSO, 1976.

Information sheets on building products B1 to 12[7]. Fire Protection Association.

ISO 834-1975, *Fire resistance tests — Elements of building construction.*

ISO 1182-1979, *Fire tests — Building materials — Non-combustibility test.*

ISO 1716-1973, *Building materials — Determination of calorific potential.*

ISO 3008-1976, *Fire resistance tests — Door and shutter assemblies.*

ISO 3009-1976, *Fire resistance tests — Glazed elements.*

ISO 3261-1975, *Fire tests — Vocabulary.*

ISO/TR 3814-1975, *The development of tests for measuring "reaction to fire" of building materials.*

ISO 4736-1979, *Fire tests — Small chimneys — Testing at elevated temperatures.*

ISO 5925/1-1981, *Fire tests — Evaluation of performance of smoke control door assemblies — Part 1: Ambient temperature test.*

ISO/TR 6585-1979, *Fire hazard and the design and use of fire tests.*

MALHOTRA H L. Fire tests and fire hazard assessment. *Fire Prevention No 144,* October 1981.

READ R E H, ADAMS F C and COOKE J M E. Guidelines for the construction of fire resisting structural elements. HMSO, 1980.

[7] Available from the Fire Protection Association, Aldermary House, Queen Street, London, EC4N 1TJ.

Publications referred to

BS 476, *Fire tests on building materials and structures.*

BS 476-3, *External fire exposure roof test.*

BS 476-4, *Non-combustibility test for materials*[8)].

BS 476-5, *Method of test for ignitability*[8)].

BS 476-6, *Method of test for fire propagation for products*[8)].

BS 476-7, *Surface spread of flame tests for materials.*

BS 476-8, *Test methods and criteria for the fire resistance of elements of building construction.*

BS 476-11, *Method for assessing the heat emission from building materials*[8)].

BS 476-12, *Method for measuring the ignitability of products using direct flame impingement*[9)].

BS 476-13, *Method for measuring the ignitability of products subjected to thermal irradiance*[9)].

BS 476-14, *Method for measuring the rate of flame spread on surfaces of products*[9)].

BS 476-15, *Method for measuring the rate of heat release of products*[9)].

BS 476-16, *Method for measuring the smoke release (obscuration) of products*[9)].

BS 476-20, *General principles and requirements for the determination of the fire resistance of elements of building construction*[9)].

BS 476-21, *Methods for the determination of the fire resistance of load bearing elements of building construction*[9)].

BS 476-22, *Methods for the determination of the fire resistance of non-load bearing elements of building construction*[9)].

BS 476-23, *Methods for the determination of the contribution provided by components and elements to the fire resistance of a structure*[9)].

BS 476-24, *Methods for the determination of the fire resistance of elements of construction penetrated by building services*[9)].

BS 476-30, *Methods for measuring the performance of flat and sloping roofs exposed to an external fire*[9)].

BS 476-31, *Methods for measuring smoke penetration through door sets and shutter assemblies*[8)].

BS 4422, *Glossary of terms associated with fire.*

BS 4422-1, *The phenomenon of fire.*

BS 4422-2, *Building materials and structures.*

BS 4422-3, *Means of escape.*

BS 4422-4, *Fire protection equipment.*

BS 4422-5, *Miscellaneous terms.*

BS 5781, *Measurement and calibration systems.*

BS 5781-1, *Specification for systems requirements.*

BS 6336, *Guide to development and presentation of fire tests and their use in hazard assessment.*

DD 70, *Method of test for ignitability of building products*[8)].

PD 6496, *A comparison between the technical requirements of BS 476-8:1972 with other relevant international standards and documents*[8)].

ISO/TR 3956, *Principles of structural fire-engineering design with special regard to the connection between real fire exposure and the heating conditions of the standard fire-resistance test (ISO 834).*

ISO/TR 5657, *Fire tests — Reaction to fire — Ignitability of building products.*

[8)] Referred to in the foreword only.

[9)] In course of preparation.

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL