
British Standard

Fire tests on building materials and structures

Part 7. Method for classification of the surface spread of flame of products

Essais au feu des matériaux et structures du bâtiment

Partie 7. Méthode de classification de la propagation de la flamme en surface des produits

Brandschutztechnische Prüfungen an Baustoffen und Bauten

Teil 7. Verfahren zur Klassifizierung der Ausbreitungsgeschwindigkeit der Flamme
an der Erzeugnisoberfläche

Foreword

This Part of BS 476 has been prepared under the direction of the Fire Standards Committee. It supersedes BS 476 : Part 7 : 1971, which is withdrawn, but will still be made available on request since it is referred to in building regulations and other legislative documents. This revision has been prepared with the aim of improving the repeatability and reproducibility of the test results by clarifying procedures and by giving additional guidance to test operators. The modifications are not expected to cause changes in material classifications, although the introduction of the water-cooled specimen holder is intended to improve the ability to classify certain thermoplastics materials.

In this method, specimens of the product (material, composite or assembly) are subjected to a specified heating and ignition regime. The test takes account of the combined effect of factors such as ignition characteristics and the extent to which the surface of the product spreads flame. The influence on these factors of any underlying materials, in relation to their ability to influence the rate of fire growth is also taken into account. The test result is a function of distance of, and rate of, lateral spread of flame, and this is classified according to performance as classes 1 to 4.

Whilst this test has been designed to give information on the performance of a product in the early stages of a fire, it should not be considered or used by itself for describing or appraising the fire hazard of a material, composite or assembly under actual fire conditions. Neither should it be used as the sole source on which a valid assessment of hazard pertaining to surface spread of flame can be based.

A series of second generation 'reaction to fire' tests, including an ignitability test, a surface spread of flame test and a heat release test are under preparation in ISO/TC 92, Fire tests on building materials, components and structures. The United Kingdom is participating in this work, and is currently developing a surface spread of flame test with higher irradiance levels than the test adopted at present.

A small scale test procedure for assessing spread of flame characteristics, which might be useful for quality control work or research and development, is being considered to form BS 476 : Part 14*.

Attention is drawn to the Health and Safety at Work etc. Act 1974, and the need to ensure that the method of test specified in this standard is carried out under suitable environmental conditions to provide adequate protection to personnel against the risk of fire and inhalation of smoke and/or toxic products of combustion.

Technical development of this test method is being continued and it is likely that an amendment will be prepared in relation to the construction of the radiation panel (in particular, the choices of porous refractory or tunnel type burner blocks) and detailed calibration procedures.

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

* In preparation.

Amendment No. 3
published and effective from 15 April 1993
to BS 476 : Part 7 : 1987

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of flame of products

Revised text

AMD 7612
April 1993

Clause 10.5

Delete the existing text (but not the existing note) and substitute the following:

'10.5 A suffix Y shall be added to the classification if any of the following occur:

- (a) The product distorts during testing (e.g. curls away at the hot end) so that areas of the test specimen are shielded from the irradiance from the radiation panel such that the test classification may be affected.
- (b) The test specimen does not remain in position for the duration of the test (see 8.1(e)) because the product softens or slumps.
- (c) The test specimen delaminates, with the flaming portion of the specimen falling away, thus preventing further flame spread.
- (d) There is delamination from the substrate over a substantial area of the specimen.
- (e) A thin product that softens or melts and coalesces so that areas of the substrate become exposed but without the product falling away.

NOTE to items (a) to (e). Movement of the test specimen should not lead to the addition of a Y suffix if this results in the specimen being subjected to increased irradiance from the radiation panel.'

In the existing note, after 'NOTE', insert 'to clause 10'.

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Method

1 Scope

This Part of BS 476 specifies a method of test for measuring the lateral spread of flame along the surface of a specimen of a product orientated in the vertical position, and a classification system based on the rate and extent of flame spread. It provides data suitable for comparing the performances of essentially flat materials, composites or assemblies, which are used primarily as the exposed surfaces of walls or ceilings.

Appendix A gives guidance to operators carrying out this method of test. Appendix B discusses the effect of thermal characteristics on the performance of assemblies and gives advice on the construction and preparation of test specimens. Appendix C is a summary test report indicating the information to be given.

NOTE 1. The test results relate only to the behaviour of the test specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

NOTE 2. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard, the definitions given in BS 4422 : Parts 1, 2 and 5 and BS 476 : Part 10 apply, together with the following:

- 2.1 exposed surface(s).** The surface(s) of the product subjected to the heating conditions of the test.
- 2.2 spread of flame.** The propagation of a flame front over the surface of a product under the influence of imposed irradiance.
- 2.3 flame front.** The furthest extent of travel of a coherent flame along the reference line marked on the test specimen.
- 2.4 irradiance (at a point on a surface).** The total thermal radiant flux incident on an infinitesimal element of the surface containing the point divided by the area of that element.
- 2.5 essentially flat surface.** A surface from which can be obtained specimens that have an irregularity from a flat plane which is less than ± 3 mm.
- 2.6 flashing.** Existence of flame on or over the surface of the specimen for periods of less than 1 s.
- 2.7 transitory flaming.** Existence of flame on or over the surface of the specimen for periods of between 1 s and 3 s.
- 2.8 sustained flaming.** Existence of flame on or over the surface of the specimen for periods of over 3 s.
- 2.9 radiant exitance (at a point of a surface).** Quotient of the radiant flux leaving an element of the surface containing the point, by the area of that element.

3 Suitability of a product for testing

3.1 Surface characteristics

3.1.1 A product having one of the following is suitable for evaluation by this method:

- (a) an essentially flat exposed surface;
- (b) a surface irregularity that is evenly distributed over the exposed surface (see A.1), provided that:
 - (1) at least 50 % of the surface of a representative square area of 280 mm $\times$ 280 mm lies within a depth of 6 mm from a plane taken across the highest points on the exposed surface;
 - (2) any cracks, fissures or holes do not exceed 6.5 mm in width nor a depth of 10 mm, and the total area of such cracks, fissures or holes at the surface does not exceed 30 % of a representative square area of 280 mm $\times$ 280 mm of the exposed surface.

3.1.2 Where a product has areas of its surface which are distinctly different, but each of these separate areas can satisfy the surface characteristics specified in 3.1.1, then more than one surface spread of flame test shall be conducted to evaluate fully the product.

3.1.3 When an exposed surface does not comply with the requirements of either 3.1.1(a) or 3.1.1(b), it is permissible for the product to be tested in a modified form with an essentially flat exposed surface, and this shall be stated in the report. A prefix D shall be added to the spread of flame classification of any product which has been tested in a modified form.

3.2 Thermally unstable products

In cases where the test method is inadequate for assessing products that react in particular ways under exposure to the specified heating conditions (see 8.2.3), provision shall be made either to apply a suffix to the result (see 10.2 and item (j) of clause 11) or to prohibit an assessment being made because the product is unsuitable for testing by this method.

NOTE. Products showing these characteristics do not necessarily behave poorly in fire situations and should be assessed by other test methods.

4 Test specimens

4.1 Number of specimens

A minimum of six and a maximum of nine test specimens shall be provided which shall be representative of the exposed surface of the product.

4.2 The exposed surface

The product shall be tested on that face which will normally be exposed in practice, taking account of the following.

- (a) If it is possible for either or both of the faces to be exposed in use then, if the faces are different, or if the core to those faces is asymmetrical, both faces shall be tested.
- (b) If the face of the product contains a surface irregularity that is specifically directional, e.g. corrugations which may, in practice, run horizontally or vertically, the product shall be tested in both orientations.
- (c) If the exposed face contains distinct areas of different surface finish or texture, then the appropriate number of specimens shall be provided for each distinct area of such finish or texture to be evaluated.

4.3 Size of specimens

4.3.1 With the following exception, the specimens shall be rectangular and 885 ± 5 mm long $\times$ 270 ± 5 mm wide. However, if specimens are being prepared with a view to achieving only a class 1 standard of performance then it is permissible for the length of the specimen to be reduced to a minimum of 250 mm. If transitory flaming is exhibited by any short specimen to the end of the specimen, then full size specimens shall be tested. Where reduced specimen lengths are used, then the remaining length shall be a filler piece comprising a panel of non-combustible board, the surface of which shall be level with the surface of the specimen. The use of reduced size specimens shall be reported.

4.3.2 When the product is of insufficient size to allow the specimen size to be achieved in width and/or length, it is permissible for the smaller pieces of the product to be placed adjacent to each other to obtain the required dimension, provided that an essentially flat surface can be achieved and it is considered that such a procedure does not have any influence on the surface flame spread. The use of such specimens shall be reported.

4.3.3 All specimens shall be tested at full thickness providing they will fit into the specimen holder. If the product is of such a thickness that it will not fit into the specimen holder, its thickness shall be reduced by cutting away the unexposed face of the product to reduce the thickness to a minimum of 50 mm.

4.4 Construction of specimens

4.4.1 When the product is a surface coating, it shall be applied to the selected substrate (see appendix B), using a method and application rate recommended by the manufacturer for its use.

4.4.2 When the product is a material or composite which would normally be attached to a substrate, it shall be

tested in conjunction with the selected substrate (see appendix B), using the fixing technique recommended by the manufacturer, e.g. bonded with the appropriate adhesive or mechanically fixed.

4.4.3 When cutting specimens from products with irregular surfaces (see 3.1.1(b)), the highest point of the surface shall be arranged to be in contact with the pilot flame when the specimen is in its test position.

4.5 Conditioning

4.5.1 All specimens shall be conditioned to constant mass* at a temperature of 23 ± 2 °C, and a relative humidity of 50 ± 10 %, and maintained in this condition until required for testing.

4.5.2 Backing boards and spacers (see 4.7) shall be conditioned for at least 12 h before use in the conditions specified in 4.5.1.

4.6 Preparation of specimens

4.6.1 Reference line. The exposed face of each specimen shall be marked on its surface with a reference line along its length 95 ± 3 mm above its bottom edge. To assist in the observation of flame travel, the specimen shall be marked at intervals along its length with lines normal to the reference line and at the intervals shown in figure 7.

NOTE. Special provisions may be required for certain types of material which may be affected by the marking.

4.6.2 Products without air gaps. Where a product will normally be used without an air gap behind it, then the unexposed face of the specimen shall be placed directly on, and in direct contact with, a backing board without any adhesion or mechanical fixing.

4.6.3 Products with air gaps. Where a product will normally be used with an air gap behind it, then the specimen shall be placed over the spacers positioned around its perimeter and mounted onto a backing board so that a 25 ± 1 mm enclosed air gap is provided between the unexposed face of the specimen and the backing board.

4.7 Backing boards and spacers

4.7.1 The backing boards shall be rectangular, 885 ± 5 mm long $\times$ 270 ± 5 mm wide, and shall be made of non-combustible insulation board of oven-dry density 825 ± 125 kg/m³ and nominal thickness 12 mm.

4.7.2 Spacers used to form air gaps within an assembly shall be of the same material as the backing boards and shall be 25 ± 1 mm thick and approximately 20 mm wide.

4.7.3 It is permissible for backing boards and/or spacers used to back the specimens to be re-used after storing in the conditioning atmosphere for at least 12 h (see 4.5.2), if they are not contaminated. If there is any doubt about the condition of a backing board or spacer it shall be discarded.

* Constant mass is considered to be attained when two successive weighing operations, carried out at an interval of 24 h, do not differ by more than 0.1 % of the mass of the specimen, or 0.1 g, whichever is the greater.