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BRITISH STANDARD DEFINITIONS FOR FIRE-RESISTANCE, INCOMBUSTIBILITY AND NON-INFLAMMABILITY OF BUILDING MATERIALS AND STRUCTURES

(INCLUDING METHODS OF TEST).

LONDON
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The Building Divisional Council, under which this Specification was prepared, consists of representatives from the following Government Departments and Scientific and Industrial Organisations:—

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The Government Departments and Scientific and Industrial Organisations marked with an asterisk on the above list, together with the following, were directly represented on the Committee entrusted with the preparation of this Specification.

British Electrical and Allied Industries Research Association.
Building Research Station (D.S.I.R.)
Fire Offices Committee.
Forest Products Research Laboratory (D.S.I.R.).
Institution of Fire Engineers.
London Master Builders' Association.
National Fire Brigades Association.

This Specification, having been approved by the Building Divisional Council, was published by the authority of the General Council as a British Standard on 29th December, 1932.

NOTE.

In order to keep abreast of progress in the Industries concerned, the British Standard Specifications are subjected to periodical review.

Suggestions for improvements, addressed to the British Standards Institution, 28, Victoria Street, London, S.W.1, will be welcomed at all times. They will be recorded, and in due course brought to the notice of the Committees charged with the revision of the Specifications to which they refer.

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PD 374

Amendment No. 2 : July, 1945

to B.S. 476 : 1932

Addendum

SURFACE SPREAD OF FLAME

Introduction

It was noted in the Introduction to B.S. 476 that the demand for incombustibility on occasion may be unreasonably severe and definitions and a test were therefore provided to distinguish degrees of inflammability. Experience in testing materials of various types has shown, however, that this test does not give completely the degree of discrimination which is required. Many building materials in common use, and having valuable properties in other directions, are too inflammable to be classified in the test, even although, in practice, there are obvious differences in the nature of the fire hazards they may present. Observation has shown that one difference of importance is that of the rate at which flames spread across the surface of combustible materials, particularly in the case of those used as lining materials for walls and ceilings. For any one material this rate of spread may vary with the intensity of radiant heat to which the material may be subjected as the fire develops, but this variation is not necessarily of the same order from one material to another.

A test is therefore now introduced to differentiate between the rates at which flames will spread over the surfaces of those combustible materials used as wall and ceiling linings, which takes into account the effects of radiant heat on the materials in influencing their rate of burning.

Scope

1. Only building materials used as linings for floors and ceilings shall be classified by this test.

Definition

2. Combustible materials shall be classified as having surfaces of very low flame spread, surfaces of low flame spread, surfaces of medium flame spread, and surfaces of rapid flame spread, according to their behaviour when tested in the manner specified.

Test Procedure

3. (i) *Size and number of specimens.*—At least 3 test pieces, each 36 in. × 9 in. × the normal thickness, from each sample shall be subjected to test, but a greater number may be required at the discretion of the testing authority.

ERRATUM

Clause 1. For "floors" read "walls"

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(ii) *Preparation and conditioning of specimens.*—Before test, the edges together with a strip 1½ in. wide from the edges on the unexposed face shall be painted, with sodium silicate paint of the composition defined in B5/ARP 39 (see Note at end), after which the specimens shall be conditioned to a moisture content in equilibrium with air at 50–70°F. and 55–65 per cent relative humidity.

(iii) *Method of test.*—The test piece shall be placed with its long axis horizontal and its face vertical. The intensity of radiant heat to which the specimen shall be exposed shall vary along the length of the specimen in such a way that the temperature of gold disc thermocouples if placed in the same plane and along the position occupied by the test piece would be raised to the following temperatures within ± 3 per cent.

Distance from hotter end (in.)	0	3	6	9	12	15	18	21	24	27	30	33	36
Temp. °C.	500	435	385	345	310	280	250	225	200	180	160	145	130

The gold disc thermocouple shall consist of a 1 in. diameter gold disc, 35 S.W.G., to the centre of which shall be silver soldered a chromel-alumel thermocouple made from 26 S.W.G. wire. The gold disc thermocouple shall be well blackened on the thermocouple side with platinum black or lamp black and this side exposed to the radiant heat. The other side of the disc shall be maintained bright and polished.

Support for the specimen shall be provided by nailing it to a backing of wood faced with asbestos millboard in such a way that burning can take place on the face of the specimen without obstruction from other supports. The nails shall be placed along a line ¾ in. from the long edge of the specimen and at 3 in. distances apart.

The room in which the tests are made shall be substantially free from draughts.

The specimen shall be brought from room temperature into its position of exposure to the full intensity of radiant heat taking not more than 5 seconds over this operation, and immediately a vertical luminous gas flame 7 in. long issuing from ⅜ in. diameter orifice shall be applied to the hot end for 1 minute. The orifice shall be placed at not more than ¼ in. forward from the surface and at ¼ in. above the lower edge of the specimen.

(iv) *Observations during testing.*—As soon as the igniting flame is in contact with the specimen, observations shall be made of the time of spread of the flame front for measured distances along the top and bottom edges of the specimen. Measurements shall be continued until the flame front has either traversed the whole surface, or, if this does not take place, either until flames have died out or for 10 minutes, whichever is the longer. Similar observations shall be made on all the specimens of the sample in turn.

(v) *Computation of results.*—The following procedure shall be adopted for determining the mean distance of spread of flame :

(*a*) If the distance of spread of flame does not exceed 15 in. on any of the specimens, the mean value of the distances along the top and bottom edges of all the test pieces tested in the sample shall be taken.

(*b*) If the distance of spread of flame exceeds 15 in. on any one specimen a mean curve of rate of spread with time shall be obtained in the following manner :—

A curve of the distance of spread of flame with time shall be drawn for each specimen by plotting the mean value of the distances along the top and bottom edges against time. If flaming ceases along one edge while continuing along the other, the distance at which flaming ceases on the one edge shall be used together with the additional results from the other edge to determine mean values.

From the curves for each specimen, a mean curve shall be constructed for the whole group. As before, if the curve for one specimen ceases at some particular distance while the remainder continues, the value at this distance shall be used to determine the mean of all the specimens, *i.e.*, in effect the curve shall be continued as a line parallel to the time ordinate and averages then determined in the normal way.

Classification

4. Materials shall be classified into one of the following groups according to their observed behaviour under test. Where the surfaces of a material are different both sides shall be tested and classified.

Class 1. *Surfaces of very low flame spread.*—Those surfaces on which not more than 6 in. mean spread of flame occurs.

Class 2. *Surfaces of low flame spread.*—Those surfaces on which during the first 1½ minutes of test the mean spread of flame is not more than 15 in. and the final spread does not exceed 18 in.

Class 3. *Surfaces of medium flame spread.*—Those surfaces on which during the first 1½ minutes of test the mean spread of flame is not more than 15 in. and during the first 10 minutes is not more than 33 in.

Class 4. *Surfaces of rapid flame spread.*—Those surfaces on which during the first 1½ minutes of test the mean spread of flame is more than 15 in., or during the first 10 minutes is more than 33 in.

NOTE ON COMPOSITION OF SODIUM SILICATE PAINT

The following is the relevant extract from B.S./ARP 39 :—

The silicate paint shall conform to the following proportions :—

Kaolin . . .	150 lb.
Sodium silicate .	112 lb.
Water . . .	100 lb.

The sodium silicate shall be in the form of an aqueous syrup in which the ratio of silica to soda is between 3·2 and 3·4 and which has a specific gravity between 1·41 and 1·43.

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The figures in British measure are to be regarded as the Standard. Approximate metric equivalents are given for the convenience of users in countries in which the metric system has been generally adopted.

INTRODUCTION.

There are three ways in which building regulations are utilised to minimise fire risks in buildings.

A. By making certain requirements as regards the planning of buildings, *e.g.*, the provision of suitable exits and means of escape, limitations of height, floor area and volume, etc.

B. By requiring certain types of construction for elements of structures and certain properties for the structural or decorative materials to be used therein.

C. By demanding fire-extinguishing appliances as part of the equipment of buildings and easy access for fire brigade appliances.

This Specification deals with Item B only.

The present requirements relating to fire-resistance, incombustibility and non-inflammability of building materials and structures are capable of varying interpretations.

In attempting to put the matter on a rational basis by drawing up definitions for expressions used in legal provisions having for their object the control of fire risks, the Committee appointed by the British Standards Institution felt it necessary to consider the question *ab initio* and to decide at the outset what definitions were needed and how they should be applied. They further considered that these should be so framed that they might be employed to decide whether or not any given type of structure or any given material complied with the requirements. The existing legal provisions were carefully reviewed, with the idea of elucidating the original purpose behind them, in order that their real intention could be fully met by the application of the new Definitions.

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