BS 4790 : 1987

UDC 645.13 : 536.468

British Standard Method for

Determination of the effects of a small source of ignition on textile floor coverings (hot metal nut method)

Méthode de détermination des effets d'une petite source de flamme sur les revêtements de sols textiles (méthode de l'écrou chaud)

Verfahren zur Beurteilung des Verhaltens textiler Bodenbeläge gegenüber einer kleinen Zündquelle (Heißmetallmutterprüfung)

British Standards Institution

Foreword

This British Standard prepared under the direction of the Textiles and Clothing Standards Committee is a revision of BS 4790 : 1972 which is withdrawn. This revision makes provision for the testing of the floor covering fitted with an underlay or in the fully adhered state as an alternative to the loose-laid mode described in the 1972 edition, in order to reflect more accurately the performance of the floor covering in use.

The method takes no account of smoke and toxic fumes that may be produced. Surface flash in pile structures may be assessed by the method given in BS 4569.

The method is not intended to be used to assess the effects of other sources of ignition nor to assess the contribution a textile floor covering will make to an established fire.

Attention is drawn to BS 5287, which deals with the labelling of textile floor coverings tested to BS 4790 and reference should also be made to BS 6307, which is intended to supplement this standard.

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

Contents

Method

1 Scope

This British Standard describes a method for the determination of the effects of a small source of ignition on textile floor coverings using a hot metal nut. It is applicable to all types of textile floor coverings whether loose-laid or fully adhered and used with or without an underlay.

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

2 Definitions

For the purposes of this British Standard the following definitions apply.

NOTE. Definitions 2.1, 2.2 and 2.3 have been extracted from BS 6373.

2.1 afterglow. Persistence of glowing of a material, under specified test conditions, after cessation of flaming or, if no flaming occurs, after removal of the ignition source.

2.2 flame (verb). To undergo combustion in the gaseous phase with emission of light.

2.3 smouldering. The combustion of a material with or without emission of light and generally evidenced by smoke.

2.4 loose-laid. A specimen placed on a horizontal substrate and subsequently held in position only by the mass of the clamping ring.

3 Principle

A heated stainless steel nut is placed on the use-surface of the material to be tested. The times of flaming and of afterglow and the greatest radius of the effects of ignition from the point of application of the nut are measured.

4 Apparatus

4.1 *Hexagonal nut,* of grade A2 as specified in BS 6105, of mass $30\ ^{+3}_{-2}$ g, and of dimensions as specified for M16 in BS 3692.

NOTE. There is a loss in mass of these nuts on repeated heating, therefore the mass should be checked at intervals and the nut discarded when it falls outside the given tolerance.

4.2 *A steel annulus,* of area equalling 16 mm square cross section and of internal diameter 250 mm (clamping ring).

4.3 *Transparent grid,* of diameter 245 mm marked with concentric rings of 5 mm radial separation.

4.4 *Muffle furnace,* capable of heating the nut to 900 °C.

4.5 *Test chamber,* as described in appendix A and illustrated in figure 1.

4.6 *Stop-watch,* accurate to 1 s.

4.7 *Crucible tongs.*

5 Atmosphere for conditioning and testing

The atmosphere required for conditioning and testing shall be the standard temperate atmosphere for testing textiles defined in BS 1051, i.e. a relative humidity of 65 ± 2 % and a temperature of 20 ± 2 °C (see also **8.1**).

6 Test specimens

From each sample, cut at least three test specimens each measuring 300 mm x 300 mm, including any backing or underlay that forms part of the final installation, following the procedure described in BS 4664.

7 Preparation of test specimens

7.1 Treatment of specimens with pile surface

Raise the pile by shaking the specimen when held by the edge to which the pile is pointing.

7.2 Conditioning

Lay each specimen flat, singly and use-surface uppermost in the standard temperate atmosphere for testing textiles (see clause 5) for at least 24 h or for a longer period sufficient to ensure that the mass of the specimen shows no progressive change greater than 0.25 % when determined at intervals of 2 h. The minimum conditioning time of 24 h shall also apply to specimens mounted in accordance with the method described in **8.3** to allow sufficient time for volatile substances present in the adhesive to evaporate, and shall also apply to the underlay specified in **8.4**.

8 Methods of mounting test specimens

8.1 General

The test specimen shall be mounted in one of three ways, according to whether the textile floor covering is loose-laid, fully adhered, or loose-laid with an underlay.

The substrate shall be in good condition and free from the debris of previous tests.

8.2 Method 1: loose-laid

Place the test specimen on the floor of the test chamber (see appendix A) in the loose-laid condition ensuring that the back of the test specimen and the surface of the bottom of the box are flat.

NOTE. The supplier may assist by providing only flat specimens for testing packed between rigid boards.

After placing the clamping ring (**4.2**) on top of the specimen press down the specimen firmly with a finger in the centre and at four positions approximately mid-way between the centre and the clamping ring. If any down-and-up movement of the body of the specimen is observed showing it not to be truly in contact with the substrate it shall be replaced by another specimen.

NOTE. If the test specimen and the substrate are not truly flat then air pockets can exist at the interface; the presence of this air will tend to assist combustion which can lead to the occurrence of a falsely high radius of char.

8.3 Method 2: fully-adhered

Stick down the test specimen on the substrate using the type and quantity of adhesive recommended by the carpet manufacturer and applied in accordance with the instructions supplied with the adhesive.

8.4 Method 3: loose-laid with underlay

Place the test specimen in the loose-laid condition with an appropriate underlay interposed between the specimen and the substrate, establishing that air is not present between the specimen and underlay and underlay and substrate, as described in **8.2.**

NOTE. It is essential that the underlay specified in the contract is used in the test.

9 Test procedure

9.1 Testing atmosphere

Conduct the test in the standard temperate atmosphere for testing textiles (see clause **5**) or within 2 min of removal of the test specimen from the atmosphere.

9.2 Application of nut

Heat the nut (**4.1**) to a temperature of 900 ± 20 °C in the muffle furnace (**4.4**).

NOTE. It is not always sufficient to assume the oven is at the indicated temperature and periodically a check of the temperature of the nut should be carried out.

Mount the specimen, use-surface uppermost, on the floor of the test chamber as described in **8.2, 8.3** or **8.4** and lay the clamping ring horizontally on top so that it lies completely within the bounds of the specimen. Using the crucible tongs (**4.7**) place the heated nut onto the specimen within 3 s of its removal from the furnace. Ensure that the nut is placed centrally within the clamping ring and immediately close the sliding panel.

Open the sliding panel and remove the nut from the specimen after it has been in contact with the specimen for 30 ± 2 s, and then immediately close the sliding panel once more. Keep it closed until all effects of ignition have ceased.

After the measurements (see **9.3**) on that specimen, repeat the test and measurements on the remaining specimens.

9.3 Measurements

9.3.1 If the specimen ignites and the effects of ignition do not reach the clamping ring, note the following by use of the stop-watch (**4.6**):

(a) the elapsed time in seconds from the instant of application of the nut to the extinction of the flame;

(b) the time in seconds of any afterglow and/or smouldering subsequent to removal of the nut and to extinction of any flame.

9.3.2 Where the effects of ignition reach the clamping ring, note the time in seconds to reach the ring from the instant of application of the nut.

9.3.3 Before removing the clamping ring, and by using the transparent grid (**4.3**), measure and record the radius of the circle that just contains the affected area on the use-surface. In making the measurement, ensure that the centre of the rings of the grid coincides with the central point of application of the nut.

9.3.4 Measure and record the radius of the effects of ignition on the under-surface of the floor covering if observable, using the procedure described in **9.3.3.**

9.3.5 If the specimen does not ignite, this shall be noted.

10 Calculation and expression of results

For each of the three test specimens state the times to the nearest second for the items referred to in **9.3.1** or **9.3.2**, and the greatest radius to the nearest 5 mm of the affected areas measured as described in **9.3.3** and **9.3.4.**

11 Test report

The test report shall include the following.

(a) The statement 'The test results relate only to the behaviour of the test specimens after application of a small source of ignition; they shall not be used as a means of assessing how the product will contribute to an established fire'.

(b) A statement that the test procedure was conducted in accordance with this British Standard, i.e. BS 4790 : 1987.

(c) Where appropriate, for each specimen the time in seconds for the extinction of the flame and of afterglow and/or smouldering, measured as described in **9.3.1.**

(d) Where appropriate, for each specimen the time in seconds for the effects of ignition to reach the clamping ring, measured as described in **9.3.2.**

(e) The greatest radius to the nearest 5 mm of the affected area, measured as described in **9.3.3.**
NOTE. The radii of the other two tests may also be recorded.

(f) Where possible, the greatest radius to the nearest 5 mm of the affected area, measured as described in **9.3.4.** If the under-surface is not observable the reason for this shall be stated.
NOTE. The radii of the other two tests may also be recorded.

(g) The words 'Did not ignite', if the specimen did not ignite (see **9.3.5**).

(h) If used, the type and quantity of adhesive (**8.3**).

(i) If used, a full description of the underlay (**8.4**).

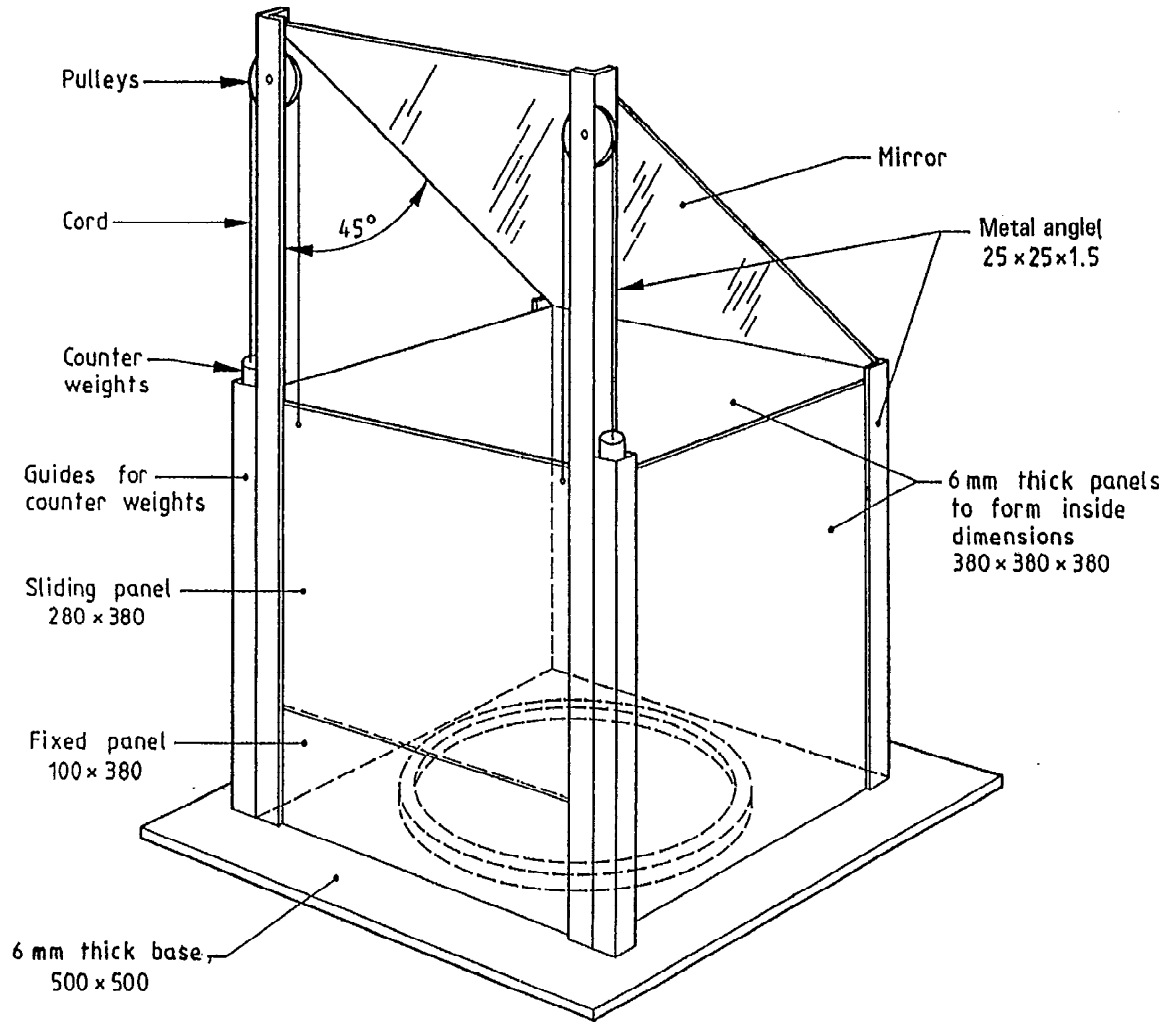
(j) The method of mounting test specimens, i.e. method 1, 2 or 3 (see clause **8**).

NOTE. Any reference to the method of test described in this standard should include the appropriate method of mounting test specimens as given in clause **8.**

Appendix

Appendix A. Test chamber

The test chamber is illustrated in figure 1 and consists of an open-top box made of 6 mm thick non-combustible heat resistant board to give inside dimensions of 380 mm x 380 mm x 380 mm. The flat bottom of the box shall be made of the same type of material and shall be easily removable. The sides are fastened together with screws or brackets and a mirror is mounted at 45 ° above the box to permit observation of the test specimens. The front panel is divided, the lower panel being fixed, and the upper panel sliding and counter-weighted for easy access and convenience. The box shall be situated in a draught-free room or fume cupboard when the tests are being conducted.



All linear dimensions are in millimetres.

Figure 1. Test chamber

Publications referred to

BS 1051	Glossary of terms relating to the conditioning, testing and mass determination of textiles
BS 3692	ISO metric precision hexagon bolts, screws and nuts
BS 4569*	Method of test for ignitability (surface flash) of pile fabrics and assemblies having pile on the surface
BS 4664	Methods of sampling and cutting specimens for physical tests on textile floor coverings
BS 5287*	Assessment and labelling of textile floor coverings tested to BS 4790
BS 6105	Specification for corrosion-resistant stainless steel fasteners
BS 6307*	Method for determination of the effects of a small source of ignition on textile floor coverings (methenamine tablet test)
BS 6373	Glossary of terms relating to burning behaviour of textiles and textile products

*Referred to in the foreword only.

This British Standard, having been prepared under the direction of the Textile and Clothing Standards Committee, was published under the authority of the Board of BSI and comes into effect on 30 April 1987.

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The following BSI references relate to the work on this standard:
Committee reference TCM/30 Draft for comment 85/36187 DC

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Textiles and Clothing Standards Committee (TCM/-) to Technical Committee TCM/30 upon which the following bodies were represented:

Association of Consulting Scientists
Association of Heavy Textile Proofers of Great Britain
British Burn Association
British Carpet Manufacturers Association Ltd.
British Clothing Industry Association
British Plastics Federation
British Steel Corporation
British Textile Employers' Association
Chemical Industries Association
Chief and Assistant Chief Fire Officers' Association
Consumer Standards Advisory Committee of BSI
Department of Health and Social Security
Department of the Environment (Building Research Establishment (Fire Research Station))
Department of the Environment (Property Services Agency)
Department of Trade and Industry (Consumer Safety Unit, CA Division)
Department of Trade & Industry (Laboratory of the Government Chemist)
Design Council
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London Scientific Services
Man-made Fibres Producers' Committee
Ministry of Defence
Royal Society for the Prevention of Accidents
Soap and Detergent Industry Association
Society of Motor Manufacturers and Traders Ltd.
Textile Institute
Textile Research Council

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

British Floor Covering Manufacturers' Association
British Resin Manufacturers' Association
City of Bradford Conditioning House
Crown Suppliers
Department of Trade and Industry (Chemical Textiles, Paper, Timber, Miscellaneous Manufacturing and Service Industries Division (CTPS))
Fibre Bonded Carpet Manufacturers' Association
Malaysian Rubber Producers' Research Association

Amendments issued since publication

Amd. No.	Date of issue	
6444	20.1.93	H. Wicks.

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BS 4790 : 1987

BSI

Amendment No. 1
published and effective from 31 May 1990
to BS 4790 : 1987

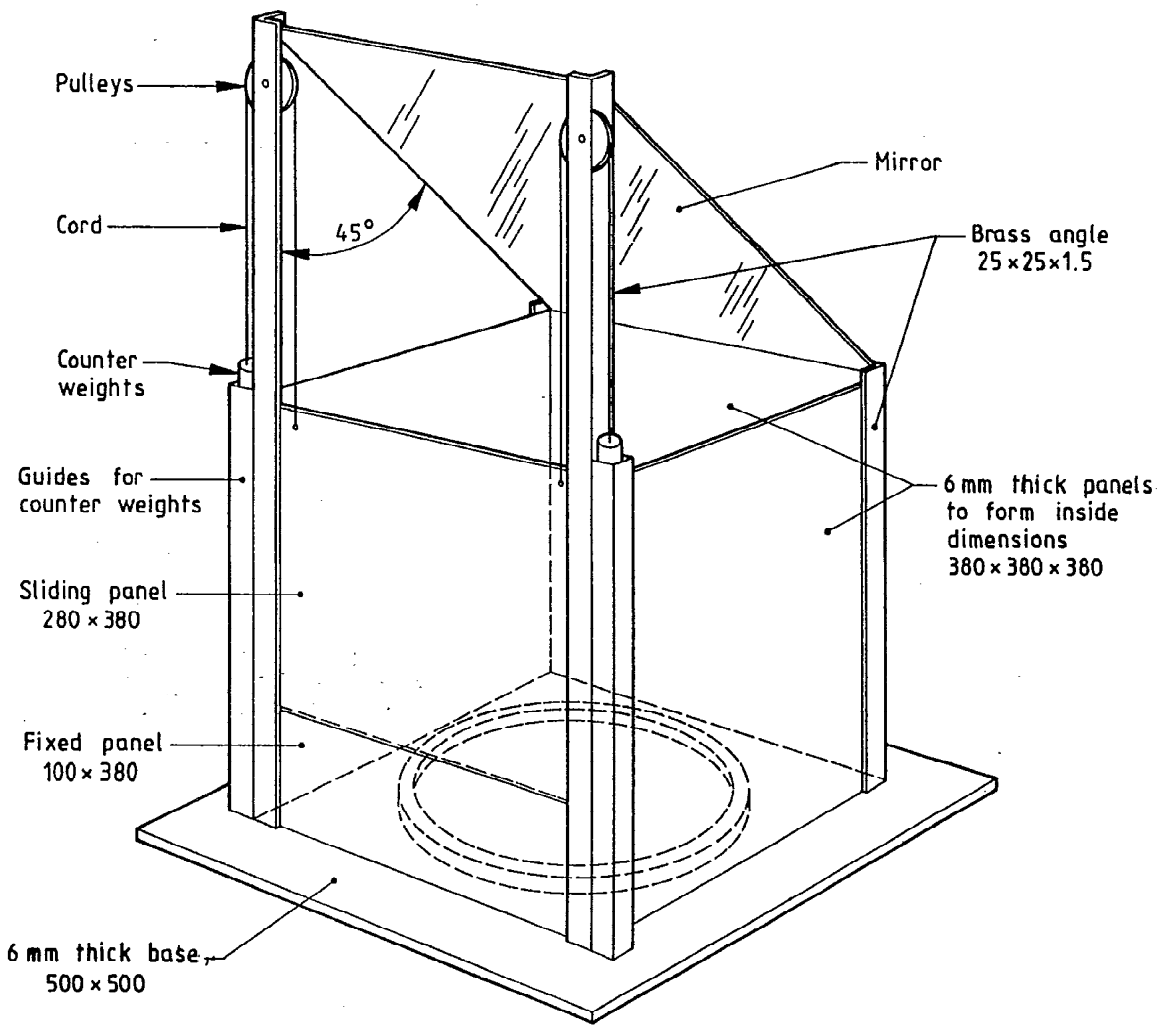
Method for determination of the effects of a small source of ignition on textile floor coverings (hot metal nut method)

Revised text

AMD 6444
May 1990

Figure 1. Test chamber

Delete the existing figure and substitute the following figure.



All linear dimensions are in millimetres.

Figure 1. Test chamber

AMD 7376

Amendment No. 2
published and effective from 15 January 1993
to BS 4790 : 1987

Method for determination of the effects of a small source of ignition on textile floor coverings (hot metal nut method)

Revised text

AMD 7376
January 1993

Figure 1. Test chamber (as amended by Amendment No. 1)

In figure 1, delete 'Brass angle' and substitute 'Metal angle'.

9301–0–0.5k–B

TCM/63