

Methods of test for

The ignitability of mattresses with primary and secondary sources of ignition

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- British Furniture Manufacturers' Federation
- British Plastics Federation
- British Rubber Manufacturers' Association
- Business Equipment Trade Association
- Chemical Industries Association
- Chief and Assistant Chief Fire Officers' Association
- Consumers' Association
- Consumer Standards Advisory Committee of BSI
- Department of the Environment (Building Research Establishment) (Fire Research Station)
- Department of the Environment (the Crown Suppliers)
- Department of Health and Social Security
- Department of Trade and Industry (Consumer safety unit, C A Division)
- Furniture Industry Research Association
- Home Office
- Man-made Fibres Producers' Committee
- National Bedding Federation
- Rapra Technology Ltd
- Textile Research Council
- Coopted member

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Foreword

This British Standard has been prepared under the direction of the Furniture and Household Equipment Standards Committee and is based on procedures developed by the National Bedding Federation and the Crown Suppliers.

When different materials and products are placed together the ignitability of the composite arrangement is very dependent on the interactions between the components. For some end uses the bed assembly is already known, e.g. barracks, married quarters, hospitals, hotels, where the specifier is responsible for all the items which make up the bed assembly. In these cases the mattress can be tested together with the respective bedcovers using smouldering or flaming ignition sources of differing severities.

On the other hand the domestic consumer has a wide range of bedding products to choose from and the mattress manufacturer will have no detailed knowledge of the bedcovers which may be used with the mattress. For a test to be usefully related to safety it should be capable of imitating these variables; this is achieved by using smoulderable or non-smoulderable insulation pads.

It cannot be assumed that protection against large flaming sources will automatically give protection against smouldering ignition. Users of the standard should therefore recognize the need to submit test specimens to both cigarette tests and flaming ignition tests.

WARNING. These tests only relate to the ignitability of the materials described in the test report [see **21** b) and c)] and are not intended to reproduce the full fire hazards that may be encountered.

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.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 18, 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.

Section 1. General

1 Scope

This British Standard describes methods of test for the ignitability of mattresses when subjected to smouldering and flaming types of primary and secondary ignition sources of differing severities. It does not include the ignitability of the bed base.

The following test options are described:

- a) mattress alone tested with primary ignition sources (section 2);
- b) mattress tested with secondary ignition sources composed of known bedcovers (section 3);
- c) mattress tested with secondary ignition sources simulating unknown bedcovers (section 4).

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 British Standard, the following definitions apply.

2.1

ignition source

source of energy which is used to ignite combustible materials or products

2.2

primary source

in a test, the initial heat supply

2.3

secondary source

in a test, the combination of primary source and the actual or simulated effect of bedcovers

2.4

progressive smouldering

an exothermic oxidation, not accompanied by flaming, that is self-propagating, i.e. independent of the ignition source. It may or may not be accompanied by incandescence

2.5

flaming

undergoing combustion in the gaseous phase with the emission of light

2.6

flammability

the ability of a material or product to burn with a flame under specified test conditions

2.7

ignitability

a measure of the ease with which a material, product or component can be ignited so as to flame or progressively smoulder

2.8

bed

a mattress placed on top of a bed base with no other bedding items present

2.9

bed covers

a general term for all items placed on the bed by a user to provide comfort and warmth. It includes sheets, blankets, bedspreads, continental quilts and quilt covers and mattress covers

2.10

made-up bed

a bed prepared for use by covering with bed covers, tucking these between the mattress and bed base, positioning pillows with pillowslips and turning down of sheets and blankets at the head end of the bed

NOTE Individual styles vary in detail depending on the user.

2.11

bed assembly

a stack of successive layers of mattress and various bed covers, with or without pillow and pillow-slip, representing a section through the centre of a made-up bed

2.12

bed base

a structure which supports the mattress

3 Criteria of ignition

3.1 Progressive smouldering ignition

For the purposes of this standard all the types of behaviour given in a) to f) are considered to be progressive smouldering ignition (but see also clause 20).

- a) Any test specimen that produces externally detectable amounts of smoke, heat or glowing after a period of 1 h following the application of the ignition source.
- b) Any test specimen that displays escalating combustion behaviour so that it is unsafe to continue the test and requires forcible extinction.
- c) Any test specimen that smoulders until it is essentially consumed within the test duration.
- d) Any test specimen that smoulders to the extremities of the specimen, viz to either side or to the full thickness of the specimen, within the duration of the test (excluding edge testing).

e) For top ignition only, using sources O, O/NS (see 18.3), O/S (see 18.4) and 1, 2 and 3, any test specimen that, on final examination, shows evidence of smouldering other than discolouration more than 25 mm in any horizontal direction from the nearest part of the original position of the source.

f) For top ignition only, using sources 4 to 7 inclusive, any test specimen that on final examination, shows evidence of smouldering other than discolouration more than 100 mm in any horizontal direction from the nearest part of the original position of the source.

NOTE In practice it has been found that there is usually a clear distinction between materials which char under the influence of the ignition source but which do not propagate further (non-progressive) and those where smouldering develops in extent and spreads (progressive).

3.2 Flaming ignition

For the purposes of this standard all the types of behaviour given in a) to e) are considered to be flaming ignition.

- a) The occurrence of any flames initiated by a smouldering source.
- b) Any test specimen that continues to flame for more than 120 s from removal of the igniting flame for sources 1, 2 and 3, 10 min after ignition of the crib for sources 4 and 5 or 13 min after ignition of the crib for sources 6 and 7.
- c) Any test specimen that displays escalating combustion behaviour so that it is unsafe to continue the test and requires forcible extinction.
- d) Any test specimen that burns until it is essentially consumed within the appropriate test duration [see 3.2 b)].
- e) Any test specimen that burns to the extremities of the specimen, viz. to either side or to the full thickness of the specimen, within the duration of the test (excluding edge testing).

3.3 Flow diagram

A flow diagram illustrating a systematic method for the detection of ignition throughout a test sequence is given in Figure 4.

4 General principle

A test specimen is subjected to smouldering and flaming ignition sources placed on top of and/or below the test specimen. The range of intensity of the primary sources has been selected to imitate that of actual sources which might be encountered in various end use environments, while the range of intensity of the secondary sources reproduces the effects of varying amounts and types of bedcovers. Normally the ignitability of a mattress is measured by working up through the sources in the sequences indicated in Table 1, Table 3 and Table 5.

Alternatively, for specific end use requirements, the tests can be used to assess the ignitability at any level but always including the cigarette ignition test.

5 Health and safety of operators

NOTE There is considerable risk with these tests and it is essential that suitable precautions be taken, which may include the provision of breathing apparatus and protective clothing.

5.1 Enclosure

For safety, the tests shall be conducted in a suitable fume cupboard or purpose built room so that individuals are not exposed to any fumes (see 6.4).

5.2 Extinguishers

Readily accessible means of extinguishing the test specimens shall be provided.

NOTE 1 For preference, water should be provided for smouldering fires and a fire extinguisher for flaming fires. Carbon dioxide extinguishers are not suitable for extinguishing test specimens.

NOTE 2 Extinction of test specimens may be difficult and care should be taken that they are only disposed of when completely inert. It may be necessary to immerse smouldering specimens in water, or place them in a sealed non-combustible enclosure. To ensure complete safety other suitable steps may have to be taken.

6 Apparatus

6.1 Test rig, consisting of a platform of expanded steel or open mesh supported at least 75 mm above a solid base.

NOTE When testing a full size mattress it may be necessary to use an actual bed base for ignition from below.

The use of extendable legs is recommended where testing with ignition sources below the mattress is specified, in which case the platform shall be 380 ± 50 mm above the solid base [see Figure 1(a)]. The test rig shall be no smaller than 150 mm less than the corresponding dimensions of the test specimen but may be any suitable amount larger than the test specimen.

The size of the mesh is not critical for top ignition but a rectangular mesh with openings $100 \pm 10 \text{ mm} \times 50 \pm 5 \text{ mm}$ as shown in Figure 1(b) shall be used for ignition from below. Similarly, the angle iron dimensions in Figure 1 are not critical for top ignition but shall be followed for ignition from below.

For the tests, the rig is sited within the enclosure (see 6.4) and the testing is performed in a substantially draught-free environment permitting an adequate supply of air.

6.2 *Stop clock*, reading to the nearest second.

6.3 *Ignition sources*, as described in sections 2, 3 and 4.

6.4 *Test enclosure*, being either a room with a volume greater than 20 m^3 (which contains adequate oxygen for testing), or a smaller enclosure with a through flow of air. Inlet and extraction systems providing air flow rates of 0.02 m/s to 0.2 m/s in the locality of the rig provide adequate oxygen without disturbing the burning behaviour.

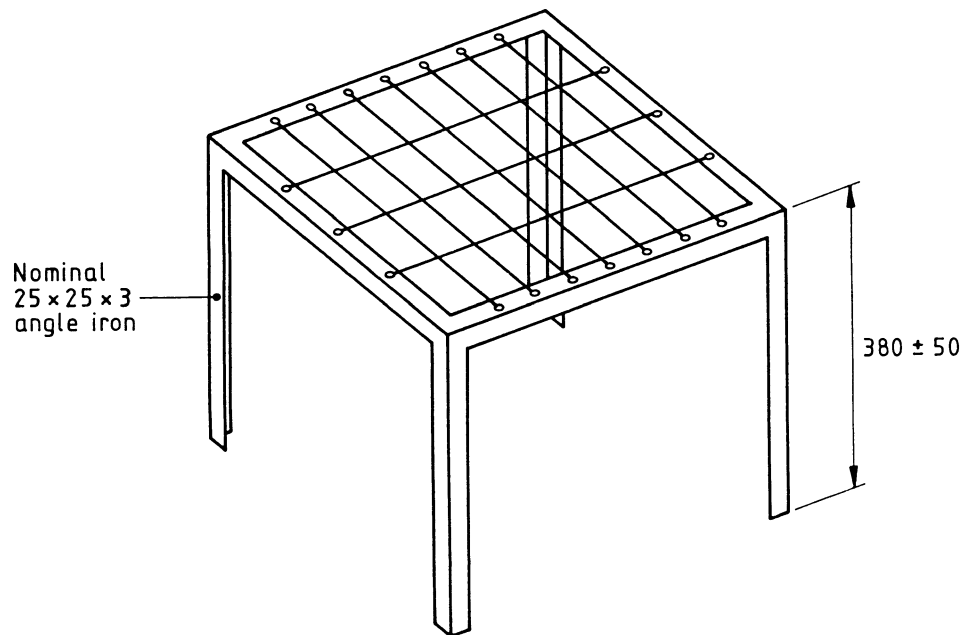
7 Atmosphere for conditioning and testing

7.1 Conditioning

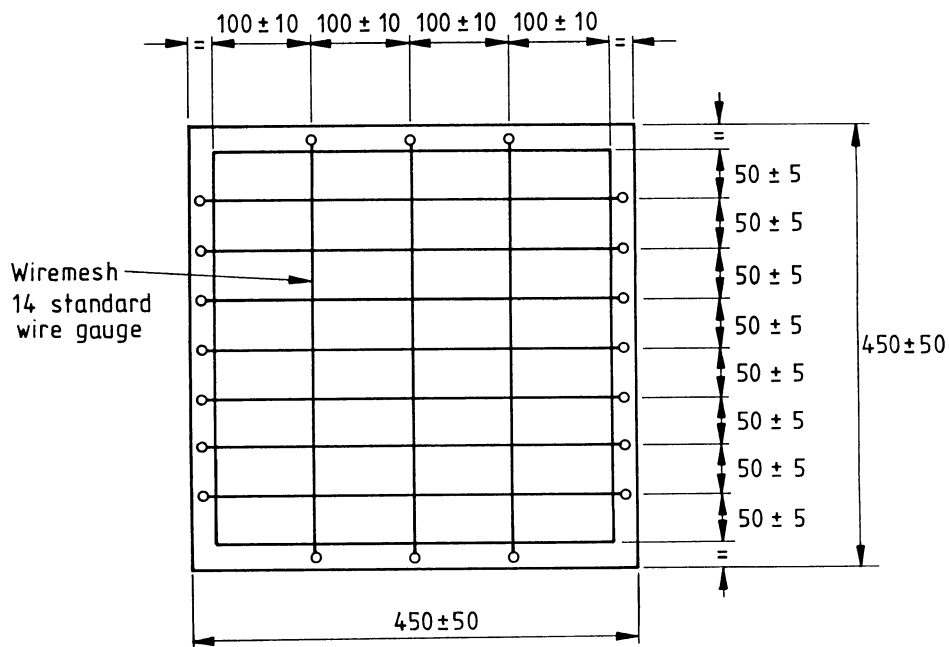
The materials to be tested and the primary and secondary ignition sources shall be conditioned immediately before the test for 72 h in indoor ambient conditions and then for at least 16 h in an atmosphere having a temperature of $20 \pm 5 \text{ }^\circ\text{C}$ and a relative humidity of $50 \pm 20 \%$.

7.2 Testing

For testing, a substantially draught-free environment having a temperature of $23 \pm 7 \text{ }^\circ\text{C}$ and a relative humidity of $45 \pm 25 \%$ shall be used.



(a) Platform showing extended legs



(b) Spacing of wire mesh platform

All dimensions are in millimetres.

Figure 1 — Test rig