

BRITISH STANDARD

Methods of test for assessment of the ignitability of upholstered seating by smouldering and flaming ignition sources

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 45 and a back cover.

Foreword

Publishing information

This British Standard was published by BSI and came into effect on 31 March 2006. It was prepared by Technical Committee FW/6, *Flammability performance and fire testing*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 5852:1990, which is withdrawn.

However, since the Furniture and Furnishings (Fire) (Safety) Regulations 1988 [1] refer to the earlier editions of the standard, neither BS 5852-1:1979 nor BS 5852-2:1982 can be withdrawn at the present time.

Relationship with other publications

This British Standard extends the range of ignition sources provided by BS EN 1021-1 and BS EN 1021-2.

Information about this document

This is a full revision of the standard. The principal changes are to update references, to bring the standard into line with BS 6807 and BS EN 1021, and to incorporate the existing amendments. There are no significant technical changes from the previous edition.

The range of methods specified enables an assessment to be made of the ignitability of upholstered furniture assemblies. These assemblies may be test composites as described in Clause 11, which may be subjected to any one of a range of flaming ignition sources, or complete items of furniture as described in Clause 12, which may be subjected to a smouldering cigarette or any one of a range of flaming ignition sources.

Ignition tests are not highly repeatable and duplicate results are required for the test rigs described in Clause 11 to achieve a full non-ignition test result. It is recognized that it will not always be possible to carry out duplicate tests on the selected sites when testing actual furniture in accordance with Clause 12 and in these cases, it is necessary to achieve an indicative non-ignition result on all of the test sites.

NOTE The tests described in Clause 12 may also be applied to non-upholstered seating.

It cannot be assumed that protection against large flaming sources will automatically give protection against smouldering ignition. It is therefore necessary to submit test specimens to both smouldering and flaming ignition tests.

Hazard warnings

WARNING. These tests only relate to the ignitability of the specimens as supplied under the particular conditions of test and do not take into consideration the effects of ageing, washing, soiling, etc. that might be encountered during the life of the product. The tests cannot give a full assessment of fire properties in all situations.

Measures taken to reduce the ignitability of an assembly can adversely affect other fire properties such as smoke and toxic gas evolution.

WARNING. This British Standard calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

CAUTION. For some upholstery tests, all outer covers might be required to be subjected to a water soaking and drying procedure prior to conditioning as described in **10.1.2**.

Guidance for test operators is given in Annex A. It is important that the details given in the annex are studied before testing is carried out.

Attention is drawn to BS 7176, which applies the tests described in this standard to upholstered furniture in various hazard areas.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its methods are expressed either as a set of instructions or in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Attention is drawn to the following regulations:

- Furniture and Furnishings (Fire) (Safety) Regulations 1988 [1];
- Furniture and Furnishings (Fire) (Safety) (Amendment) Regulations 1989 [2];
- Furniture and Furnishings (Fire) (Safety) (Amendment) Regulations 1993 [3];
- Control of Substances Hazardous to Health Regulations 2002 [4].

0 Introduction

0.1 Objective

The objective of this standard is to measure the ignitability of upholstered furniture composites and/or complete pieces of furniture.

No method using realistic shapes yet exists for measuring levels of ignition on a continuous scale for these composites and consequently the methods used in this standard provide ignition/non-ignition results at a number of fixed levels. One smouldering source together with a range of flaming sources, whose energy rises by a factor of approximately two at each step, are used. Thus a level representing the boundary of ignition can be associated with a particular construction. Although the levels do not form a continuous series, they do provide more information than an arbitrary single go/no go result and so allow smaller variations in ignitability to be related to actual hazards.

This assessment is intended eventually to form part of a much fuller fire hazard assessment when work now in progress on fire development and smoke and toxic hazards in fire is completed.

0.2 Background

0.2.1 An assessment of the results of various research projects, carried out to investigate the fire properties of furniture, clearly indicates that tests carried out on component materials in isolation could not give a true indication of their behaviour when combined with other component materials in a piece of furniture. Therefore, to evaluate the ignitability of any item of seating, having due regard to the effects of interactions between materials and of design, it is necessary to test the complete finished item of furniture. Such testing procedures are contained in Clause 12. However, there is a very wide range of designs and materials employed, so tests have been developed to assess upholstery materials combined together to give information regarding the ignitability properties of assemblies that might be used in a number of different circumstances. Model tests (see Clause 11) of this kind can eliminate the least useful combinations from further consideration in the design process.

0.2.2 The form of the test rig was decided after observation of many ignition experiments had shown that the position at which accidentally dropped cigarettes are most likely to cause ignition is in any angle between adjacent surfaces, whereas accidentally dropped flaming materials have worse effects where vertical and horizontal surfaces are involved. These situations have been modelled even though in practice the assembly might be used only on a single surface.

The results, therefore, provide a measure of the ignitability of a combination of cover and filling which is equally valid for the different designs of furniture in which the combination might be used and for the different applications in that furniture.

The design of the furniture is an important additional consideration which can enhance or detract from the flammability performance of the item. For example, there might be pleats or folds in the primary cover; loops or crevices created by braids, piping, zips, ruffles or other trimmings; traps and chimneys created by cushions; the presence of wing arms or other overhangs; or an exposed area beneath the seat which is vulnerable to ignition from floor level. In such cases stylized representation is not easily possible, nor practical. For these reasons tests on actual items are included in this standard.

Ideally these tests should be the final stage of the sifting process for ignitability, when the most useful candidate constructions are checked to ensure that the extra complexities of shape and added materials do not render the predictions from rig tests misleading.

0.2.3 The following ignition sources are specified.

- a) *Smouldering*. This consists of a single cigarette since it is unrealistic to use multiple cigarettes at a single position and the “fail-safe” magnitude is a full cigarette rather than smaller parts.
- b) *Flaming*. This range consists of butane flames and burning wooden cribs which form a sequence of increasing thermal output from that approximating to the burning of a small flame to that approximating to the burning of four double sheets of a full-size newspaper. It has to be emphasized that the cribs are not intended to reproduce burning newspapers in all respects and the thermal output comparisons are given for guidance only. The cribs have been designed to give an additional weight loading (greater than that obtained with newspaper) on the upholstery composite. This is important in order to include situations that might occur in practice and to ensure that the test method errs on the side of safety with combinations prone to failure under load. Examples of these situations might be high localized cover tension induced by deep-buttoned upholstery, or the presence of heavy books close to the ignition source.

These sources are also static and apply their energy over a restricted area. Some real life sources spread flames gradually over a larger area of the composite. The latter type of behaviour is different from, and is not modelled by, the larger ignition sources of equivalent thermal energy defined in this standard.

0.2.4 The scenarios modelled by these tests do not include deliberate arson and/or vandalism, though the tests include the application of reasonably large sources to undamaged furniture. The larger sources are intended to cover situations where a higher degree of carelessness is more probable or for locations where a higher level of resistance to secondary ignition is paramount. If arson is an important part of the in-use situation then other test methods attempting to reproduce the ingenuity of the fire-raiser should be carried out.

0.3 Method of use

The test methods in Clause **11** measure the ignitability of the overall composite of materials, i.e. cover(s), filling materials, etc. as constructed on the test specimen. The results cannot be stated as being applicable to the general behaviour of any individual component but only to the total composite tested.

The ignitability of an assembly may be determined by applying the sources in the order of source 2 to source 7, but for many specification purposes a test(s) involving one, or a limited number of selected sources, might be necessary.

The ignitability of an assembly may be determined by applying source 0 and source 1 which are defined in BS EN 1021-1:1994 and BS EN 1021-2:1994 respectively.

The ignitability of a complete item of furniture may be determined by applying the sources in the order of source 0 to source 7, but for many specification purposes a test(s) involving one, or a limited number of selected sources, might be necessary.

In the case of the tests described in Clause **12** the results will be applicable only to the finished item of furniture tested.

1 Scope

This British Standard describes methods for assessing the ignitability of single material combinations, e.g. covers and fillings used in upholstered seating, or complete items of seating, when subjected either to a smouldering cigarette or to flaming ignition sources of thermal output ranging from that of a burning match to that approximating to the burning of four double sheets of full-size newspaper, as might be applied accidentally to any item of furniture.

NOTE 1 It does not necessarily cover ignition caused by deliberate acts of vandalism with arson.

The following methods are described:

- a) upholstered seating composites tested with flaming ignition sources (sources 2 to 7) (Clause **11**);
- b) complete items of upholstered furniture tested with smouldering or flaming ignition sources (sources 0 to 7) (Clause **12**).

NOTE 2 Possible ways in which the standard can be used either to indicate the potential ignitability of components in conjunction with other specified materials or where more specific information is required about design features are given in Annex B.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 1021-1 *Furniture – Assessment of the ignitability of upholstered furniture – Part 1: Ignition source: smouldering cigarette*

BS EN 1021-2 *Furniture – Assessment of the ignitability of upholstered furniture – Part 2: Ignition source: match flame equivalent*

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

- 3.1 ignition source**
source of energy which is used to ignite combustible materials or products
- 3.2 smouldering**
combustion of a material with or without the emission of light and generally evidenced by smoke and an increase in temperature but without a flame
- 3.3 progressive smouldering**
smouldering that is self-propagating, i.e. independent of the ignition source
- 3.4 flaming**
undergoing combustion in the gaseous phase with the emission of light and heat
- 3.5 flammability**
ability of a material or product to burn with a flame under specified test conditions
- 3.6 ignitability**
measure of the ease with which a material, product or component can be ignited so as to flame or progressively smoulder
- 3.7 test zone**
component and/or design feature of the test specimen which is nominated for localized testing

4 Criteria of ignition

NOTE 1 Ignition criteria are given for progressive smouldering and for flaming. These are both critical but are different modes of ignition and should be assessed separately.

NOTE 2 A flow diagram illustrating a systematic method for the detection of ignition throughout a test sequence for each type of ignition source is given in Figure 1, Figure 2 and Figure 3.

Figure 1 Flow diagram for detection of ignition using source 0 (cigarette)

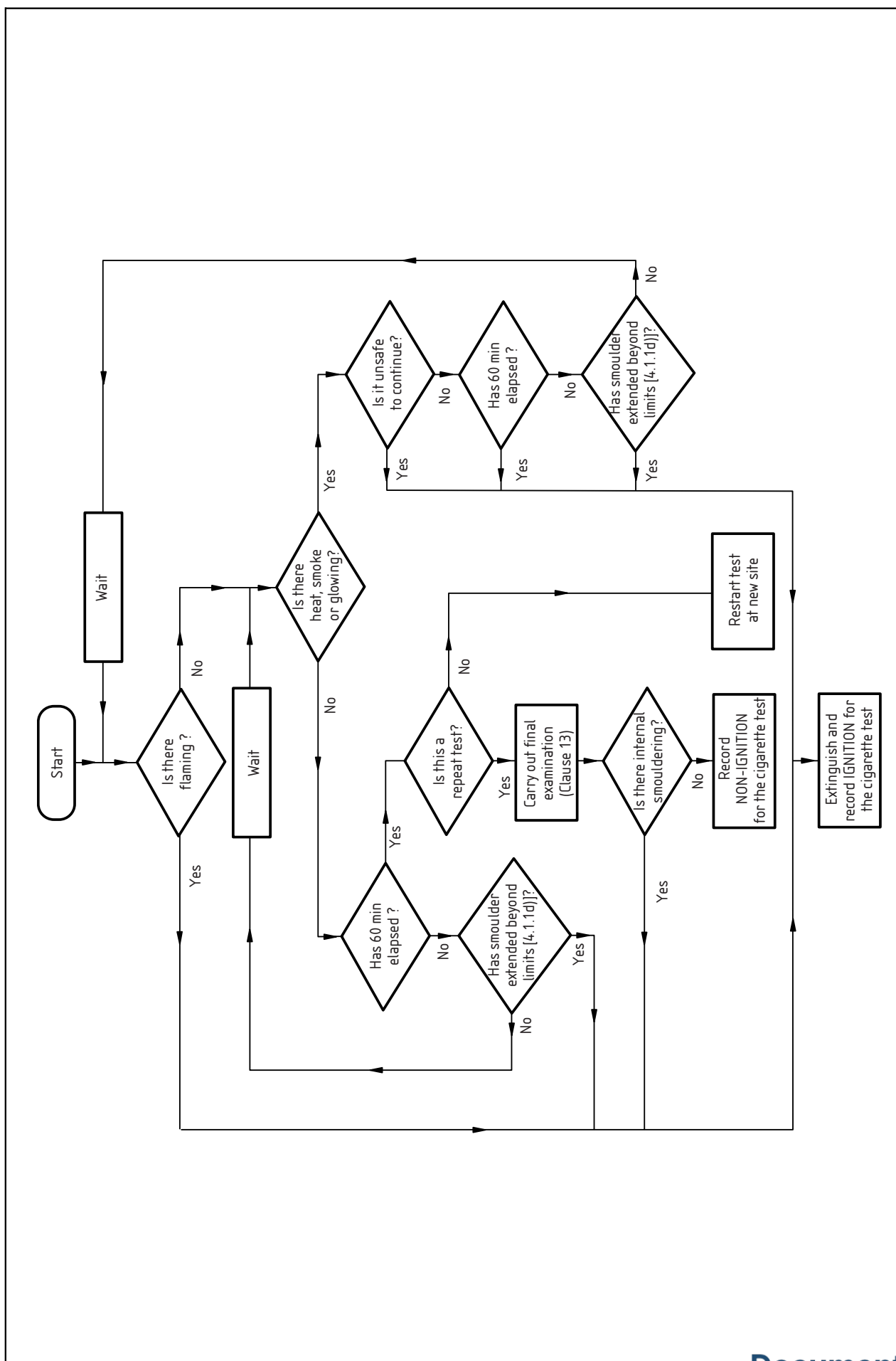
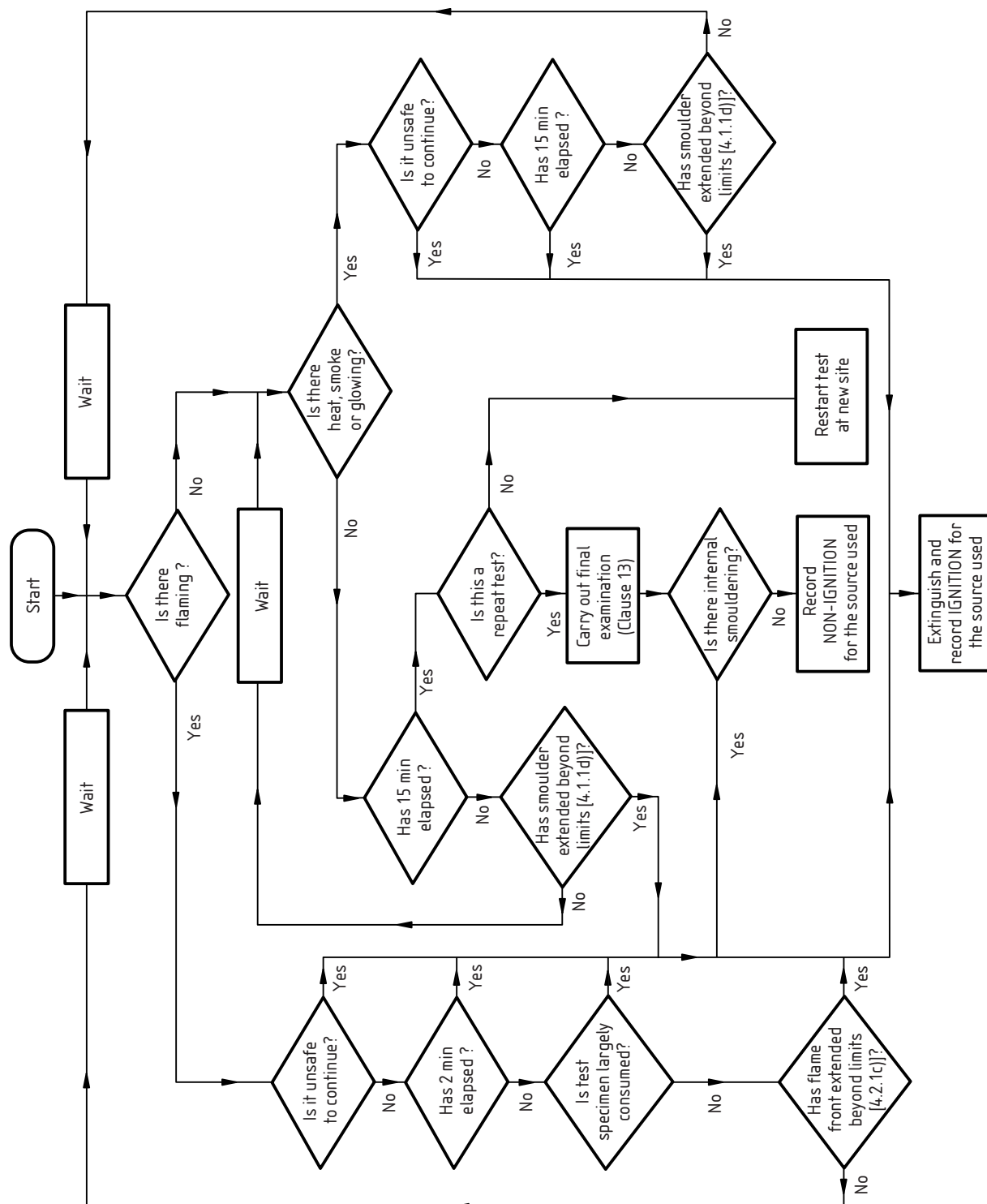
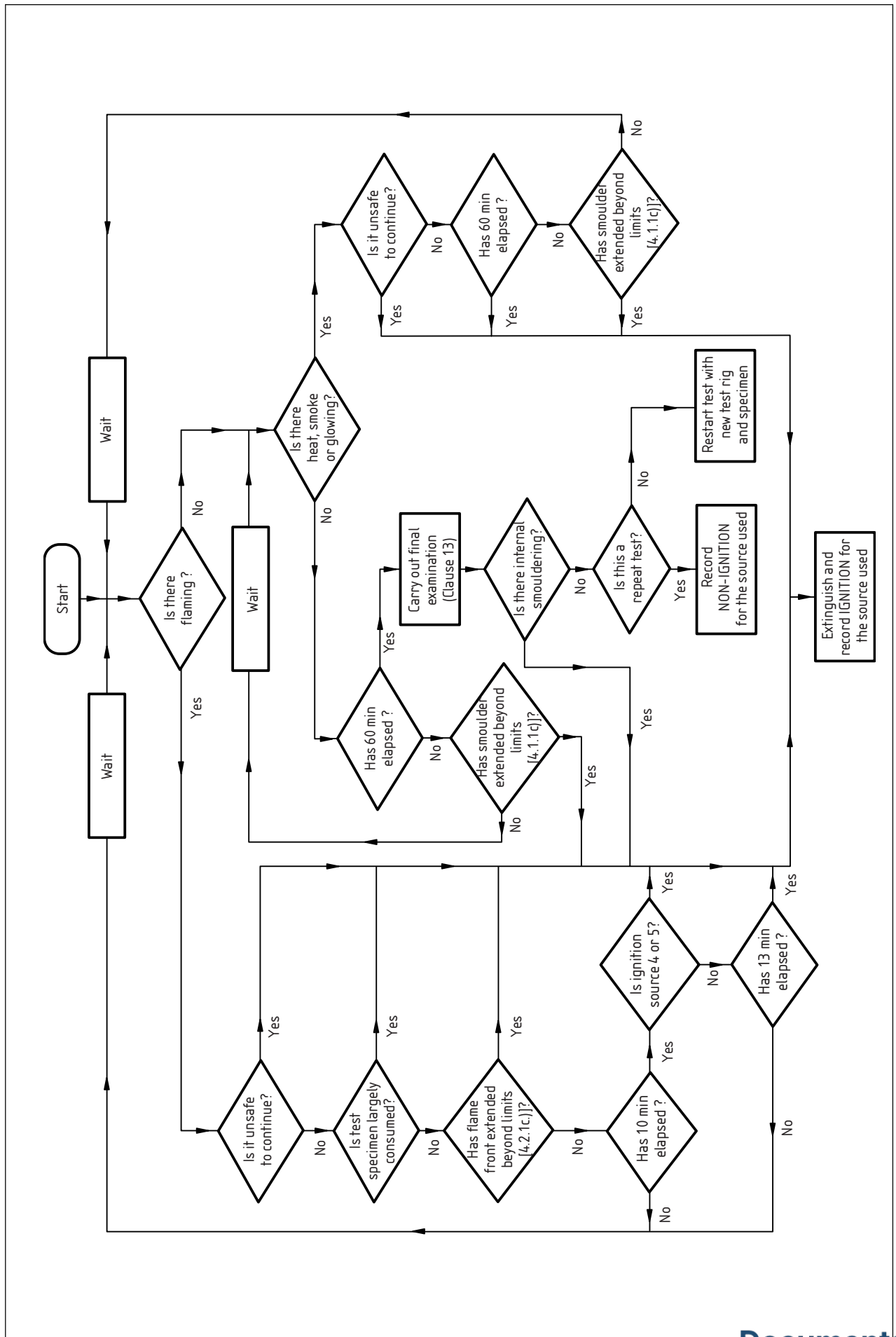


Figure 2 Flow diagram for detection of ignition using gas flame sources 1, 2 and 3



Full document details: BS 5852:2006



4.1 Progressive smouldering ignition

4.1.1 Upholstery composites

For the purposes of testing the ignitability of upholstery composites (see Clause 11), all the following types of behaviour shall be deemed to be progressive smouldering ignition (but see also Clause 13):

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

- a) any test specimen that displays escalating smouldering combustion behaviour so that it is unsafe to continue the test and forcible extinction is required;
- b) for the smouldering cigarette source 0: any test specimen that produces externally detectable amounts of smoke, heat or glowing within the period from the extinction of the source until 60 min after placement of the source;
- c) for all flaming ignition sources: any test specimen that smoulders until it is essentially consumed or that smoulders to the extremities of the specimen, i.e. to either side or to/through the full thickness of the specimen, within the duration of the test;
- d) for flaming ignition sources 2 and 3: any test specimen that produces externally detectable amounts of smoke, heat or glowing 15 min after removal of the burner tube;
- e) for flaming ignition sources 4, 5, 6 and 7: any test specimen that produces externally detectable amounts of smoke, heat or glowing 60 min after ignition of the crib;
- f) any test specimen that, on final examination (see Clause 13), shows evidence of charring within the filling (other than discoloration) more than 100 mm in any direction, apart from upwards, from the nearest part of the original position of the source.

4.1.2 Complete items of furniture

For the purposes of testing the ignitability of complete items of furniture (see Clause 12), all the following types of behaviour shall be deemed to be progressive smouldering ignition (but see also Clause 13):

- a) those given in 4.1.1 items a), b), d), e) and f);
- b) for all flaming ignition sources: any test specimen that smoulders until it is essentially consumed or that smoulders to the extremities of the specimen, i.e. to either side of the specimen or to the extremities of the upholstered test zone, within the duration of the test.

4.2 Flaming ignition

4.2.1 Upholstery composites

For the purposes of testing the ignitability of upholstery composites (see Clause 11), all the following types of behaviour shall be deemed to be flaming ignition:

- a) any test specimen that displays escalating flaming combustion behaviour so that it is unsafe to continue the test and forcible extinction is required;
- b) any test specimen that burns until it is essentially consumed within the test duration;
- c) any test specimen on which any flame front reaches the extremities of the specimen other than the top of the vertical part of the test specimen, or passes through the full thickness of the specimen within the duration of the test (but see Note 1);

NOTE 1 It is recommended that composites which fail criterion c), e.g. because the full thickness is penetrated by molten material rather than by flames, are tested as a complete item of furniture (see Clause 12).

- d) for flaming ignition sources 2 and 3: any test specimen that continues to flame for more than 120 s after removal of the burner tube or in which the flame front spreads past a vertical line 100 mm from the tip of the burner tube;
- e) for flaming ignition sources 4 and 5: any test specimen that continues to flame for more than 10 min after ignition of the crib;
- f) for flaming ignition sources 6 and 7: any test specimen that continues to flame for more than 13 min after ignition of the crib;

NOTE 2 The times quoted in items e) and f) are essentially 2 min greater than the upper 95% probable extinction times of wooden cribs determined by interlaboratory testing.

- g) for all sources: any test specimen from which flaming debris causes an isolated floor fire that continues to flame for longer than the time given in d), e) or f).

4.2.2 Complete items of furniture

For the purposes of testing the ignitability of complete items of furniture (see Clause 12), all the following types of behaviour shall be deemed to be progressive smouldering ignition:

- a) those given in 4.2.1 items a), b), d), e), f) and g), but including source 1 for item 4.2.1d);
- b) any test specimen on which any flame front reaches the extremities of the specimen other than the top of the vertical part of the test specimen, within the duration of the test;
- c) for source 0 (cigarette): the occurrence of any visible flaming within 60 min of placement of the cigarette.

5 Principle

A test specimen is subjected to a series of ignition sources.

NOTE The series is designed to represent a range of actual intensities that might be accidentally encountered in various end-use environments.

In Clause 11 the test rig stylizes the critical geometry of vertical/horizontal junctions typically found in furniture, but tests a single cover/filling combination. In Clause 12 the test specimen consists of a complete item of furniture.

6 Health and safety of operators

WARNING. This British Standard calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

NOTE 1 Suitable precautions might include the provision of breathing apparatus and protective clothing.

NOTE 2 Attention is drawn to the Health and Safety at Work etc. Act 1974 [5] in respect of safety precautions.

6.1 Test enclosure

The tests shall be conducted in a suitable fume cupboard or purpose-built room so that individuals are not exposed to fumes (see 7.4).

6.2 Extinguishers

Readily accessible means of extinguishing the test specimens shall be provided. For the purposes of testing the ignitability of complete items of furniture (Clause 12), the extinguishing system shall be of sufficient capacity to deal with a fully developed fire.

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 smouldering test specimens.

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