

The Furniture Retail Quality Group Best Practice Guide



Flammability Testing

**Best Practice Guide for ignition testing regarding
the UK Furniture and Furnishings (Fire) (Safety)
Regulations 1988 amended 1989, 1993 and 2010**

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FOREWORD

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Publication history

First published December 2011

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1. INTRODUCTION

The Furniture and Furnishings (Fire) (Safety) Regulations 1988, amended 1989, 1993 and 2010, have been implemented in the UK for over 20 years. The Regulations contain requirements for the ignition resistance of upholstery components.

The procedures for assessing the ignition resistance of upholstery components, required by the regulations, are contained in a series of Schedules. These Schedules call up various British Standard test methods which detail the methods by which testing to prove compliance with the regulations is to be conducted. The methods contained within the cited British Standards are further modified by the wording within these Schedules.

The test requirements for different upholstery components can be difficult to understand without considerable experience.

Overall the specified test procedures are reasonably clear on how the testing should be performed. However a small number of uncertainties exist, pertaining to the testing and the regulatory requirements, which cause concern to the industry especially where reproducibility between testing laboratories is concerned.

This best practice guide draws upon experience gained by retailers, test organisations when conducting ignition tests for the industry and other interested parties, since the introduction of the regulations over twenty years ago, in order to demonstrate compliance with the Furniture and Furnishing (Fire) (Safety) Regulations and simply aims to identify and document a series of 'best practice rules' for upholstery suppliers and laboratories worldwide to reduce any uncertainties and enhance reproducibility.

Note: More information on the Furniture and Furnishings (Fire) (Safety) Regulations can be found in the British Furniture Confederation's document 'Fire safety of furniture and furnishings in the home. A Guide to the UK Regulations', available as a free download from FIRA (www.fira.co.uk).

2. OBJECTIVES

The objectives of this document are to:

- Provide advice to manufacturers and suppliers of upholstery and components, and to help identify the requirements for different upholstery components in a simple and straight forward manner,
- Provide advice to test laboratories, and to identify and document 'best practice rules' for ignition test procedures relating to the testing requirements of the UK furniture regulations in order to reduce any uncertainties and enhance reproducibility.

The objectives of this document are not to modify the requirements of the Regulations as these are enshrined in law and must take precedence in all instances.

3. BACKGROUND

3.1 Scope

All the components of upholstered furniture (e.g. the visible and non-visible cover fabrics and all filling materials) must meet all the requirements of the 1988 Furniture & Furnishings (Fire) (Safety) Regulations 1988 (as amended).

Upholstered furniture includes:-

- Sofas and armchairs¹
- Upholstered dining and bedroom chairs¹
- Upholstered foot stools and bar stools¹
- Headboards, footboards and upholstered beds²
- Mattress fillings³
- Pillows
- Outdoor furniture with upholstery that could be used or stored indoors⁴
- Scatter cushions and seat pads sold separately⁵
- Floor cushions and bean bags⁵
- Children's furniture
- Mattress toppers⁶

Notes

¹ The dust cover on the underside of chairs, stools and seat pads are classed as non-visible cover materials.

² The front **and** back of a headboard are classed as 'visible cover materials'.

³ In addition to the fillings complying with regulations in the UK, under the General Product Safety Regulations, the final mattress should also conform to BS 7177: 2008 – low hazard criteria for domestic use.

- ⁴ *Where any doubt exists as to whether a product could be used indoors then it is recommended that the product complies with the appropriate part of the Regulations.*
- ⁵ *A scatter cushion is generally considered to be a cushion that would fit within a 60 cm x 60 cm square. Cushions larger than this are classed as floor cushions. Seat pads are generally considered to be tie on cushions with dimensions no greater than 30 cm x 30 cm x 1 cm. Scatter cushions and seat pads sold separately to an item of furniture only require their fillings to comply with the Regulations. Floor cushions and scatter cushions/seat pads sold with an item of furniture have to fully comply with the Regulations.*
- ⁶ *A mattress topper or mattress pad is a padded item intended to add additional comfort to a mattress. This should not be confused with a mattress protector which is a cover designed to prevent moisture/soil ingress and is intended to be washed in a domestic washing machine. Whilst mattress toppers are deemed to be covered by the Regulations and BS 7177, mattress protectors are not.*

3.2 Basic Requirements

These regulations have separate schedules that list the requirements for each type of upholstery.

These are as follows:-

- Schedule 1 – Ignitability tests for foam fillings only.
- Schedule 2 - Ignitability tests for non-foam fillings only.
- Schedule 3 - Ignitability tests for interliner materials.
- Schedule 4 - Cigarette tests for cover materials.
- Schedule 5 - Match tests for cover materials.
- Schedule 6 - Display swing ticket label requirements.
- Schedule 7 - Permanent label requirements.

It is a legal requirement that the product that is sold in the UK meets all the schedule requirements as listed above. More information on the requirements is detailed below:

3.2.1 Schedule 1 Part I – Slab Foam Fillings

Where a foam filling is used in upholstered furniture, it must meet the test requirements defined in Schedule 1 Part 1 in its own right before it can even be placed in the product.

This test is very prescriptive and requires the following test sample sizes:-

- 2 x pieces @ 450mm x 450mm x 75mm
- 2 x pieces @ 450mm x 300mm x 75mm

The foam is tested using ignition source 5, also known as a 'crib 5' ignition source. During the test:

- The sample must self extinguish within 10 minutes.
- The sample must cease all smouldering within an hour.
- The complete test rig is weighed before the test and is again once the test is complete. The weight loss must be less than 60g in order to pass the test, and the damage must not penetrate the full thickness of the test sample and must not reach the extremities of the test rig.
- Any debris falling from the test rig during the test must not be weighed as part of the sample after test.

3.2.2 Schedule 1 Part II – Crumb Foam Fillings

Where a crumb foam filling is used in upholstered furniture, it must meet the test requirements defined in Schedule 1 Part II in its own right before it can even be placed in the product.

The crumb foam must come with supporting evidence that it meets the requirements of Schedule 1 Part I in block form. A test rig is constructed using the same packing density of crumb foam that will be used in the final product, or a packing density of 36 kg/m³ where this is not known.

The fillings are tested using an ignition source 2 match flame and this is applied for 40 seconds. During the test:

- The sample must self extinguish within 120 seconds of removal of the ignition source.

3.2.3 Schedule 1 Part III – Latex Foam Fillings

Where a foam filling is used in upholstered furniture, it must meet the test requirements defined in Schedule 1 Part II in its own right before it can even be placed in the product.

This test is very prescriptive and requires the following test sample sizes:-

1 x pieces @ 450mm x 450mm x 75mm

1 x pieces @ 450mm x 300mm x 75mm

The fillings are tested using an ignition source 2 match flame and this is applied for 40 seconds. During the test:

- The sample must self extinguish within 120 seconds of removal of the ignition source.
- The complete test rig is weighed before the test and is again once the test is complete. The weight loss must be less than 60g in order to pass the test, and the damage must not penetrate the full thickness of the test sample and must not reach the extremities of the test rig.
- Any debris falling from the test rig during the test must not be weighed as part of the sample after test.

3.2.4 Schedule 2 – Non-foam fillings

Where non-foam fillings are used in upholstered furniture, they must meet the test requirements defined in Schedule 2 in their own right before they can be used in the product. There are four parts

- Part I - Non-foam single filling e.g. fibre, feathers, polystyrene balls
- Part II - Furniture composite e.g. feather-fibre mix
- Part III - Pillows/scatter cushions
- Part IV - Mattresses

The fillings are tested using an ignition source 2 match flame and this is applied for 40 seconds. During the test:

- The sample must self extinguish within 120 seconds of removal of the ignition source.
- In addition for Parts II and IV the flaming must not penetrate the full thickness of the test sample and must not reach the extremities of the test rig.

3.2.5 Schedule 3 – Interliners

Where an interliner material is used in upholstered furniture, it must meet the test requirements defined in Schedule 3 in its own right before it can even be placed in the product.

The interliner is tested using ignition source 5, also known as a 'crib 5' ignition source. During the test:

- The interliner material (if fabric) is 'water-soaked' to remove any non-permanent / non-durable FR treatments.
- It is left to drip dry (line dry) and then needs to re-condition to set temperature & humidity before test.
- The interliner is tested using a non-combustion modified polyurethane foam as the filling material.
- The sample must self extinguish within 10 minutes.
- The sample must cease all smouldering within an hour.
- The flaming must not penetrate the full thickness of the test sample and must not reach the extremities of the test rig.

3.2.6 Schedule 4 Part 1 – Visible cover fabrics - Cigarette test

The decorative cover material must pass the cigarette test requirements when tested in conjunction with either the actual filling materials that it would be used with – or a filling material that is representative of what it might be used with (normally combustion modified FR foam –see section for more details).

The fabric is tested using ignition source 0, a cigarette. During the test:

- If the cover material has a fire retardant treatment it must be 'water-soaked' to remove any non-permanent / non-durable FR treatments.
- It is left to drip dry (line dry) and then needs to re-condition to set temperature & humidity before test.
- The cigarettes are lit and placed onto the test rig.
- They must self- extinguish and cease all smouldering within one hour.

3.2.7 Schedule 5 Part 1 – Visible covers – Match test

The decorative cover material must pass the match test requirements defined in Schedule 5 in its own right before it can even be placed in the product.

The fabric is tested using ignition source 1, a match flame equivalent (see section for more details), which is applied for 20 seconds. During the test:

- If the cover material has a fire retardant treatment it must be 'water-soaked' to remove any non-permanent / non-durable FR treatments.
- It is left to drip dry (line dry) and then needs to re-condition to set temperature & humidity before test.
- The cover material is tested using a non-combustion modified polyurethane foam as the filling material.
- Once the ignition source is removed, the sample must self extinguish within 2 minutes.
- If the cover splits at an early stage of the match flame application, the flame is directly exposed to the PU foam and this does not normally self extinguish and normally results in a fail.
- If the cover does not split, the flame is only exposed to the cover material and therefore we are only dealing with the fabric to self extinguish which should be ok if the fabric is FR treated correctly.

Note: For visible cover fabrics there are two routes to compliance:-

Route 1:- The cover fabric must pass the requirements of Schedule 4 Part 1 and Schedule 5 Part 1 (cigarette and match tests).

Or:-

Route 2:- The cover material must pass the requirements of Schedule 4 Part 1 (cigarette test) and is used in conjunction with an interliner material that satisfies the requirements of schedule 3. This route can only be taken if the fibre content of the cover fabric is at least 75% by weight of:- cotton / modal / flax / silk / viscose / wool – whether used separately or together and are not coated with polyurethane or a polyurethane preparation.

3.2.8 Requirements for non-visible cover materials

Non- visible covers (also called invisible fabrics) include the dust covers on the underside of chairs and stools. Where cover materials are classed as non-visible they should be tested to a modified cigarette and modified match test.

The difference is very simple in that:-

- Schedule 4 is modified so that there is no watersoak procedure.
- Schedule 5 is modified so that there is no watersoak procedure and the test is carried out over combustion modified FR foam instead of a non-combustion modified foam.

3.3 Labelling

3.3.1 Schedule 6 – Display swing ticket labels

All upholstered furniture must carry the swing ticket to indicate that the product complies with the regulations and which of the above routes has been taken to achieve that compliance.

If route 1 has been taken – and the cover material satisfies both the cigarette and match test requirements, then the product must be labelled with the green square display label.



If route 2 has been taken – and the cover material meets the fibre content rules and passes the cigarette test (and is used in conjunction with a schedule 3 interliner) then product must be labelled with the red warning triangle.



The graphic portion of the label in each case should be at least 50 mm x 50 mm.

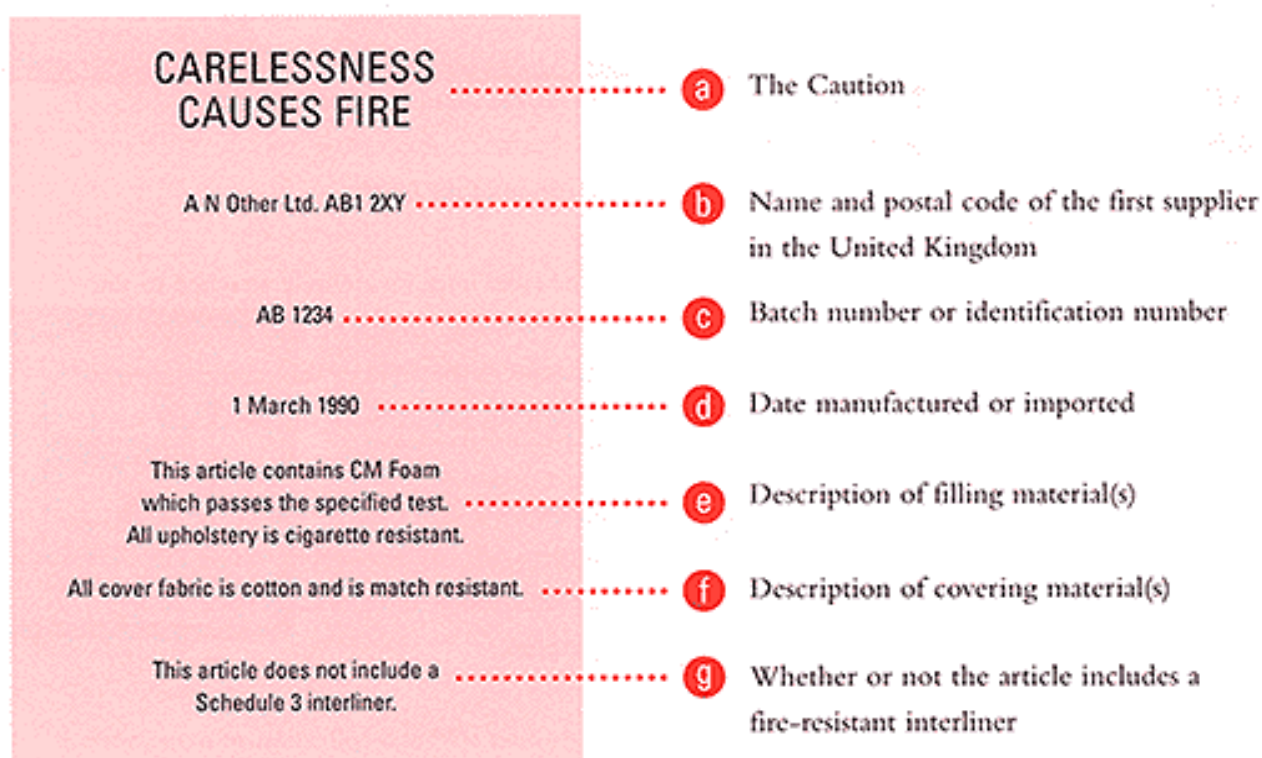
3.3.1 Schedule 7 – Permanent labels

All upholstered furniture must carry a permanent label to indicate that the product complies with the regulations. The label must be securely attached to the furniture (i.e. cannot be removed without causing damage to the label or the product). It may appear on any external surface of the article.

All words and numbers on the permanent label must be in medium letters of AT LEAST 10 point (or at least 2.5mm high) in upper or lower case. The letters must be legible, in durable print, and appear on a label of sufficient colour contrast to enable them to be seen clearly.

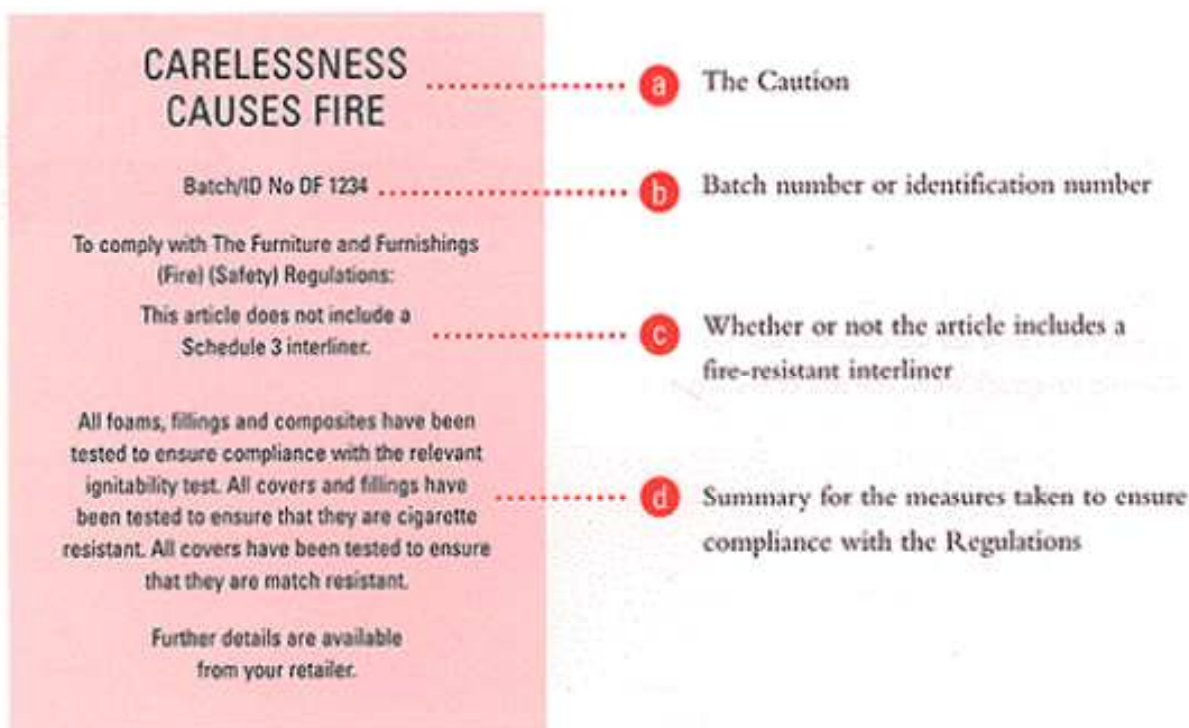
There are two versions of permanent labels that suppliers can choose from. These are:

- A label giving full information about the furniture:



or

- A shorter label giving only the minimum information about the furniture (as follows)



The manufacturer must check with their customer as to which method is preferred.

3.4 Frequency of Test

3.4.1 Recommendation

There is no absolute standard which details the frequency with which repeat testing on upholstery components suitable for use regarding the furniture regulations should be performed. However, in order to satisfy the requirements of the General Product Safety Regulations 2005, there is an obligation to carry out regular testing on products.

It is well established that the enforcement body expects to see test certificates which are no more than 12 months old and in some cases less than 6 months old dependant on volume of product supplied.

For initial orders / new development items it is required that all upholstery materials are tested to the relevant schedules of the Furniture & Furnishings (Fire) (Safety) Regulations.

For subsequent deliveries it is required that these certificates to be updated at least once every 6 months.

If the item is a high volume product, the frequency of testing would need to be increased.

Note: It is the supplier's duty to ensure that all products satisfy the relevant requirements and as such, the supplier of the product will need to ensure adequate traceability in the event of a fail result being recorded on a production item.

3.5 Traceability Guidance

All first suppliers of upholstered furniture to the UK must maintain and be able to demonstrate traceability from final product back to specific batches of raw material.

Documentation for all raw materials is necessary to ensure traceability of the final item of upholstered furniture

The following best practice rules are recommended as a minimum to ensure the traceability process is viable:

- Traceability from final product back to raw materials
- Full test reports containing the results of all relevant flammability tests for the supplied furniture items and its components
- The correlation of test results to specific batches of furniture
- The correlation of records to labels, batch numbers or marks attached to the furniture
- The ability to demonstrate that an ignition testing plan is in place and is followed
- All records and documentation must be kept for a minimum of 10 years from the last delivery of product

4. BEST PRACTICE - TEST METHODS

The following information relates to clarification and interpretations of the test methods contained within the Schedules of the Furniture and Furnishings (Fire) (Safety) Regulations to ensure consistency of testing and test results across all test laboratories.

4.1 The Smouldering Cigarette Test

4.1.1 Nominal weight – tolerance

The smouldering cigarette test detailed Schedule 4 of the regulations identifies the procedure in BS 5852: Part 1: 1979 as the test method of choice. The standard specifies that the cigarette ignition source must comply with requirements relating to mass, length, diameter and smoulder rate. However the requirements detailed for cigarette mass, length and diameter are not given with a tolerance. The requirements for the cigarette detailed in later editions of BS 5852, and in the harmonised European Standard BS EN 1021-1 for assessment of cigarette resistance, all provide tolerances for these measurements.

Based on information contained in republished versions of BS 5852 and BS EN 1021-1 and from considerable knowledge of conducting ignition tests for over thirty years the tolerance values that shall be used and considered as 'best practice' when measuring the cigarette requirements to ensure the cigarette is suitable for use when assessing cigarette resistance according to the UK furniture regulations as specified in Schedule 4 are:

Mass:	1 (+ 0, - 0.15) g
Length :	68 (\pm 2) mm
Diameter:	8 (\pm 0.5) mm
Smoulder rate:	12.0 (\pm 3.0) min/50 mm

NOTE: Note as of Mid November 2011 only reduced ignition propensity (RIP) cigarettes will be available for sale in the EU. These cigarettes will cease burning if not inhaled, and therefore do not meet the requirements of the Regulations. Care must be sought when purchasing cigarettes to ensure that they are suitable for testing to the Regulations.

4.1.2 Worst case testing – method

The regulations require that all upholstery composites are cigarette resistant. This means that all combinations of upholstery components - cover/interliner/filling - must comply with the relevant cigarette test detailed in Schedule 4 of the regulations.

It has long been recognised by the industry and the enforcement body (Trading Standards) that the requirement for every combination of upholstery materials to be cigarette resistant places an impractical test burden on the first supplier of upholstered furniture in the UK. The smouldering cigarette ignition behaviour of various cover/filling combinations is well documented and this existing knowledge of the manner in which they are likely to behave is commonly used throughout the industry to provide an accurate predictive result.

Thus a 'worst case' cigarette test system where a single test for a particular cover in combination with a 'worst case' filling is considered acceptable to demonstrate compliance with the cigarette test.

'Worst case' means the use of a filling that is likely to render the material combination most prone to ignition from a cigarette. Simply, a cover can be tested over a filling that is either worse than any that is used or is the worst that can be used by an individual producer. A positive test result indicates that a particular cover would be acceptable with other less smoulder prone filling combinations.

The most obvious choice is for a non-combustion modified urethane foam to be used as the 'worst case' filling for the cigarette test and common practice confirms this. Non-combustion modified urethane foam is the filling type of choice used by most test laboratories to assess the cigarette resistance of upholstery covers. As non-combustion modified urethane foam is not only ignitable from a small flame but also smoulder prone it can be quite safely assumed that a pass result would hold good for the vast majority of upholstery combinations because the filling materials which are required to be used by the regulations are less smoulder prone than a non-combustion modified foam.

The final complication here is that if an unsatisfactory result is recorded with the 'worst case' filling selected it must be remembered that this does not always mean the cover is unsuitable for use in terms of cigarette resistance. The option to test the cover with the filling selected to be used on the actual upholstered product remains, only if this final test does not satisfy the cigarette test is the cover/filling combination unsuitable

Consequently based on expert knowledge of the cigarette ignition behaviour of different cover types and filling materials the following 'best practice rules' shall be followed when selecting a worst case filling for cigarette testing:

- *Initial testing carried out using a non-combustion modified urethane foam*
- *If a non satisfactory result is obtained decide whether a further test using the actual filling in the final product is required*

The non-combustion modified urethane foam for 'worst case' cigarette testing shall be that specified for the match test in Schedule 5 of the regulations – A non-fire retardant polyurethane foam corresponding to the specification set out in BS 3379 Type B Hardness grade 130 and of a density of 20 – 22 kg per m³.

The filling used for the cigarette test shall be clearly recorded in the test report.

Note: The Regulations require that the cigarette test is carried out over the upholstery composite. Where there is any doubt about compliance the requirements of the Regulations must take precedence.

4.2 The Match Test

4.2.1 Gas Flame Temperature

The match test detailed Schedule 5 of the Regulations identifies the test procedure as the match test in BS 5852: Part 2: 1979. The standard specifies that the manner in which the correct calorific output for ignition source 1 – match equivalent ignition source – can be achieved. The type of gas, flow meter, flow rate, flexible tubing, burner tube, gas temperature, etc is clearly set out by the standard.

There are concerns however with the delivery of gas at a temperature of 25°C at a flow rate of 45 ± 2 ml/min. These relate to tolerance on gas temperature and the manner in which the specified gas temperature is achieved.

Tolerance

For consistency of testing the gas temperature shall be 25 (± 2.0) °C. The gas temperature shall be measured at the entry to the calibrated flow meter.

Method of control

There are many ways to control temperature. One method of achieving a gas temperature is to pass the gas from the gas bottle through a coiled copper tube of at least 1M in length situated in a water bath at a suitable temperature, prior to it passing through the specified flow meter and flexible tube on its journey to the burner tube. The temperature of the water bath should be monitored at all times and values recorded via a suitable temperature measuring device.

4.3 Water Soak Procedure

4.3.1 Drying Method

In the case of the water soak procedure the method is provided in both Schedule 4 and 5. The test procedure nominated for this procedure is detailed specified clauses of BS 5651: 1978. The regulations then state that the cover is dried by any means suitable. The drying procedure has been discussed at length since the introduction of the regulations and it is acknowledged that the acceptable and 'best practice' method for drying is to line dry the cover.

The cover specimen should be dried by hanging it vertically from the shorter edge, nearest to the cut-outs, so that it is not in contact with other specimen's materials or surfaces.

5. REPORTING

To ensure traceability of test reports and test certificates to final product and to simplify the process of approving test results, laboratories shall observe the following procedures when producing test reports or test certificates.

5.1 Sample description

The sample description used on all test reports and test certificates should be unique and should be such that the description on the test report can be related to the final product

5.1.1 Fabrics

Test reports for fabrics shall include the following descriptions

Use of fabric: e.g. cover fabric, non-visible fabric or interliner
 Type of fabric: e.g. woven, non-woven, PU, coated fabric etc
 Properties: e.g. colour, weight (g/m^2) and/or thickness (mm)
 Unique reference: e.g. fabric batch number or name, final product name or number
 For cover fabrics additional information as to whether the product has been watersoaked in accordance with the Regulations and line dried.

5.1.2 Foams and fillings

Test reports for fabrics shall include the following descriptions

Type of filling: e.g. PU, PE, Latex foam, polyester fibre etc
 Properties: e.g. density of foam (kg/m^3) or packing density of other fillings (kg/m^3)
 Unique reference: e.g. foam batch number or name, final product name or number

5.2 Report format

The front page of the report, or test certificate, must carry at least the following information:

Product name: comprising the fabric/filling type and unique reference
 Test requirement: e.g. Schedule I Part 1 or Schedule 4 Part 1 & Schedule 5 Part 1
 Test result: Either the words Pass or Comply for a successful result, or
 Either the words Fail or Non-Comply for an unsuccessful result

6. BEST PRACTICE MATRIX – FLAMMABILITY TESTING RECOMMENDATIONS

Provided that the relevant test procedures are followed as detailed in the Schedules to the Furniture & Furnishings (Fire) (Safety) Regulations, the use and implementation of the following 'best practice rules', designed to augment ignition test procedures relating to the testing requirements, it is considered that any uncertainties will be reduced and reproducibility enhanced.

TEST/REGULATORY REQUIREMENT	BEST PRACTICE REQUIREMENT
<p>Smouldering Cigarette Test</p> <p>Mass of cigarette Length of cigarette Diameter of cigarette Smoulder rate:</p>	<p>1 (+0.0, - 0.15) g 68 (± 2) mm 8 (± 0.5) mm 12.0 (± 3.0) min/50 mm</p>
<p>'Worst Case' Cigarette Test</p> <p>The Regulations require that the test is carried out on the upholstery composite (actual fabrics and fillings to be used within the product).</p>	<p>Initial testing of fabric over a non-fire retardant polyurethane foam complying to BS 3379 type B Hardness grade 130 and of a density of 20 – 22 kg per m³.</p> <p>If a non satisfactory result is obtained decide whether a further test using the actual filling in the final product is required.</p> <p>Details of the filling used shall be recorded on the test report</p>
<p>The Match Test</p> <p>Gas Flame Temperature at flow rate of 45ml/min</p>	<p>25 (± 2.0) °C</p>
<p>Water Soak procedure</p> <p>Drying Method</p>	<p>The cover should be line dried. Dry the specimen by hanging it vertically from the shorter edge, nearest to the cut-outs, so that it is not in contact with other specimen's materials or surfaces.</p>

7 REFERENCES

- SI 1234: 1988 The Furniture and Furnishings (Fire) (Safety) Regulations 1988.
- SI 2358: 1989 The Furniture and Furnishings (Fire) (Safety) (Amendment) Regulations 1989.
- SI 207: 1993 The Furniture and Furnishings (Fire) (Safety) (Amendment) Regulations 1993.
- SI 2205: 2010 The Furniture and Furnishings (Fire) (Safety) (Amendment) Regulations 2010.
- BS 3379: 1975 Specification for flexible urethane foam for load bearing applications.
- BS 5651: 1978 Cleansing and wetting procedures for use in the assessment of the effect of cleansing and wetting on the flammability of textile fabrics and fabric assemblies.
- BS 5852: Part 1: 1979 Fire tests for furniture. Part 1. Methods of test for the ignitability by smokers' materials of upholstered composites for seating.
- BS 5852: 2006 Methods of test for assessment of the ignitability of upholstered seating by smouldering and flaming ignition sources.
- BS 7177: 2008 Specification for the resistance to ignition of mattresses, mattress pads, divans and bed bases.
- BS EN 1021-1: 2006 Furniture. Assessment of the ignitability of upholstered furniture. Ignition source smouldering cigarette.