BS 5651 : 1989

British Standard Method for

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

Modes opératoires de nettoyage et d'humectage utilisés pour évaluer l'effet de ces opérations sur l'inflammabilité des supports et tissus textiles

Reinigungs- und Benetzungsverfahren zur Beurteilung der Reinigungs- und Netzwirkung auf die Entflammbarkeit von textilen Flächengebilden und textilen Konstruktionen

British Standards Institution

Foreword

This British Standard has been prepared under the direction of the Textiles and Clothing Standards Policy Committee and forms a revision of BS 5651 : 1978, which will be withdrawn on a date to be announced. BS 5651 : 1978 is referred to in the Nightwear (Safety) Regulations 1985 and the Furniture and Furnishings (Fire Safety) Regulations 1988 and will not be withdrawn until those Regulations are revised.

NOTE. Upon publication of this revision, BSI Sales Department will respond to purchase orders for BS 5651 by supplying copies of the 1989 edition. Copies of the 1978 edition may be obtained by quoting the number 'BS 5651/78'.

This British Standard provides a series of laboratory procedures for cleansing and wetting textile materials. These laboratory procedures are designed to simulate cleansing methods used in practice and hence assessment of their effects on the flammability of the materials indicates the possible changes in flammability performance to be expected when materials are wetted or cleansed. It is intended that this British Standard be used in conjunction with BS 5438, which gives test methods for flammability, but it may also be used when some other method of test for flammability is employed.

Several basic procedures are given which vary in their severity. The selection of the appropriate procedure will depend largely on the end uses of the material and particularly on the method of cleansing likely to be used.

The basic procedures are:

(a) a water soaking procedure, applicable to fabrics which are not normally washed or dry cleaned but which might be subjected to wetting or spot cleaning;

(b) a dry cleaning procedure;

(c) a domestic washing procedure;

(d) a commercial laundry procedure;

(e) a disinfecting laundry procedure, for fabrics which are washed in commercial or hospital laundries under high temperature disinfection conditions;

(f) a cleaning/flexing procedure, for fabric end uses such as tentage and tarpaulins.

The choice of procedure is also determined to some extent by the properties of the fabric or fabric assembly.

Alternative procedures, using reduced mechanical action and temperature or reduced chemical action, are provided for washing fabrics such as wool or certain low melting point acrylic or chlorofibres, which shrink excessively during the normal washing procedure. Thus a total of eight separate procedures is given, covering a wide range of cleansing and wetting treatments suitable for different fabric/end use combinations. The number of cycles specified for the dry cleaning and washing methods represents a compromise between the needs to reproduce actual use conditions and to enable the test to be completed within a reasonable time. In certain circumstances it may be necessary to specify the use of fewer or more test cycles, e.g. some nonwovens will require fewer cycles, whilst products subject to DHSS performance specifications are likely to require more.

It is possible to test a particular type of fabric and to establish its general pattern of behaviour after all the different procedures, but it is not practical to test production lots or small quantities of fabric by more than one procedure. Performance standards for different end uses should therefore specify certain minimum levels of flammability performance after a single appropriate procedure. They should also specify the use of labelling to indicate which test procedure has been employed, any other suitable cleansing process, and any cleansing processes which may produce a significant impairment of the flammability properties.

The flammability properties of fabrics may be affected by combinations of such factors as high wash temperatures, bleaching agents, hard water, and soap based products. These changes in flammability properties are sometimes due to deposits of agents on the fabric rather than to removal of the flame retardant components. As effects of deposits are highly dependent on the particular wash conditions used, it is not possible to specify a standard procedure to predict them and steps should be taken to minimize the likelihood of their occurrences in practice.

The water hardness specified (160 mg/L) in the domestic washing procedure is sufficient to detect possible adverse interaction between hard water and any flame retardant. Additional physical deposits may occur when much harder water is used, but no attempt is made to predict their likely effects, since these have been found to be very inconsistent. In general, the harder the water, the higher the level of deposition and the greater the detrimental effect on the flammability properties of fabrics.

It has to be realized, however, that water with much higher hardness levels than the 160 mg/L specified are commonly found in the United Kingdom. There may be small reductions in the flammability performance especially of fabrics with 'add on' finishes when these are washed in such hard water, but it has not been found possible to devise a reliable and consistent procedure leading to a meaningful measure of this reduction. On fabrics examined so far, such a reduction, even at the highest level, has been shown not to lead to a performance as hazardous as would have been encountered had the fabrics not been treated with an appropriate finish.

This interaction means that these procedures do not necessarily accurately predict the flammability performance of fabrics after domestic washing in very hard water (320 mg/L). Additionally, no account is taken in any of these procedures of the effect of use between wetting or cleansing which is known in certain instances to affect flammability performance.

There are many fabrics available which are made from fibres whose properties are accepted as being unaffected by continued cleansing and wetting. If it is likely that fabrics used in particular end uses for which specifications are being prepared may be produced from such fibres (e.g. pure finish polyamide, polyester or modacrylic), then the performance specification may exclude specific and closely defined fibres from assessment after treatment by the procedures which have been shown to have no effect.

The major changes introduced by the revision are:

(a) the ECE reference detergent has been included as an alternative to the IEC reference detergent;

(b) the amount of detergent used has been reduced in the laundry procedures to reduce the amount of foaming;

(c) the commercial laundry procedure 60 has been deleted.

At the time of publication of this British Standard, no corresponding international standard existed.

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

Contents

Method

1 Scope

This British Standard describes laboratory procedures for cleansing and wetting textile fabrics and fabric assemblies. The effects of these procedures on the flammability performance of the materials can be tested by the method given in BS 5438. Depending on the performance requirements, fabrics may be tested in accordance with BS 5438 both before and after being subjected to the procedures specified in this standard. These procedures may also be applicable where methods other than those given in BS 5438 are used to assess flammability.

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

2 Principle

Specimens intended for flammability testing are subjected to the appropriate procedure specified in the relevant performance specification or according to end use. The fabric involved may, if it is required by the performance specification, be tested in accordance with BS 5438 both before and/or after treatment in accordance with this standard in order to produce comparative values of flammability.

3 Water soaking procedure

3.1 General

This procedure is applicable to those fabrics which would not normally be subjected to water or to dry cleaning in use, but which might be subjected to spot cleaning or casual rinsing, e.g. under a tap. It is also used as a preliminary treatment to the dry cleaning procedure in order to remove water soluble finishes which, in use, may be affected by wetting.

3.2 Reagents

3.2.1 *Water*, of 160 ± 20 mg/L hardness (expressed as calcium carbonate) determined in accordance with BS 1427 at a temperature of 40 ± 3 °C, from one of the following sources:

(a) supply water of 160 ± 20 mg/L hardness;

(b) supply water of higher than 180 mg/L hardness and diluted to 160 ± 20 mg/L with water of a lower hardness;

(c) supply water of known initial hardness of n mg/L where n is less than 140 mg/L and artificially hardened to 160 ± 20 mg/L. To 5 L of the water add 500 mL of the calcium chloride hexahydrate solution (3.2.2) and follow this with 500 mL of the sodium hydrogen carbonate solution (3.2.3) and then sufficient of the water to give a total of 10 ± 0.1 L.

3.2.2 *Calcium chloride hexahydrate*, 43.8 (160 − n) mg/L solution in water of hardness n mg/L.

3.2.3 *Sodium hydrogen carbonate*, 33.6 (160 − n) mg/L solution in water of hardness n mg/L.

3.2.4 *Non-ionic wetting agent.*

NOTE. The exact nature of this reagent is not critical.

3.3 Apparatus

3.3.1 *Flat-bottomed dish* of sufficient size to enable the test specimens to be completely immersed.

3.3.2 *Iron or press*, to be used at a temperature setting appropriate to return the fabric to its original state.

3.4 Specimens

Use sufficient material to permit subsequent preparation of test specimens of the dimensions and number required for the method of test for flammability.

NOTE. Depending on the dimensions of the flat bottomed dish (3.3.1) the specimen may require folding depending on the specimen size.

3.5 Procedure

Using a liquor ratio of 1:20, completely immerse each specimen in water (3.2.1) containing 0.5 g/L of non-ionic wetting agent (3.2.4) in the flat-bottomed dish (3.3.1) at an initial temperature of 40 ± 1 °C. Ensure the specimen remains completely immersed.

After 30 min, remove the specimen, rinse in the water (3.2.1) using a liquor ratio of 1:20 for 2 min, and then flat or line dry the specimen. If the specimen has been folded during immersion refold before rinsing.

NOTE. This procedure is particularly applicable to upholstery fabrics, not intended to be ironed in use. For other types of fabric it may be necessary to dry the specimens partially by any method suitable for the fabric type and then to iron or press them at an appropriate temperature setting.

4 Dry cleaning procedure

4.1 General

This procedure is applicable to those fabrics which would normally be subjected to a dry cleaning procedure. A preliminary water soak (3.1) is also specified to remove water soluble finishes which, in use, may be affected by wetting.

4.2 Reagents

4.2.1 *Reagents* specified in clause 4 of BS 4961 : Part 1 : 1980.

4.2.2 *Water*, of 160 ± 20 mg/L hardness (3.2.1), with 0.5 g/L non-ionic wetting agent (3.2.4).

4.3 Apparatus

4.3.1 *Flat-bottomed dish.*

4.3.2 *Dry cleaning apparatus*, as specified in 5.1 of BS 4961 : Part 1 : 1980.

4.4 Specimens

Use sufficient material to permit subsequent preparation of test specimens of the dimensions and number required for the method of test for flammability.

4.5 Procedure

4.5.1 *Water soak.* Treat each specimen in accordance with clause 3.

4.5.2 *Dry cleaning.* Subject each specimen to a total of six dry cleaning and finishing procedures as specified in BS 4961 : Part 1 using the machine procedure appropriate to the fabric being tested.

5 Domestic washing procedures

5.1 General

This procedure is applicable to those fabrics which would normally be subjected to a water wash treatment in use. Two washing procedures are provided, appropriate to different types of fabric, as follows.

(a) Domestic wash procedure 40, carried out at a temperature of 40 °C and using a gentle wash rhythm (see 5.3.1) and a lighter load.

(b) Domestic wash procedure 50, carried out at a temperature of 50 °C and using a normal wash rhythm (see 5.3.1) and a greater load.

5.2 Reagents

5.2.1 *Water*, of 160 ± 20 mg/L hardness, as specified in 3.2.1.

5.2.2 *IEC test detergent, type 1*, or ECE reference detergent.* Sodium perborate shall be added immediately before use in the ratio of 1 g of sodium perborate to 4 g of detergent.

NOTE 1. The nominal compositions of these detergents are given in appendix A.

NOTE 2. The quantities specified in the test procedures are of detergent plus sodium perborate.

5.3 Apparatus

5.3.1 *Washing machine**, of the horizontal cylindrical rotating-cage type, provided with an automatic reversing mechanism and with an integral means of centrifuging. It shall reverse once every 5 to 15 revolutions and shall be capable of operating at both a normal wash rhythm, where the ratio of the period of agitation to the period of rest lies between 4:1 and 5:1, and at a gentle wash rhythm where the ratio lies between 1:4 and 1:5.

The machine shall possess a means of heating to the required temperature within the required time (see 5.5.2.4) and a means of maintaining and indicating that temperature. It shall be fitted with a suitable means for determining the amount of water in the cage, e.g. direct visual means or an external glass gauge. The diameter of the cage, which shall be fitted with internal lifters, preferably three or four (three are recommended), shall be not less than 460 mm and not more than 520 mm. The depth of the cage shall be not less than 210 mm. The speed of rotation of the cage shall be between 38 r/min and 52 r/min.

5.3.2 *Iron or press*, as specified in 3.3.2.

5.4 Specimens

Use sufficient material to permit subsequent preparation of the test specimens of the dimensions and number required for the method of test for flammability.

5.5 Procedure

5.5.1 *Domestic wash procedure 40.*

5.5.1.1 The values for the mass of the load, the volume of the liquor, and the amount of reagents in this procedure are based on a cage space of 70 L, a degree of loading of 37 g/L to 43 g/L cage space and a liquor ratio of 14.3 ± 1.8 L/kg of load. If a machine with a different cage space is used, the mass of the load, the volume of the liquor and the amount of the reagents shall be adjusted accordingly.

5.5.1.2 Use a load of 2.8 ± 0.2 kg, consisting of specimens plus makeweights. At least half the load shall consist of the fabric under test together with fabric which is of similar fibre type, the remainder consisting of makeweight of polyester filament fabric. If testing cellulosic textiles at least half the load shall be cellulosic.

NOTE. A suitable makeweight is specified in BS 4923.

5.5.1.3 Place the load in the machine. Add 40 ± 2.0 L of water (5.2.1) at a temperature of 40 ± 3 °C together with 200 g of detergent (5.2.2) and commence agitation at the gentle wash rhythm.

The volume of liquor may be gauged by a predetermined dip (see appendix B).

5.5.1.4 Maintaining the liquor at a temperature of 40 ± 3 °C, run the machine at the gentle wash rhythm for 30 min. Drain without agitation for 2 min.

5.5.1.5 Rinse the load as follows. Without agitation, add 40 ± 2.0 L of water (5.2.1) at a maximum temperature of 43 °C, then run the machine at the gentle wash rhythm for 3 min. Drain without agitation for 2 min. Repeat twice to give three rinses in all.

5.5.1.6 Centrifuge the load for 3 min.

5.5.1.7 Repeat the washing, rinsing and centrifuging cycles a further 11 times, making a total of 12 cycles.

NOTE. If the 12 cycles cannot be completed without interruption, the fabric may be left in the machine only after centrifuging, i.e. at the end of any one complete cycle.

5.5.1.8 Dry the specimens by any method suitable for the fabric type and iron or press them at an appropriate temperature setting.

NOTE. Ironing or pressing may be omitted for fabrics not suitable for ironing or pressing.

* For information on the availability of a suitable washing machine and of a suitable detergent, apply to Enquiry Section, BSI, Linford Wood, Milton Keynes MK14 6LE enclosing a stamped addressed envelope for reply.

5.5.2 *Domestic wash procedure 50.*

5.5.2.1 The values for the mass of the load, the volume of the liquor and the amount of reagents in this procedure are based on a cage space of 70 L, a degree of loading of 54 g/L to 60 g/L cage space and a liquor ratio of 10 ± 1 L/kg of load. If a machine with a different cage space is used, the mass of the load, the volume of the liquor and the amount of the reagents shall be adjusted accordingly.

5.5.2.2 Use a load of 4.0 ± 0.2 kg, consisting of specimens plus makeweights. At least half the load shall consist of the fabric under test together with fabric which is of similar fibre type, the remainder consisting of makeweight of polyester filament fabric. If testing cellulosic textiles at le[illegible]alf the load shall be cellulosic.

NOTE 1. A suitable makeweight is specified in BS 4923.

NOTE 2. With certain bulky fabrics it is impossible to load the washing machine with 4 kg of textile whilst maintaining adequate washing. Use a load of 2.8 kg in these cases and report that a reduced load was used.

5.5.2.3 Place the load in the machine. Add 40 ± 2.0 L of water (5.2.1) at a temperature of 40 ± 3 °C together with 200 g of detergent (5.2.2) and commence agitation at the normal wash rhythm.

The volume of liquor may be gauged by a predetermined dip (see appendix B).

5.5.2.4 Heat the liquor to a temperature of 50 ± 3 °C in 5 min to 10 min. Maintaining this temperature, run the machine for a further 30 min and then drain for 2 min.

5.5.2.5 Rinse the load as follows. Add 40 ± 2 L of water (5.2.1) at a maximum temperature of 43 °C, then run the machine for 3 min and then drain for 2 min. Repeat twice to give three rinses in all.

5.5.2.6 Centrifuge the load for 3 min.

5.5.2.7 Repeat the washing, rinsing and centrifuging cycles a [illegible]ther 11 times, making a total of 12 cycles.

NOTE. If the 12 cycles cannot be completed without interruption, the fabric may be left in the machine only after centrifuging, i.e. at the end of any one complete cycle.

5.5.2.8 Dry the specimens by any method suitable for the fabric type and iron or press them at an appropriate temperature setting.

NOTE. Ironing or pressing may be omitted for fabrics not suitable for ironing or pressing.

6 Laundry procedures

6.1 General

These procedures are applicable to those fabrics employed in end-uses to which laundering will be applied. Hard water is not required for the wash liquor because launderers almost invariably use softened water. Three procedures are given, one commercial laundering procedure at a temperature of 40 °C with reduced agitation, and two hospital or commercial procedures at the minimum disinfecting temperature of 71 °C, one with normal agitation and the other with reduced agitation intended primarily for wool blankets.

There is no objection to washing together similar fabrics with the same finish.

6.2 Reagents

6.2.1 *Water*, with a maximum hardness of 20 mg/L (expressed as calcium carbonate) determined in accordance with BS 1427 at a temperature of 40 ± 3 °C.

6.2.2 *Detergent* as specified in 5.2.2.

6.2.3 *Non-ionic ethoxylated alkyl phenol detergent.*

6.2.4 *Citric acid monohydrate.*

6.3 Apparatus

6.3.1 *Mechanical washing machine* as specified in 5.3.1.

6.3.2 *Iron or press*, as specified in 3.3.2.

6.4 Specimens

Use sufficient material to permit subsequent preparation of the test specimens of the dimensions and number required for the method of test for flammability.

6.5 Procedure

6.5.1 *Commercial laundry procedure 40*

6.5.1.1 The values for the mass of the load, the volume of the liquor, and the amount of reagents in this procedure are based on a cage space of 70 L, a degree of loading of 37 g/L to 43 g/L cage space and a liquor ratio of 14.3 ± 1.8 L/kg of load. If a machine with a different cage space is used the mass of the load, the volume of the liquor and the amount of the reagents shall be adjusted accordingly.

6.5.1.2 Use a load of 2.8 ± 0.2 kg, consisting of specimens plus makeweights. At least half the load shall consist of the fabric under test together with fabric which is of similar fibre type, the remainder consisting of makeweight of polyester filament fabric. If testing cellulosic textiles at least half the load shall be cellulosic.

NOTE. A suitable makeweight is specified in BS 4923.

6.5.1.3 Place the load in the machine. Add 40 ± 2 L of soft water (6.2.1) at a temperature of 40 ± 3 °C, together with 40 g of detergent (5.2.2) and commence agitation at the gentle wash rhythm.

The volume of liquor may be gauged by a predetermined dip (see appendix B).

6.5.1.4 Maintaining the liquor at a temperature of 40 ± 3 °C, run the machine at the gentle wash rhythm for 30 min. Drain without agitation for 2 min.

6.5.1.5 Rinse the load as follows. Without agitation, add 40 ± 2.0 L of soft water (6.2.1) at a maximum temperature of 43 °C, then run the machine at the gentle wash rhythm for 3 min. Drain without agitation for 2 min. Repeat twice to give three rinses in all.

6.5.1.6 Centrifuge the load for 3 min.

6.5.1.7 Repeat the washing, rinsing and centrifuging cycles a further 11 times, making a total of 12 cycles.

NOTE. If the 12 cycles cannot be completed without interruption, the fabric may be left in the machine only after centrifuging, i.e. at the end of any one complete cycle.

6.5.1.8 Dry the specimens by any method suitable for the fabric type and iron or press them at an appropriate temperature setting.

NOTE. Ironing or pressing may be omitted for fabrics not suitable for ironing or pressing.

6.5.2 *Hospital laundry procedure (wool)*

6.5.2.1 The values for the mass of the load, the volume of the liquor, and the amount of reagents in this procedure are based on a cage space of 70 L, a degree of loading of 37 g/L to 43 g/L cage space and a liquor ratio of 14.3 ± 1.8 L/kg of load. If a machine with a different cage space is used, the mass of the load, the volume of the liquor and the amount of the reagent shall be adjusted accordingly.

6.5.2.2 Use a load of 2.8 ± 0.2 kg, consisting of specimens plus makeweights. At least half the load shall consist of the fabric under test together with fabric which is of similar fibre type, the remainder consisting of makeweight of polyester filament fabric.

NOTE. A suitable makeweight is specified in BS 4923.

6.5.2.3 Place the load in the machine. Add 40 ± 2 L of soft water (**6.2.1**) at a temperature of 40 ± 3 °C, together with sufficient detergent (**6.2.3**) predissolved to produce a good running lather and 28 g citric acid monohydrate (**6.2.4**). Commence agitation at the gentle wash rhythm. The volume of liquor may be gauged by a predetermined dip (see appendix B).

6.5.2.4 Heat the liquor to a temperature of 74 ± 3 °C in 10 min to 20 min. Maintaining this temperature, run the machine at the gentle wash rhythm for a further 8 min. Drain without agitation for 2 min.

6.5.2.5 Rinse the load as follows. Without agitation add 40 ± 2 L of soft water (**6.2.1**) at a maximum temperature of 43 °C, then run the machine at the gentle wash rhythm for 2 min. Drain without agitation for 2 min. Repeat twice to give three rinses in all.

6.5.2.6 Centrifuge the load for 3 min.

6.5.2.7 Repeat the washing, rinsing and centrifuging cycles a further 11 times, making a total of 12 cycles.

In certain cases additional washing, rinsing and centrifuging cycles may be required, depending on the individual performance specification (e.g. DHSS performance specifications for wool blankets require 50 cycles).

NOTE. If the 12 cycles (or more if specified) cannot be completed without interruption, the fabric may be left in the machine only after centrifuging, i.e. at the end of any one complete cycle.

6.5.2.8 Dry the specimens by any method suitable for the fabric type and iron or press them at an appropriate temperature setting.

NOTE. Ironing or pressing may be omitted for fabrics not suitable for ironing or pressing.

6.5.3 *Hospital laundry procedure (normal)*

6.5.3.1 The values for the mass of the load, the volume of the liquor and the amount of reagents in this procedure are based on a cage space of 70 L, a degree of loading of 54 g/L to 60 g/L cage space and a liquor ratio of 6 ± 0.8 L/kg of load for the washing stage, and 10 ± 1.0 L/kg of load for the rinsing stage. If a machine with a different cage space is used, the mass of the load, the volume of the liquor and the amount of reagents shall be adjusted accordingly.

6.5.3.2 Use a load of 4.0 ± 0.2 kg, consisting of specimens plus makeweights. At least half the load shall consist of the fabric under test together with fabric which is of similar fibre type, the remainder consisting of makeweight of polyester filament fabric. If testing cellulosic textiles at least half the load shall be cellulosic.

NOTE 1. A suitable makeweight is specified in BS 4923.

NOTE 2. With certain bulky fabrics it is impossible to load the washing machine with 4 kg of textile whilst maintaining adequate washing. Use a load of 2.8 kg in these cases and report that a reduced load was used.

6.5.3.3 Place the load in the machine. Add 24 ± 2 L of soft water (**6.2.1**) at a temperature of 40 ± 3 °C together with 24 g of detergent (**5.2.2**) and commence agitation at the normal wash rhythm.

The volume of liquor may be gauged by a predetermined dip (see appendix B).

6.5.3.4 Heat the liquor to a temperature of 74 ± 3 °C in 10 min to 20 min. Maintaining this temperature, run the machine for a further 15 min and then drain for 2 min.

6.5.3.5 Rinse the load as follows. Add 40 ± 2 L of soft water (**6.2.1**) at a maximum temperature of 43 °C, run the machine for 3 min and then drain for 2 min. Repeat three times to give four rinses in all.

6.5.3.6 Centrifuge the load for 3 min.

6.5.3.7 Repeat the washing, rinsing and centrifuging cycles a further 11 times, making a total of 12 cycles.

In certain cases additional washing, rinsing and centrifuging cycles may be required, depending on the individual performance specification (e.g. DHSS performance specifications require 50 cycles for curtains and 200 cycles for other textiles).

NOTE. If the 12 cycles (or more if specified) cannot be completed without interruption, the fabric may be left in the machine only after centrifuging, i.e. at the end of any one complete cycle.

6.5.3.8 Dry the specimens by any method suitable for the fabric type and iron or press them at an appropriate temperature setting.

NOTE. Ironing or pressing may be omitted for fabrics not suitable for ironing or pressing.

7 Leaching/flexing procedure

7.1 General

This procedure is applicable to heavy tentage and tarpaulin fabrics which are not subjected to the laundry or dry cleaning procedures.

7.2 Reagent

7.2.1 *Water*, of 160 ± 20 mg/L hardness as described in **4.2.1.**

7.3 Apparatus

7.3.1 *Vessel* for containing the water and specimens at a liquor ratio of 20:1.

7.3.2 *Drying oven* regulated at 105 ± 5 °C.

7.3.3 *Smooth steel rod* 10 mm *diameter*, over which specimens are flexed.

7.3.4 *Mass-piece*, 1 kg, for tensioning specimens while flexing.

7.4 Specimens

Use sufficient material to permit subsequent preparation of test specimens of the dimensions and number required for the method of test for flammability, making allowance for the extra fabric required for holding the specimen during the flexing procedure.

7.5 Procedure

7.5.1 Thoroughly crumple each specimen by gripping it at opposite edges and rotating the hands 12 times so that the surface of the fabric is rubbed on itself. Turn the specimen over, grip by the other two edges and repeat the operation. Squeeze the fabric into a ball between the two rotations and after the second.

NOTE. This procedure applies essentially to square samples. If specimens for testing in accordance with test 3 of BS 5438 are being treated, the procedure may be modified by marking, without cutting the specimen into four approximately square sections for the crumpling procedure, and crumpling each section in turn. It is essential that the material be thoroughly crumpled, flexed and, to a degree, abraded.

7.5.2 Using a liquor ratio of 20:1, immerse each crumpled specimen in water (7.2.1) starting at 60 ± 5 °C and allow the water to cool.

7.5.3 After 4 h, remove each specimen, and repeat the crumpling procedure specified in 7.5.1 on each wet specimen.

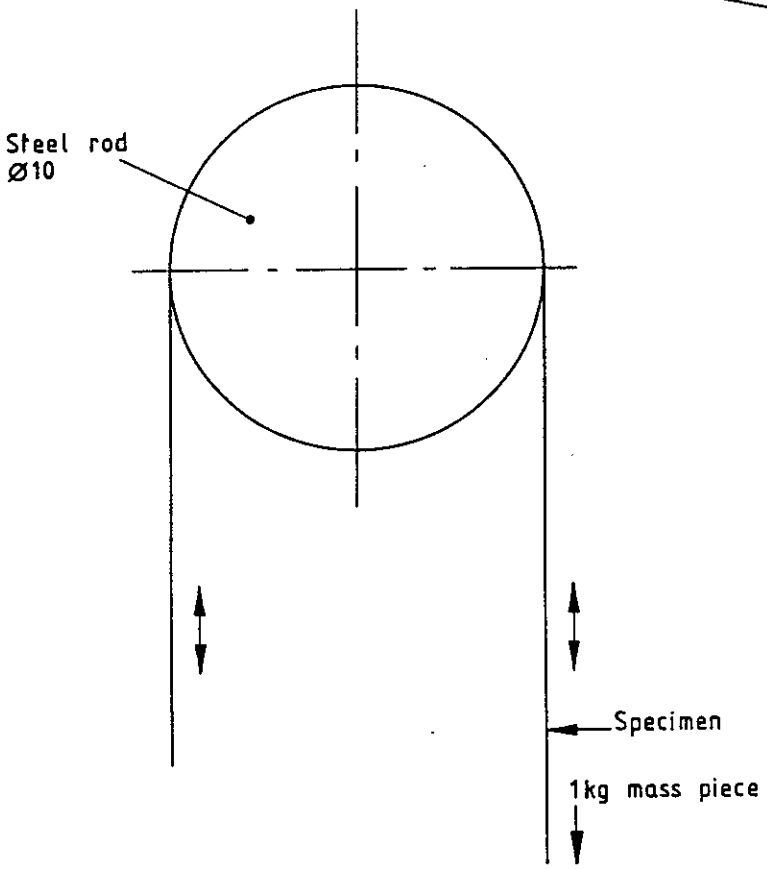
7.5.4 Dry each specimen in the drying oven (7.3.2) at 105 ± 5 °C for 2 h.

7.5.5 Flex each specimen for 10 cycles over a smooth horizontal steel rod 10 mm in diameter with a 1 kg mass-piece attached to the lower edge in such a way that the load is evenly spread across the width of the specimen (see figure 1). Repeat a further 10 cycles with the other surface of the specimen in contact with the rod. Each cycle is double-rub making a total of 20 double-rubs.

7.5.6 Repeat the soaking procedure specified in **7.5.2.**

7.5.7 Absorb surface water with a lint free cloth and allow each specimen to air dry.

7.5.8 Ensure sufficient fabric has been flexed to give sufficient fabric for subsequent flammability tests. Discard the section of fabric not flexed around the steel rod prior to flammability tests.



The dimension is in millimetres.

Figure 1. Flexing procedure

Appendices

Appendix A. ECE and IEC reference detergents

Table 1. Nominal composition of ECE reference detergent and IEC test detergent, type 1

Component	Nominal percentage composition	
	ECE detergent	IEC detergent
	(*m/m*)	(*m/m*)
Linear sodium alkyl benzene sulphonate (mean length of alkane chain: $C_{11.5}$)	8.0	8.0
Ethoxylated tallow alcohol (14 EO)	2.9	2.9
Sodium soap (chain length C_{12-22})	3.5	3.5
Sodium tripolyphosphate	43.7	43.7
Sodium silicate (SiO_2/Na_2O = 3.3:1)	7.5	7.5
Magnesium silicate	1.9	1.9
Carboxymethylcellulose	1.2	1.2
Ethylenediaminetetra-acetic acid (tetrasodium salt)	0.2	0.2
Sodium sulphate	21.2	21.0
Optical brightener for cotton (dimorpholinostilbene type)		0.2
Moisture	9.9	9.9

Appendix B. Determination of depth of liquor in the cage

It may be convenient to control the water by observation of the mean depth of water in the cage when the loaded machine is running (i.e. the 'running' dip). For each machine and type of load the appropriate running dips produced by the specified volume of added water can readily be determined experimentally.