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British Standard Method for
Determination of the resistance to pilling and
change of appearance of fabrics

Méthode de détermination de la résistance au boulochage et au changement d'aspect des étoffes

Verfahren zur Bestimmung der Pillbeständigkeit und zur Beurteilung der Veränderung
im Aussehen textiler Flächengebilde

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The following BSI references relate to the work on this standard: Committee reference TCM/24 Draft for comment 85/41463 DC

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Textiles and Clothing Standards Committee (TCM/-) to Technical Committee TCM/24, upon which the following bodies were represented:

- British Textile Employers' Association
- Confederation of British Wool Textiles Limited
- International Wool Secretariat
- Man-made Fibres Producers' Committee

- Manchester Testing House
- Ministry of Defence
- Soap and Detergent Industry Association
- Society of Dyers and Colourists
- Society of Motor Manufacturers and Traders Limited
- Textile Institute
- Textile Research Council

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Foreword

This British Standard has been prepared under the direction of the Textiles and Clothing Standards Committee and is a revision of BS 5811 : 1979, which is withdrawn.

Pills are formed when fibres on a fabric surface 'tease-out' and become entangled during wear. Such surface deterioration is generally undesirable, but the degree of consumer tolerance for a given level of pilling will depend on the garment type and fabric end-use.

Generally, the level of pilling which develops is determined by the rates of the following parallel processes:

- (a) fibre entanglement leading to pill formation;
- (b) development of more surface fibre;
- (c) fibre and pill wear-off.

These rates depend, in a complex way, on the fibre, yarn and fabric properties. Two extreme situations can be found. The first case, typically found in wear with fabrics containing strong fibres, is where the rates of pill formation, (a), and surface fibre development, (b), exceed the rate of wear-off, (c). The second, typically the case of wool, is where the rate of fibre and pill wear-off competes with the rate of pill formation. An attendant mechanism, in the second case, is where some surface fibres wear off before forming pills, thus influencing the rate of process (b).

The ideal laboratory test would accelerate the wear processes (a), (b) and (c) by exactly the same factor, and would be universally applicable to all fibre, yarn and fabric types. No such test has been developed, nor is it likely to be. However, a test procedure has been established in which fabrics can be ranked in the same order of pilling propensity as is likely to occur in end-use wear.

Particular attention is drawn to appendix A, which gives advice on conducting the test, care of apparatus and significance of results. It is recommended that the appendix be studied prior to carrying out the test procedure.

The principal changes introduced by this revision are as follows.

- (a) The photographic standards have been replaced by a visual assessment on a five point rating scheme, which has been found to give more reproducible results. The rating scheme includes assessment of surface fuzzing as well as pilling.
- (b) The method has been extended to include knitted fabrics.

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Method

1 Scope

This British Standard describes a method for the determination of the resistance to pilling and change of appearance of apparel fabrics.

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 fuzzing. The roughing up of the surface fibres and/or teasing out of the fibres from the fabric, which produces change in appearance. This change can occur during washing, dry cleaning or testing.

2.2 pilling. The entangling of fibres into balls (pills) which stand proud of the fabric. This change can occur during washing, dry cleaning or testing. A pill is of such density that light will not penetrate and will cast a shadow.

3 Principle

Specimens are mounted on polyurethane tubes and tumbled randomly, under defined conditions, in a cork-lined box. After an agreed period of tumbling the change in appearance of the specimens is assessed against a rating scale.

4 Apparatus

4.1 Pill testing box*, a cubical box with internal dimensions, before lining, of 235 mm. All internal surfaces of the box shall be lined with cork jointing material of 3.2 mm thickness. The box shall be rotated at 60 ± 2 r/min about a horizontal axis passing through the centres of two opposite faces. One side of the box shall be removable for access.

NOTE. Advice on the calibration and comparison of pill testing boxes is given in appendix A.

Cork linings shall be inspected at regular intervals and shall be replaced when obviously damaged or soiled in such a way as to alter their frictional properties.

4.2 Polyurethane specimen tubes*, (four), each 140 mm long \times 31.5 mm outside diameter \times 3.2 mm wall thickness, mass 52.25 ± 1.0 g.

4.3 Mounting jig*, to mount specimens on tubes.

4.4 Self-adhesive PVC tape*, 19 mm wide.

4.5 Sewing machine.

4.6 Viewing cabinet, which provides high intensity oblique incident illumination (see figure 1) and in which specimens are so mounted that the light casts a shadow across the specimens. The cabinet shall be placed in a darkened area.

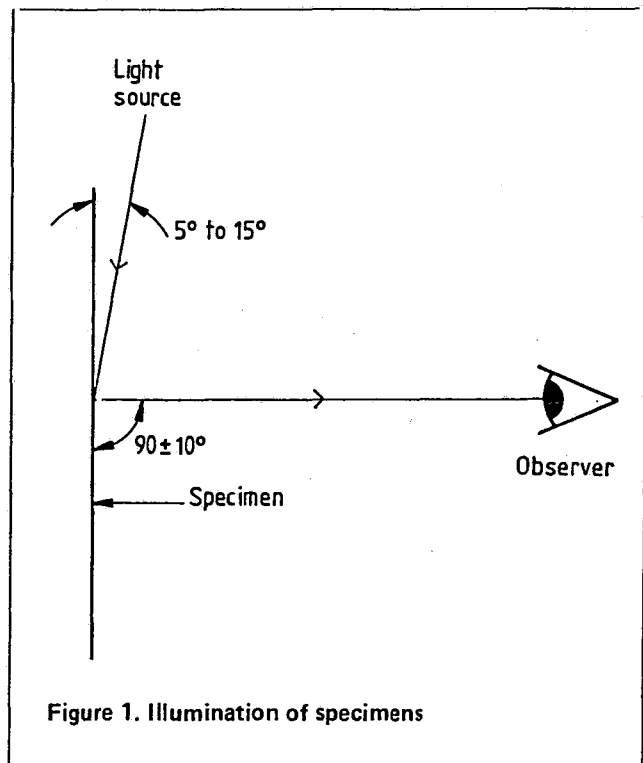


Figure 1. Illumination of specimens

5 Conditioning and testing atmosphere

The standard temperate atmosphere for conditioning and testing textiles as defined in BS 1051 shall be used, i.e. a temperature of 20 ± 2 °C and a relative humidity of 65 ± 2 %.

6 Preparation of test specimens

6.1 Unless otherwise agreed launder or dry clean the sample using a method agreed between the interested parties.

NOTE 1. The procedures described in BS 4923 or BS 4961 : Part 1 may be suitable.

NOTE 2. It is recommended to launder or dry clean test specimens to protect the friction surfaces of the pilling box and specimen tubes from lubricants or finishes which may cause inconsistent results.

If laundering or dry cleaning is carried out, assess the specimens before and after treatment using the rating scheme in 8.2.

6.2 From the sample, cut four specimens, each 125 mm \times 125 mm. On each specimen mark the back of the fabric and the length direction. Where a fabric has no discernible face, test both sides.

6.3 Take two specimens and fold each with its face, if discernible, inward and with the machine direction running in the direction of the fold. Sew 12 mm from the cut edges to form a tube, using a stitch density so as to

*For details of the sources of supply of suitable apparatus write to Enquiry Section, BSI, Linford Wood, Milton Keynes MK14 6LE, enclosing a stamped addressed envelope for reply.

produce a balanced seam. Prepare the other two specimens similarly with the cross direction running in the direction of the fold.

6.4 Turn each specimen inside out, so that the fabric face forms the outside of a tube, and cut 6 mm off each end of the fabric tube, thereby removing any sewing distortion. Using the mounting jig (4.3), mount one prepared specimen on each polyurethane specimen tube (4.2) (see figure 2), so that the specimen ends are an equal distance in from the ends of the polyurethane specimen tube. Ensure that the seamed portion lies as flat as possible. Apply self-adhesive PVC tape (4.4) around each of the cut ends of each specimen, so that the tape fixes the specimen onto the tube and leaves 6 mm of the polyurethane specimen tube exposed. The length of tape on each end of the specimen shall not exceed a length of approximately 1.5 times the circumference of the tube.

6.5 Condition the specimens in the atmosphere specified in clause 5 for at least 16 h. Carry out the test in the same atmosphere.

7 Procedure

7.1 Ensure that the inside of the pill testing box (4.1) is clean and free from lint.

7.2 Place the four mounted specimens from the sample in the same pill testing box. Close and firmly secure the lid. Tumble the tubes in the box for the agreed number of revolutions.

NOTE. No test/wear predictions are available and therefore a suitable number of revolutions needs to be agreed for the particular fabric composition between the parties concerned.

7.3 Remove the specimens from the box, and cut along the seam.

8 Assessment of pilling and/or fuzzing

8.1 Mounting of test specimens

Mount the four tested specimens with the length directions vertical on a piece of A4 size card, making sure that the

specimens cover the entire card. Attach a piece of the untested sample to the card.

8.2 Assessment

Place the specimen under assessment and a piece of untested sample centrally on the lectern (see figure 1), with the length direction vertical. If necessary, use a piece of self-adhesive PVC tape (4.4) to ensure correct placement.

View each specimen from just outside the viewing cabinet (4.6) (to prevent glare from the light source) and directly in front of the specimen, with the eyes approximately 15 cm to 30 cm above the centre of the specimen.

Rate each specimen in accordance with the rating scheme given in table 1. If the rating appears between two grades report the result as, for example, 3–4.

Rating	Description	Points to be taken into consideration during assessment
5	No change	No visual change
4	Slight change	Slight surface fuzzing
3	Moderate change	The test specimen may exhibit either or both of the following: (a) moderate fuzzing; (b) isolated fully formed pills.
2	Significant change	Distinct fuzzing and/or pilling
1	Severe change	Dense fuzzing and/or pilling which covers the specimen

NOTE. The rating for pilling may alter on storage of the tested specimens.

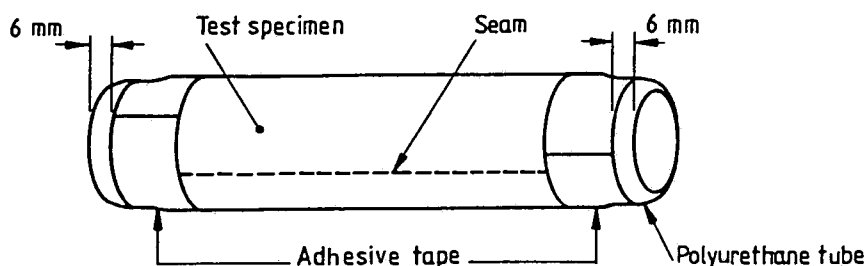


Figure 2. Mounting of specimen onto polyurethane tube

9 Calculation and expression of results

Record the rating for each specimen and calculate the mean result. If the mean result is not a whole number express the result to the nearest half grade, e.g. 3.5, 4, etc.

10 Test report

The report shall contain the following information:

(a) the number and date of this British Standard, i.e. BS 5811 : 1986, together with details of any deviations from the test procedure;

(b) details of the sample tested;

(c) details of the pretreatment (e.g. washing, dry cleaning), if carried out, and assessments both before and after the treatment (see 6.1);

(d) the number of revolutions;

(e) the result, expressed as described in clause 9;

(f) if the rating for any specimen is greater than 0.5 of a grade from the mean, the grade for each specimen, with the yarn direction along the tube (either length direction or cross direction along the tube).

Appendix A. Advice on the use of the pill testing box

A.1 Pill testing box

The rotational speed of 60 ± 2 r/min should be checked periodically.

New liners require running in for approximately 200 h with four blank tubes until the liner has stopped shedding cork dust. Generally, the frictional properties of the cork are not a major source of test result variation, but after prolonged use the surface of the cork may become polished or contaminated. Such changes can lead to less severe pill testing. In such cases the cork liners should be replaced.

A.2 Specimen tubes

The normal, black, polyurethane, press-moulded tubes should be virtually identical to each other when new. Experience of intensive use has shown that no significant wear of these tubes occurs under normal use conditions.

The most critical part of the tube is the convex outer surface at its end. New tubes should be checked on receipt to ensure that no moulding faults have occurred in the critical region. In use, damage is unlikely, but if it should occur it is essential that the tube be replaced.

A.3 Cleaning and maintenance

Before each test it is essential to ensure that all fluff and debris from the previous test have been removed from inside the box, e.g. by means of a vacuum cleaning device or by using a painter's small brush. Periodically, it may be

necessary to clean the cork liners if they have become contaminated by finishes, etc. from test fabrics. Suitable cleaning solvents are industrial methylated spirit or 1,1, 1-trichloroethane. Use only a minimum amount of solvent to wipe the surface of the cork.

NOTE. It should be noted that the use of industrial methylated spirit is governed by The Industrial Methylated Spirits Regulations, 1952 (S.I. 1952, No 2230).

A.4 Calibration

It is recommended that each user of this test method should retain two reference fabrics relevant to the work of the laboratory and having different levels of pilling in the range grade 1–2 to grade 4.

These reference fabrics should be used to test every newly installed box and every newly relined box, and the tested fabric specimens should be retained for subsequent reassessment. At regular intervals, e.g. 6 months, the reference fabrics should be retested and compared with the initially tested specimens. In this way any drift either between boxes or within a box can be detected. The fact that specimens may have a slightly flattened surface should be taken into account.

A.5 Accuracy of results

A.5.1 The variation in the result based on the mean of four test specimens, ignoring assessment error, should be no more than 0.5 of a grade.

A.5.2 The variation in the assessment of the grades of the four specimens on visual assessment should be no more than 0.5 of a grade.

Publications referred to

- | | |
|---------|--|
| BS 1051 | Glossary of terms relating to the conditioning, testing and mass determination of textiles |
| BS 4923 | Schedule of domestic washing and drying procedures for textile testing |
| BS 4961 | Methods for determination of dimensional stability of textiles to dry cleaning in tetrachloroethylene
Part 1 Machine method |