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## Textiles — Determination of fabric propensity to surface pilling, fuzzing or matting —

### Part 1: Pilling box method

*Textiles — Détermination de la propension des étoffes au boulochage, à l'ébouriffage ou au moutonnement en surface —*

*Partie 1: Méthode de la boîte de boulochage*

ICS: 59.080.01

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ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Fax: +41 22 749 09 47  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 24, *Conditioning atmospheres and physical tests for textile fabrics*.

This second edition cancels and replaces the first edition (ISO 12945-1:2000), which has been technically revised.

The main changes compared to the previous edition are as follows:

- **Clause 9:** visual assessment of pilling, fuzzing, and matting is carried out according to ISO 12945-4.

A list of all parts in the ISO 12945- series, under the general title *Textiles- Determination of the fabric propensity to surface pilling, fuzzing or matting*, can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

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.

The rates of these processes depend on the fibre, yarn and fabric properties. Examples of extreme situations are found in fabrics containing strong fibres versus fabric containing weak fibres. A consequence of the strong fibre is a rate of pill formation that exceeds the rate of wear-off. This results in an increase of pilling with an increase of wear. With a weak fibre the rate of pill formation competes with the rate of wear-off. This would result in a fluctuation of pilling with an increase of wear. There are other constructions in which the surface fibre wear-off occurs before pill formation. Each of these examples demonstrates the complexity of evaluating the surface change on different types of fabric.

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. However, a test procedure has been established in which fabrics can be ranked in the same order of pilling, fuzzing, and matting propensity as is likely to occur in end-use wear.

Particular attention is drawn to [Annex A](#) which gives advice on the maintenance of the apparatus. It is recommended that [Annex A](#) be studied prior to carrying out the procedure.

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# Textiles — Determination of fabric propensity to surface pilling, fuzzing or matting —

## Part 1: Pilling box method

### 1 Scope

This part of ISO 12945 describes a method for the determination of the resistance to pilling, fuzzing, and matting of textile fabrics using a rotating pilling box apparatus.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 139, *Textiles — Standard atmospheres for conditioning and testing*

ISO/DIS 12945-4:2019, *Textiles — Determination of fabric propensity to surface pilling, fuzzing or matting — Part 4: Assessment of pilling, fuzzing and matting by visual analysis*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/DIS 12945-4 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

#### 3.1 pills

entangling of fibres into balls (pills) which stand proud of the fabric and are of such density that light will not penetrate and will cast a shadow

Note 1 to entry: This change can occur during washing, dry cleaning, and/or wearing.

[SOURCE: ISO/DIS 12945-4:2019, 3.1]

#### 3.2 pilling

generation of pills over the surface of the fabric

[SOURCE: ISO/DIS 12945-4:2019, 3.2]

#### 3.3 fuzzing

roughing up of the surface fibres and/or teasing out of the fibres from the fabric, which produces a visible surface change

Note 1 to entry: This change can occur during washing, dry cleaning, and/or wearing.

[SOURCE: ISO/DIS 12945-4:2019, 3.3]

### 3.4

#### **matting**

disorientation of the raising fibres from a napped fabric, which produces a visible surface change

[SOURCE: ISO/DIS 12945-4:2019, 3.4]

## 4 Principle

Specimens are mounted on polyurethane tubes and tumbled randomly in a cork-lined box at a constant rotational speed. Fuzzing, pilling, and matting are assessed visually after defined stages of testing.

## 5 Apparatus

**5.1 Pill testing box (pilling box)**, cubic, 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  $(60 \pm 2)$  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 [Annex 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 (see [A.4](#)).

**5.2 Polyurethane specimen tubes**, (four are required), each measuring  $(140 \pm 1)$  mm in length by  $(31,5 \pm 1)$  mm outside diameter by  $(3,2 \pm 0,5)$  mm wall thickness, mass  $(52,25 \pm 1)$  g.

**5.3 Mounting jig**, used to mount specimens on the tubes.

**5.4 Self-adhesive polyvinyl chloride (PVC) tape**, 19 mm wide.

**5.5 Sewing machine.**

## 6 Preparation of test specimens

### 6.1 Pretreatment

Laboratory samples may be pre-treated by washing or dry-cleaning before cutting the test specimens, using conditions appropriate for the fabric end use or conditions agreed upon between the interested parties. When pre-treated, the evaluation of the tested specimen from the pre-treated laboratory sample is done in comparison with that laboratory sample.

If there is no specific pre-treatment agreed upon between the interested parties, the specimen is tested as received.

Regardless of the pre-treatment, samples shall be conditioned according to [Clause 8](#) prior to testing.

NOTE The procedures described in ISO 6330 or in a part of the series of ISO 3175 can be suitable (see Bibliography).



## 6.2 Cutting out

From the sample, cut four test specimens, each  $(125 \pm 1) \text{ mm} \pm (125 \pm 1) \text{ mm}$ . On each test specimen mark the back of the fabric and the length direction. Where a fabric has no discernible face, test both sides. An additional cut specimen of  $125 \text{ mm} \pm 125 \text{ mm}$  is required for assessment.

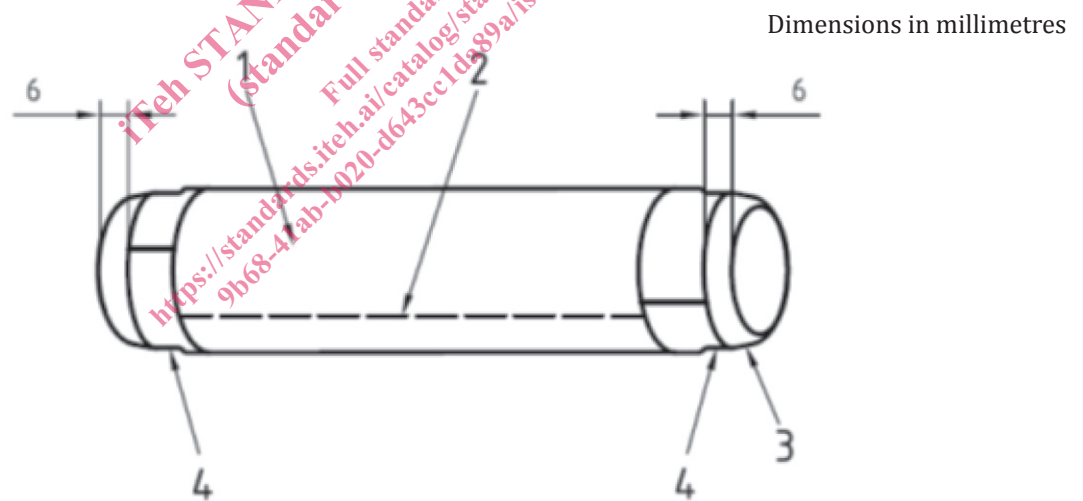
NOTE Test specimens should be randomly placed with none of the test specimens having common warp or weft threads.

## 6.3 Number of test specimens

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 such that a balanced seam is produced. Prepare the other two specimens similarly with the cross direction running in the direction of the fold.

## 6.4 Mounting of test specimens

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 to remove any sewing distortion. Using the mounting jig (5.3), mount one prepared specimen on each polyurethane specimen tube (5.2) so that the specimen ends are an equal distance in from the ends of the polyurethane specimen tube (see Figure 1). Ensure that the seamed portion lies as flat as possible. Apply self-adhesive PVC tape (5.4) around each of the cut ends of each specimen, so that the tape fixes the specimen on to 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.



### Key

- 1 test specimen
- 2 seam
- 3 polyurethane tube
- 4 adhesive tape

Figure 1 — Mounting of specimen on to polyurethane tube

## 7 Conditioning and testing atmosphere

The standard atmosphere for conditioning and testing textiles as defined in ISO 139 shall be used.

It is recommended that the test specimens are conditioned for at least 16 h prior to testing.