INTERNATIONAL STANDARD

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

Part 3: Random tumble pilling method

Textiles — Détermination de la propension des étoffes au boulochage, à l'ébouriffage ou au moutonnement en surface — Partie 3: Méthode d'essai de boulochage par chocs aléatoires dans une chambre cylindrique

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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).

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).

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.

This document was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 24, *Conditioning atmospheres and physical tests for textile fabrics*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 248, *Textiles and textile products*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 12945-3:2000), which has been technically revised.

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

— in Clause 10, visual assessment of pilling, fuzzing, and matting have been carried out according to ISO 12945-4.

A list of all parts in the ISO 12945 series 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.

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 that 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 and checking of the apparatus and liners. It is recommended that Annex A be studied prior to carrying out the procedure.

Annex C gives rationale especially regarding the testing of napped fabrics.

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

Part 3:
Random tumble pilling method

1 Scope

This document specifies a method for the determination of the resistance to pilling, fuzzing, and matting of textile fabrics using the random tumble pilling tester. This method is applicable to most of woven and knitted fabrics, including napped fabrics (fleeces, inlay fabrics).

This method is not applicable to fabrics which cannot tumble freely.

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 48-2, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 2: Hardness between 10 IRHD and 100 IRHD*

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

ISO 12945-4, *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 following terms and definitions apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
pill
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 12945-4:2020, 3.1]

3.2
pilling
generation of *pills* (3.1) over the surface of the fabric

[SOURCE: ISO 12945-4:2020, 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 12945-4:2020, 3.3]

3.4
matting
disorientation of the raised fibres from a napped fabric, which produces a visible surface change

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

[SOURCE: ISO 12945-4:2020, 3.4]

3.5
jamming
wedging
entanglement
event when test specimens either become entangled on the impeller or lie on the side of the cylinder wall resulting in the fabric not tumbling in the required random action

4 Principle

Test specimens are tumbled randomly, under defined conditions, in a lined cylindrical test chamber. Pilling, fuzzing, and matting are assessed visually after a defined period of tumbling.

5 Apparatus and auxiliary materials

5.1 Apparatus

The apparatus shall include:

5.1.1 Device, consisting of one or several cylindrical test chambers, horizontally positioned, with the inside dimensions of (152,4 ± 1,0) mm in depth and (146,0 ± 1,0) mm in diameter. In the centre of each chamber is a horizontal shaft with cross rods (impellers) which rotate at 1 200 min^{-1} (see Figure 1 – The tolerance on all dimensions is ± 0,5 mm unless otherwise stated). This device shall have a mean capable of sustaining a steady movement of the test specimens (thus, avoiding jamming during the test); this functionality can be set by either an air jet (which can blow onto the cylinder wall) or plastic blades (placed on the shaft, see Figure 1, which can move physically jammed test specimens from the cylinder wall).

The use of either air jet device or plastic blades shall be reported.

5.1.2 Lining material, polychloroprene liner. The polychloroprene liner shall conform to the following criteria as described in Table 1. Length and width of the polychloroprene liner shall be such that it fits securely in the test chamber without gaps or bulging.

Table 1 — Criteria for polychloroprene liner

Criteria	Units	Polychloroprene liner
Thickness	mm	3,2 ± 0,4
Hardness	IRHD[a]	60 to 70
[a] IRHD is an abbreviation for international rubber hardness degree and shall be checked according to ISO 48-2 (method N, i.e. normal test).		

5.2 Auxiliary materials

5.2.1 Glue, a white water-based all-purpose glue, for sealing the edges of the test specimens.

NOTE Generally, this kind of glue is an emulsion of polyvinyl acetate.

5.2.2 Device for cutting, test specimens square or round to provide a test area (100 ± 2) cm^2.

NOTE Studies have shown that the shape of the test specimens does not influence the test results.

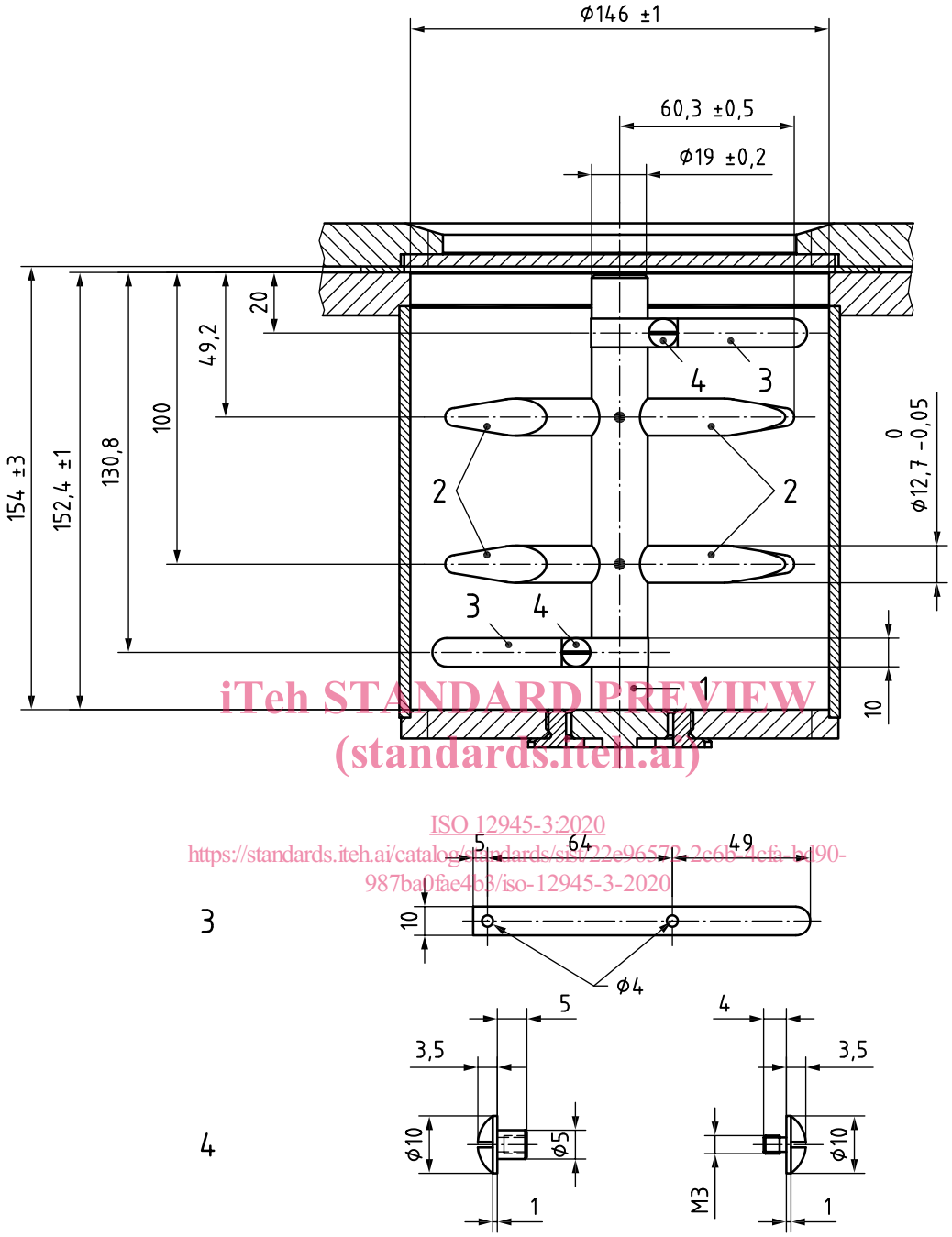
5.2.3 Rating standards (optional), a set of five photographs numbered 1 to 5 illustrating varying degrees of pilling. The photographs shall be the same size as the test specimens.

5.2.4 Cork liner (optional), if agreed upon between the interested parties, cork liner can be used instead of the polychloroprene liner (see 5.1.2).

NOTE The replacement of the polychloroprene liner by the cork liner leads to increase the testing time to two times as specified in 9.4.

5.2.5 Cotton linters (optional), if agreed upon between the interested parties, cotton linters can be used to highlight the possible occurrence of pills.

Dimensions in millimetres



Key

1 axis of the impeller
2 cross rods
3 plastic blades (optional) and as component in the middle view
4 cap screws and as component in the bottom view

Figure 1 — View of the testing chamber and its components

6 Preparation of test specimens

6.1 Pretreatment of the laboratory sample

Laboratory samples may be pretreated 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 pretreated, the evaluation of the tested specimen from the pretreated laboratory sample is done in comparison with that laboratory sample.

If there is no specific pretreatment agreed upon between the interested parties, the test specimen is tested as received.

Regardless of the pretreatment, samples shall be conditioned according to Clause 8 prior to testing.

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

Test specimens should be laundered or dry-cleaned in order to protect the friction surfaces of the polychloroprene liner and cross rods from lubricants or finishes which might cause inconsistent results.

6.2 Sampling of test specimens

Take specimens from areas evenly spaced across the width of the fabric or from three different panels of a garment. Stagger specimens in such a manner that no two specimens contain the same yarns. Avoid areas with wrinkles and other distortions. Unless otherwise specified, do not cut specimens nearer to the selvedge than one-tenth the width of the fabric.

Handle the specimen by applying minimal tension to avoid stretching.

Cut test specimens in squares (105 ± 1) mm × (105 ± 1) mm on the bias at an approximate 0,78 rad (45°) angle to the warp (wale) and weft (course) directions. Circles 100 cm^2 can be used as an alternative if agreed upon between the interested parties.

6.3 Fixation of test specimen edges

In order to prevent fraying or de-knitting, apply a strip of glue (5.2.1) to the edge of the test specimen not exceeding 3 mm in width when dried. Hang the test specimens in order to allow the glue to dry completely before testing (at least for 2 h).

6.4 Number of test specimens and marking

Prepare four test specimens: three test specimens for testing (and mark each of them with a number, from 1 to 3) and a fourth to serve as an untreated reference test specimen for assessment. This fourth need not have the edges secured.

For the alternative method as described in Annex B, six test specimens shall be prepared: five for testing and one for the assessment.

7 Preparation of polychloroprene liners

Both side of a polychloroprene liner can be used to carry out a test. After completion of the two testing, the polychloroprene liner shall be removed, and then cleaned and dried according to the procedure described in A.2.1.

A new polychloroprene liner shall be run-in according to the procedure described in A.2.2.

The polychloroprene liner shall be discarded as soon as its use leads to significant differences in results (one or more than one grade) when testing an in-house standard reference fabric of known pilling, fuzzing, or matting resistance.