SRI LANKA STANDARD 1243 PART 1: 2021
(ISO 12945-1:2020)
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METHOD FOR DETERMINATION OF FABRIC PROPENSITY TO SURFACE PILLING, FUZZING OR MATTING –
PART 1- PILLING BOX METHOD
(First Revision)

SRI LANKA STANDARDS INSTITUTION

Sri Lanka Standard

METHOD FOR DETERMINATION OF FABRIC PROPENSITY TO SURFACE PILLING, FUZZING OR MATTING – PART 1- PILLING BOX METHOD

(First Revision)

SLS 1243 PART 1: 2021
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This Standard does not purport to include all the necessary provisions of a contract

Sri Lanka Standard
METHOD FOR DETERMINATION OF FABRIC PROPENSITY TO SURFACE PILLING, FUZZING OR MATTING – PART 1- PILLING BOX METHOD
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ATIONAL FOREWORD

This Sri Lanka Standard was approved by the Sectoral Committee on Textiles and Garment, and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2021-12-22.

This is the first revision of **SLS 1243 – 1: 2002**, Method for determination of fabric propensity to surface fuzzing and to pilling - Part 1- pilling box method, which is the direct adoption of **ISO 12945 – 1: 2000**.

In 2020, **ISO 12945 - 1** has been revised for the first time with some important technical changes. The main change compared to the previous edition is, the assessment of pilling, fuzzing and matting is carried out according to the newly introduced part 4 of the same series. Therefore, the corresponding national Standard is found as necessary to be revised accordingly.

TERMINOLOGY AND CONVENTIONS

The text of the International Standard has been accepted as suitable for publication without deviation, as a Sri Lanka Standard. However certain terminology and conventions are not identical with those used in Sri Lanka Standards. Attention is therefore drawn to the following:

a) Wherever the words “International Standard” appear referring to this standard they should be interpreted as “Sri Lanka Standard”.

b) The comma has been used throughout as a decimal marker. In Sri Lanka Standards it is the current practice to use a full point on the baseline as the decimal marker.

c) Whenever page numbers are quoted, they are ISO page numbers.

CROSS REFERENCES

International Standard	Corresponding Sri Lanka Standard
ISO 139, Textiles — Standard atmospheres for conditioning and testing	SLS 16, Standard atmospheres for conditioning and testing of textiles
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	SLS 1243-4, Method for determination of fabric propensity to surface pilling, fuzzing or matting — Part 4: Assessment of pilling, fuzzing and matting by visual analysis

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INTERNATIONAL STANDARD

ISO 12945-1

Second edition
2020-10

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

Reference number
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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).

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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 12945-1:2000), which has been technically revised.

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

— in Clause 9, the visual assessment of pilling, fuzzing, and matting has 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 of the apparatus. It is recommended that Annex A be studied prior to carrying out the procedure.

INTERNATIONAL STANDARD **ISO 12945-1:2020(E)**

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

Part 1: Pilling box method

1 Scope

This document specifies 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 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 out from 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]

4 Principle

Test 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 ± 2) mm. All internal surfaces of the box shall be lined with cork jointing material of (3,2 ± 0,4) mm thickness. The box shall be rotated at (60 ± 2) min^{-1} about a horizontal axis passing through the centres of two opposite faces. One side of the box shall be removable for access.

The pill testing box shall be equipped with a cycle counter.

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 Auxiliary materials

5.2.1 Polyurethane test specimen tubes, (four are required), each measuring (140 ± 1) mm in length by (31,5 ± 1,0) mm outside diameter by (3,2 ± 0,5) mm wall thickness, mass (52,25 ± 1,00) g.

5.2.2 Mounting jig, used to mount test specimens on the tubes.

5.2.3 Self-adhesive polyvinyl chloride (PVC) tape, (19 ± 1) mm wide.

5.3 Sewing machine.

6 Preparation of test specimens

6.1 Pretreatment of the laboratory sample

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 pretreated, 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 pretreatment agreed upon between the interested parties, the test specimen is tested as received.

Regardless of the pretreatment, laboratory samples shall be conditioned according to Clause 7 prior to testing.

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

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.

From the laboratory sample, cut four test specimens, each (125 ± 1) mm × (125 ± 1) 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 test specimen of 125 mm × 125 mm is required for assessment.

6.3 Number of test specimens

Take two test specimens and fold each with its face, if discernible, inward and with the machine direction running in the direction of the fold. Sew (12 ± 1) mm from the cut edges to form a tube, using a stitch density such that a balanced seam is produced. Prepare the other two test specimens similarly with the cross direction running in the direction of the fold.

7 Conditioning and testing atmosphere

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

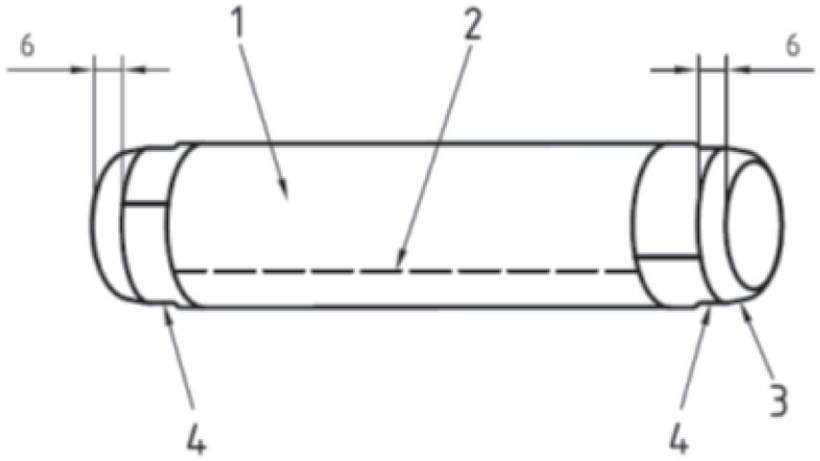
The test specimens on their tube (mounted as described in 8.1) should be conditioned for at least 16 h prior to testing.

8 Procedure

8.1 Mounting of test specimens

Turn each test 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 test specimen on each polyurethane test specimen tube (5.2) so that the test specimen ends are an equal distance in from the ends of the polyurethane test 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 test specimen, so that the tape fixes the test specimen on to the centre of the tube leaving exposed each part with the equivalent dimensions. The length of tape on each end of the test specimen shall not exceed a length of approximately 1,5 times the circumference of the tube.

Dimensions in millimetres



Key

1 test specimen
2 seam
3 polyurethane tube
4 adhesive tape

Figure 1 — Mounting of test specimen on to polyurethane tube

8.2 Testing

Ensure that the inside of the pill testing box (5.1) is clean and free from lint.

Place the four mounted test specimens from the laboratory 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. Examples of number of revolutions can be found in Annex A, Table A.1.

The concerned parties should agree on the number of revolutions for the particular fabric construction or end use under test, as no test/wear predictions are available covering all types of textile fabrics.

Remove the test specimens from the box and remove the stitching from the seam.

9 Assessment of pilling, fuzzing and matting

The visual assessment of pilling, fuzzing and matting, respectively, shall be carried out respectively according to ISO 12945-4.

If agreed between interested parties, the assessment may be additionally carried out according to an instrumental assessment.

10 Results

For each surface appearance (i.e. pilling, fuzzing, and matting), record the grade for each test specimen. Calculate the mean result for all tested specimens for each surface appearance separately: for pilling, for fuzzing and for matting (as described in Clause 9). If the mean result is not a whole number, round the result to the nearest half grade. The variation in the result based on the mean of four test specimens should be no more than half a grade. If this variation is more than half a grade, the grading of each test specimen shall be reported.

Table 1 shows an example of presentation of the results.

Table 1 — Example of a table with results at one stage

	Pilling	Fuzzing	Matting
Test specimen 1 – length direction	Grade	Grade	Grade
Test specimen 2 – length direction	Grade	Grade	Grade
Test specimen 3 – cross direction	Grade	Grade	Grade
Test specimen 4 – cross direction	Grade	Grade	Grade
Average	**Grade**	**Grade**	**Grade**

11 Test report

The test report shall include at least the following information:

a) a reference to this document, i.e. ISO 12945-1:2020;

b) description of the laboratory sample;

c) where applicable, details of pretreatment of the laboratory sample;

d) For each stage, individual test specimen pilling grades, fuzzing grades, and matting grades (according to ISO 12945-4) and the related stage (number of revolutions);

e) date of test;

f) For each stage, the rounded mean grade assessed in relation to the type of the surface change(s) - i.e. pilling, fuzzing and matting respectively - (to the nearest half grade) - according to ISO 12945-4 (and when carried out according to an instrumental assessment) -, and the related stage (number of revolutions);

g) details of any deviation from the given procedure;

h) any unusual features observed.

Annex A
(informative)

Advice on the use of the pill testing box

A.1 Pill testing box

The rotational speed of (60 ± 2) min^{-1} 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 can become polished or contaminated. Such changes can lead to less severe pill testing. In such cases, the cork liners should be replaced.

A.2 Test specimen tubes

The press-moulded polyurethane tubes should be 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 in order 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 Examples of settings of number of revolutions

The following examples of settings have been found suitable and are given for convenience of laboratories. Nonetheless, it is reminded that the number of revolutions should be agreed between interested parties.

Table A.1 — Examples of number of revolutions in relation to the fabric types and their use

Fabric types	Range of number of revolutions
Knitted fabrics with carded yarns	7 200
Knitted fabrics with combed yarns	10 800 to 14 400
Woven fabrics with carded yarns	7 200 to 18 000
Woven fabrics with combed yarns	14 400 to 18 000
Heavyweight fabrics (e.g. for workwear fabrics)	18 000 to 36 000

A.4 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, for example 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. A suitable cleaning solvent is industrial methylated spirit. Use only a minimum amount of solvent to wipe the surface of the cork.

NOTE The use of industrial methylated spirit can be subject to national legal regulations.

A.5 Quality check

Each user of this test method should retain two calibration fabrics relevant to the work of the laboratory and having different levels of pilling, fuzzing and matting in the range grade 1 to grade 4.

These calibration 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, for example 6 months, the calibration 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 test specimens can have a slightly flattened surface should be taken into account.

Bibliography

[1] ISO 3175-1, *Textiles — Professional care, drycleaning and wetcleaning of fabrics and garments — Part 1: Assessment of performance after cleaning and finishing*

[2] ISO 3175-2, *Textiles — Professional care, drycleaning and wetcleaning of fabrics and garments — Part 2: Procedure for testing performance when cleaning and finishing using tetrachloroethene*

[3] ISO 3175-3, *Textiles — Professional care, drycleaning and wetcleaning of fabrics and garments — Part 3: Procedure for testing performance when cleaning and finishing using hydrocarbon solvents*

[4] ISO 3175-4, *Textiles — Professional care, drycleaning and wetcleaning of fabrics and garments — Part 4: Procedure for testing performance when cleaning and finishing using simulated wetcleaning*

[5] ISO 6330, *Textiles — Domestic washing and drying procedures for textile testing*

[6] ISO 12945-2, *Textiles — Determination of fabric propensity to surface pilling, fuzzing or matting — Part 2: Modified Martindale method*

[7] ISO 12945-3, *Textiles — Determination of fabric propensity to surface pilling, fuzzing or matting — Part 3: Random tumble pilling method*

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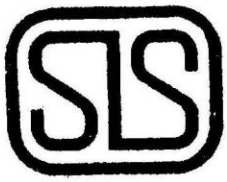

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