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

Part 4:  
**Assessment of pilling, fuzzing and  
matting by visual analysis**

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

*Partie 4: Évaluation du boulochage, de l'ébouriffage et du  
moutonnement par analyse visuelle*

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Published in Switzerland

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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*, 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).

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](http://www.iso.org/members.html).

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

## Part 4: Assessment of pilling, fuzzing and matting by visual analysis

### 1 Scope

This document specifies a method for the visual assessment of pilling, fuzzing and matting respectively of textile fabrics. This method is applicable to most of woven and knitted fabrics, including napped fabrics (fleeces, inlay fabrics).

### 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 3668, *Paints and varnishes — Visual comparison of colour of paints*

ISO 12945-1, *Textiles — Determination of fabric propensity to surface pilling, fuzzing or matting — Part 1: Pilling box method*

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

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

### 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.

#### 3.2 pilling

generation of pills (3.1) over the surface of the fabric

### 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.

### 3.4

#### **matting**

disorientation of the raised fibres of 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 16847:2016, 3.1, modified — Note 1 to entry has been removed.]

## 4 Principle

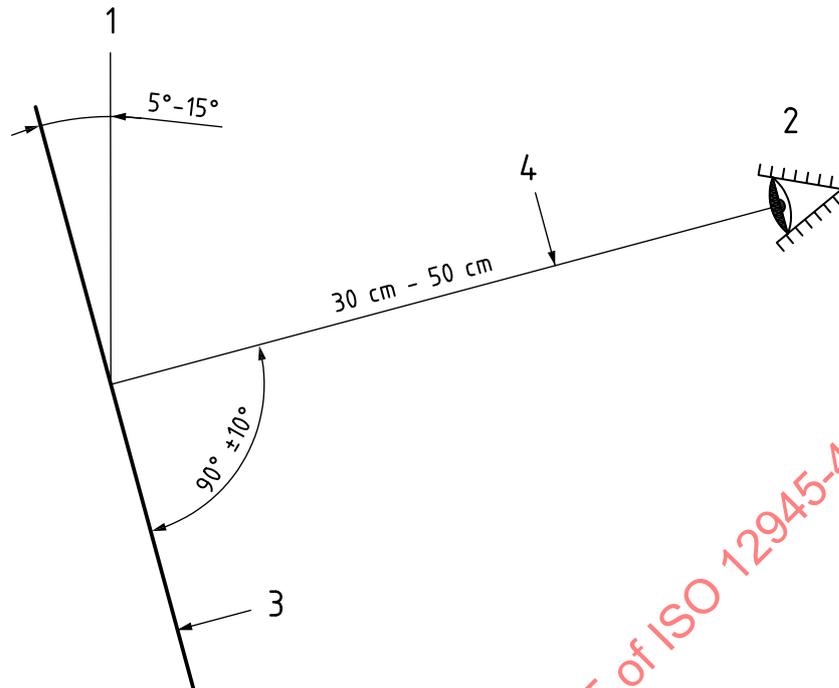
After the specimens have been prepared, under the defined conditions in of ISO 12945-1, ISO 12945-2 and ISO 12945-3 pilling, fuzzing, and matting are assessed visually.

## 5 Apparatus

**5.1 Assessment unit**, illuminated with a light source with artificial daylight D65 (in accordance with ISO 3668) with a brightness of at least 600 lx to give uniform illumination over the surface of the specimen(s) and masked in such a way that the observer does not look directly into the light. It should be used after a warm up period of at least 10 min. The illuminant should be positioned at an angle between 5° and 15° to the plane of the specimen (see [Figure 1](#)). The distance between the eye and the specimen should be between 30 cm to 50 cm for normal corrected vision.

Alternative assessment units may be used as agreed between interested parties and shall be reported.

NOTE The use of different assessment units can lead to different test results.

**Key**

- 1 light source
- 2 observer
- 3 specimen
- 4 vision axis

**Figure 1 — Illumination of specimens**

## 6 Preparation of test specimens

The test specimens shall be prepared and tested in accordance to ISO 12945-1, ISO 12945-2 or ISO 12945-3.

## 7 Assessment of pilling, fuzzing, and matting

7.1 The assessment unit shall be situated in a darkened room.

7.2 Clear away loose parts of surface for the purpose of assessment.

7.3 Place the tested specimen and a reference specimen (with or without pretreatment as appropriate) centrally in the specimen mount on the assessment unit (see [Figure 1](#)) with the length direction vertical. If necessary, use a piece of self-adhesive tape to ensure correct placement. Mount the tested specimen on the left and the reference specimen on the right.

7.4 View each specimen at a distance of 30 cm to 50 cm between eye, as shown in [Figure 1](#), and specimen as placed on assessment unit (see [5.1](#)) ensuring glare from the light source is not visible.

7.5 Grade each specimen in accordance with the grading scheme given in [Table 1](#) (pilling), [Table 2](#) (fuzzing) and [Table 3](#) (matting). If the grading appears between 2 grades, report the “half” grading as, for example, 3-4.

For digital application, the decimal “,0” or “,5” can be used to express the grade. For example, the grade “3-4” can be expressed as “3,5”.

7.6 More than one observer should assess the tested specimens.

Each observer assesses each test specimen with respect to pilling, fuzzing and matting to give three separate grades.

When more than one observer is involved in the assessment, the test result for the laboratory sample is the average of the observer grade averages with respect to pilling, fuzzing and matting separately.

If the grade difference between any observer is one or more than one grade for the same test specimen, then, the concerned observers shall assess again this test specimen. If the grade difference between any observer remains one or more than one grade for the same test specimen (dissensus), then, the minimum and the maximum grades shall be reported in addition to the average.

The grades, except grade 5, refers to a change in appearance of the test specimen compared to original state, not to the appearance itself of the test specimen.

Photographic rating standards may be used to support the primary descriptive method of assessment, as agreed upon between the interested parties. Where used, choose either commercially available photographic rating standards that are closest to the fabric construction of the fabric under test or use in-house produced assessment standards (if the use and production of which is agreed upon by interested parties) to assess against. These photographic rating standards shall have visual grades equivalent to the descriptive grades. When used, it shall be reported.

An additional assessment can be made by rotating the specimen to a position where the observed pilling, fuzzing or matting is more severe. This assessment can be used to provide data for an “extreme condition”, e.g. where a surface is being viewed along the plane of the surface. When used, it shall be reported.

Report any other aspect which shows deterioration in surface appearance.

**Table 1 — Pilling grading scheme**

Grade	Description
5	No change
4	Partially formed pills
3	Moderate pilling — pills of varying size and density partially covering the specimen surface
2	Distinct pilling — pills of varying size and density covering a large proportion of the specimen surface
1	Severe pilling — pills of varying size and density covering the whole of the specimen surface

**Table 2 — Fuzzing grading scheme**

Grade	Description
5	No change
4	Slight surface fuzzing
3	Moderate surface fuzzing
2	Distinct surface fuzzing
1	Dense surface fuzzing

**Table 3 — Matting grading scheme**

Grade	Description
5	No change
4	Slight surface matting
3	Moderate surface matting
2	Distinct surface matting
1	Dense surface matting

## 8 Results

For each surface appearance (i.e. pilling, fuzzing, and matting), record the grade for each 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 7](#). If the mean result is not a whole number, round the result to the nearest half grade.

Examples of tables for the presentation of the results can be found in ISO 12945-1, ISO 12945-2 and ISO 12945-3.

## 9 Test report

The test report shall give the following information:

- a) a reference to this document, i.e. ISO 12945-4:2020;
- b) description of the tested specimens (i.e. ISO 12945-1, ISO 12945-2 or ISO 12945-3);
- c) number of specimens;
- d) number of observers;
- e) 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);
- f) if agreed between interested parties, individual test specimen pilling grades, fuzzing grades, and matting grades;
- g) in case of dissensus between observers ([7.6](#)), minimum and the maximum test specimen pilling grades, fuzzing grades, and matting grades;
- h) date of test;
- i) if applicable, the photographic rating standards used;
- j) if applicable, the extreme assessment conditions used;
- k) any other aspect which shows deterioration in surface appearance;
- l) details of any deviation from the given procedure
- m) any unusual features observed.