

# INTERNATIONAL STANDARD

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## **Textiles — Determination of the abrasion resistance of fabrics by the Martindale method —**

### **Part 4: Assessment of appearance change**

*Textiles — Détermination de la résistance à l'abrasion des étoffes par la  
méthode Martindale —*

*Partie 4: Évaluation du changement d'aspect*

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**ISO 12947-4:1998(E)**

<b>Contents</b>	<b>Page</b>
<b>1 Scope .....</b>	<b>1</b>
<b>2 Normative references .....</b>	<b>1</b>
<b>3 Definitions .....</b>	<b>1</b>
<b>4 Principle.....</b>	<b>1</b>
<b>5 Apparatus and materials.....</b>	<b>2</b>
<b>6 Conditioning and testing atmosphere.....</b>	<b>2</b>
<b>7 Sampling and preparation of test specimens.....</b>	<b>2</b>
<b>8 Abrasion test procedure .....</b>	<b>4</b>
<b>9 Results .....</b>	<b>4</b>
<b>10 Test report .....</b>	<b>4</b>
<b>Annex A (normative) Specimen preparation for specific fabrics .....</b>	<b>6</b>
<b>Bibliography .....</b>	<b>8</b>

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 12947-4 was prepared by Technical Committee ISO/TC 38, *Textiles*.

ISO 12947 consists of the following parts under the general title *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method*:

- *Part 1: Martindale abrasion testing apparatus*
- *Part 2: Determination of specimen breakdown*
- *Part 3: Determination of mass loss*
- *Part 4: Assessment of appearance change*

Annex A forms an integral part of this part of ISO 12947.

# Textiles — Determination of the abrasion resistance of fabrics by the Martindale method —

## Part 4: Assessment of appearance change

### 1 Scope

This part of ISO 12947 is applicable to the assessment of the appearance change of specimens covering all textile fabrics including nonwovens and fabrics where the specifier indicates the end performance as having a low abrasion wear life. This method differs appreciably from those in ISO 12947-2 and 12947-3.

NOTE Further introductory comments are given in ISO 12947-1.

### 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 12947. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 12947 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 105-A02:1993, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 139:1973, *Textiles — Standard atmospheres for conditioning and testing.*

ISO 2859-1:—<sup>1)</sup>, *Sampling procedures for inspection by attributes — Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection.*

ISO 12947-1:1998, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 1: Martindale abrasion testing apparatus.*

### 3 Definitions

For the purposes of this part of ISO 12947 the definitions given in ISO 12947-1 apply.

### 4 Principle

A circular specimen is subjected to a defined load and rubbed against an abrasive medium (standard fabric) in a translational movement tracing a Lissajous figure. The specimen holder containing the abrasive medium is additionally freely rotatable around its own axis perpendicular to the plane of the specimen. The evaluation of the abrasion resistance of the textile fabric is determined from assessment of the appearance change.

1) To be published. (Revision of ISO 2859:1989)

**ISO 12947-4:1998(E)**

Tests are performed using the mass of the specimen holder and spindle alone at  $(198 \pm 2)$  g.

The surface change of the test specimen is assessed and compared with an untested specimen of the same fabric, with the option of using two methods:

- a) abrasion testing to an agreed number of rubs and assessing whether a surface change has occurred;
- b) abrasion testing to an agreed surface change and determination of the test interval in which the surface change has been produced.

## **5 Apparatus and materials**

The test apparatus and auxiliary materials are specified in ISO 12947-1.

## **6 Conditioning and testing atmosphere**

The standard temperate atmosphere for conditioning and testing textiles as defined in ISO 139 shall be used, i.e a temperature of  $(20 \pm 2)$  °C and a relative humidity of  $(65 \pm 5)$  %.

## **7 Sampling and preparation of test specimens**

### **7.1 General**

Perform sampling in accordance with statistical rules (see ISO 2859-1).

Ensure throughout sampling and specimen preparation that handling imposes the minimum possible tensile stress so as to prevent incorrect extension of the textile fabric.

### **7.2 Selection of the laboratory sample**

Select the laboratory sample from a test lot to be representative of properties of the textile fabric. Check the representative nature of sampling from the start or end of a textile fabric.

Take the laboratory sample from across the full fabric width.

### **7.3 Sampling of the test specimens from the laboratory sample**

Before sampling the test specimens from the laboratory samples, condition the laboratory samples free from tension, for at least 18 h on a smooth horizontal surface with free access of air exposed to the standard atmosphere specified in clause 6.

For woven fabrics, take the specimens so that they each contain different warp and weft threads.

Take the test specimens at least 100 mm from the edge distributed across the entire laboratory sample. Take a sufficient number of test specimens (at least three) to be in accordance with statistical notes (see 7.1).

For patterned fabrics or fabrics with textured surface, take care that the test specimens contain all characteristic parts of the pattern, ensuring that the parts of the pattern likely to be sensitive to abrasion are contained in the test specimens.

### **7.4 Dimensions of specimens and auxiliary materials**

#### **7.4.1 Dimensions of the test specimens**

The dimensions of the test specimen shall be at least 140 mm in diameter or length and width.

#### 7.4.2 Dimensions of abradant

The diameter of the abradant shall be  $38^{+5}_0$  mm.

#### 7.4.3 Dimensions of the test specimen felt substrate

The diameter of the test specimen felt substrate shall be  $140^{+5}_0$  mm.

#### 7.4.4 Dimensions of the abradant foam backing

The diameter of the abradant foam backing shall be  $38^{+5}_0$  mm.

### 7.5 Preparation and mounting of the test specimens and cutting-out and mounting of the auxiliary materials

#### 7.5.1 Preparation

Stamp or cut out the test specimens from the laboratory sample. Give particular attention to the clean status of the cut edges to prevent the occurrence of unwanted material loss in subsequent handling.

Prepare the auxiliary materials in a similar fashion from the available pieces of woven fabric, felt or foam.

NOTE The auxiliary materials may under some circumstances be obtained already prepared to the required dimensions.

#### 7.5.2 Mounting of the specimen

Move the specimen holder guide plate to ensure free access to the abrading tables.

Place the felt on the abrading tables and place the test specimen over the felt.

Compress the felt and test specimen on the abrading table with a pressing weight having a mass  $(2,5 \pm 0,5)$  kg and a diameter of  $(120 \pm 10)$  mm.

Fit the clamping ring and secure the felt and test specimen firmly.

#### 7.5.3 Mounting of the abradant

Place the specimen holder nut in the mounting device on the machine frame.

Place the abradant in the specimen holder nut with wear side downward carefully and centrally. Place the foam backing on the abradant.

Place the specimen holder insert in the specimen holder nut, place the specimen holder body over the nut and screw down tightly.

### 7.6 Useful life of auxiliary materials

Renew the abradant and foam backing for every test.

Inspect the felt for soiling and wear after every abrasion test. If soiling or detectable wear occur replace the felt. Both sides of the felt may be used.

### 7.7 Preparation of the abrasion machine

After mounting the test specimens and auxiliary materials place the specimen holder guide plate in position and correctly position the specimen holders and spindles at their respective work stations.

**ISO 12947-4:1998(E)****8 Abrasion test procedure**

Start the abrasion tester after preselecting the number of rubs according to the relevant test series listed in table 1 and completing the preparations in accordance with clause 7. Continue the test without interruption until the prescribed number of rubs is reached.

Depending on the expected number of rubs to reach prescribed appearance change in the test specimen, use the test interval (rubs) listed in table 1, assessing the appearance of the specimen at each interval.

To assess the appearance, carefully remove the specimen holders with the mounted abradant. Remove the test specimens mounted on the abrading table from the testing machine and assess for surface change. If the prescribed surface change has not yet been established, remount the test specimens and specimen holders and continue testing to the next test interval. Ensure that test specimens and specimen holders are returned to the work stations from which they were taken.

Continue this test and assessment sequence until the prescribed surface appearance is observed in the test specimens.

The result, separately recorded for every test specimen, is the number of rubs at which the prescribed surface appearance had not yet been observed. The time interval is thereby determined in which the surface appearance occurs.

In the event of all test specimens not exhibiting the prescribed effect simultaneously, continue the abrasion test with the remaining test specimens until the last of the test specimens exhibits the prescribed effect.

Because the surface appearance of different fabrics may vary, the viewing conditions and surface appearance to be assessed shall be agreed before the start of testing and recorded in the test report.

**Table 1 — Test intervals for surface appearance testing**

Test series	Expected number of rubs to reach prescribed surface appearance	Test interval (rubs)
a	$\leq 48$	16 then every 8
b	$> 48 \leq 200$	48 then every 16
c	$> 200$	100 then every 50

**9 Results**

For each test specimen determine the test interval in which the prescribed surface effect occurs (see clause 8). From the individual values calculate the mean and where necessary the confidence limits of the mean.

If required assess shade change in accordance with ISO 105-A02.

NOTE See ISO 5725 for literature on statistical evaluation or visual examination of textiles using ordinal characteristics.

**10 Test report**

The test report shall include the following information:

- reference to this part of ISO 12947, i.e. ISO 12947-4;
- specimen constitution, presentation and technical data for the test sample;
- details and test series (see table 1) of the method used and a description or representation of basis of assessment (e.g. ordinal scale used, standard samples);

- d) test or assessment results:
  - the confidence limits of the mean value if applicable;
  - whether shade change has been assessed (see clause 9), if applicable;
- e) departures from the procedure (e.g. special agreements on the conditions of testing or assessment);
- f) date of test.



## Annex A (normative)

### Specimen preparation for specific fabrics

#### A.1 Stretch fabrics

For elastane-containing fabrics prepare the test specimen as follows.

Cut or stamp out test specimens of dimensions 60 mm × 60 mm in square shapes, parallel with the stitches or threads. Condition and place them on the square table mount of the test bed, measuring 45 mm × 45 mm, with the side to be abraded facing downwards. Place a clip of 30 mm edge length on each of the four sides of the test specimen hanging over the table, secure and hang a mass on each clip without stretching the specimen. Place the four mass pieces on the bracket that can be lowered. The mass of each weight with clamp shall be 100 g. Lower and raise the bracket (and consequently the mass too) three times in quick succession so that the test specimen is subjected to loading (extended) three times by the four mass pieces and release the load. Lower the bracket again with renewed loading (extension) of the test specimen. In this state press a square foil measuring about 50 mm × 50 mm to which double-sided tape is attached and which has a 30 mm diameter hole in the centre, on to the extended test specimen and affix it by means of the adhesive tape. Raise the bracket again. Remove the weights from the specimen, remove the specimen from the mounting device and stamp the test specimen size of 38 mm for the abrasion test. Care should be taken that the hole of 30 mm diameter stamped in the foil is precisely centred so that the stamped-out specimen is held in the lightly extended state by a foil circle 4 mm wide. To prevent the circular adhesion area loosening, mount the test specimen in the specimen holder immediately after stamping. See figure A.1.

**NOTE** Polyvinylchloride clear foils of 0,2 mm thickness have proved successful. Before stamping to the square shape measuring about 50 mm × 50 mm, attach double-sided tape (e.g. carpet fitting tape) to one side of the foil, and remove the outer protective foil only on attachment to the test specimen. Stamp a central hole of 30 mm diameter in the square foil. The test specimen upper surface thus lies with the foil ring against the specimen holder plunger.

#### A.2 Cord fabrics and pile fabrics

For cord fabrics and pile fabrics which are tested without backing, carry out the following preparatory treatment of specimens.

Mount an initial piece of the laboratory sample having dimensions at least 140 mm in diameter or length and width with the fabric back facing upwards on the abrading table over the abradant felt substrate and mount a piece of abradant having dimensions  $38^{+0,5}_0$  mm diameter in the specimen holder with specimen holder foam backing.

For apparel, subject the back of the fabric to 1 000 rubs and for upholstery 4 000 rubs under an abrasion mass of 595 g or 795 g respectively.

On completion of the prescribed number of rubs take between four and six test specimens from the specimen piece subjected to this preparatory treatment and mount in the specimen holders in the usual way.

Use a new piece of abradant for each preparatory treatment.

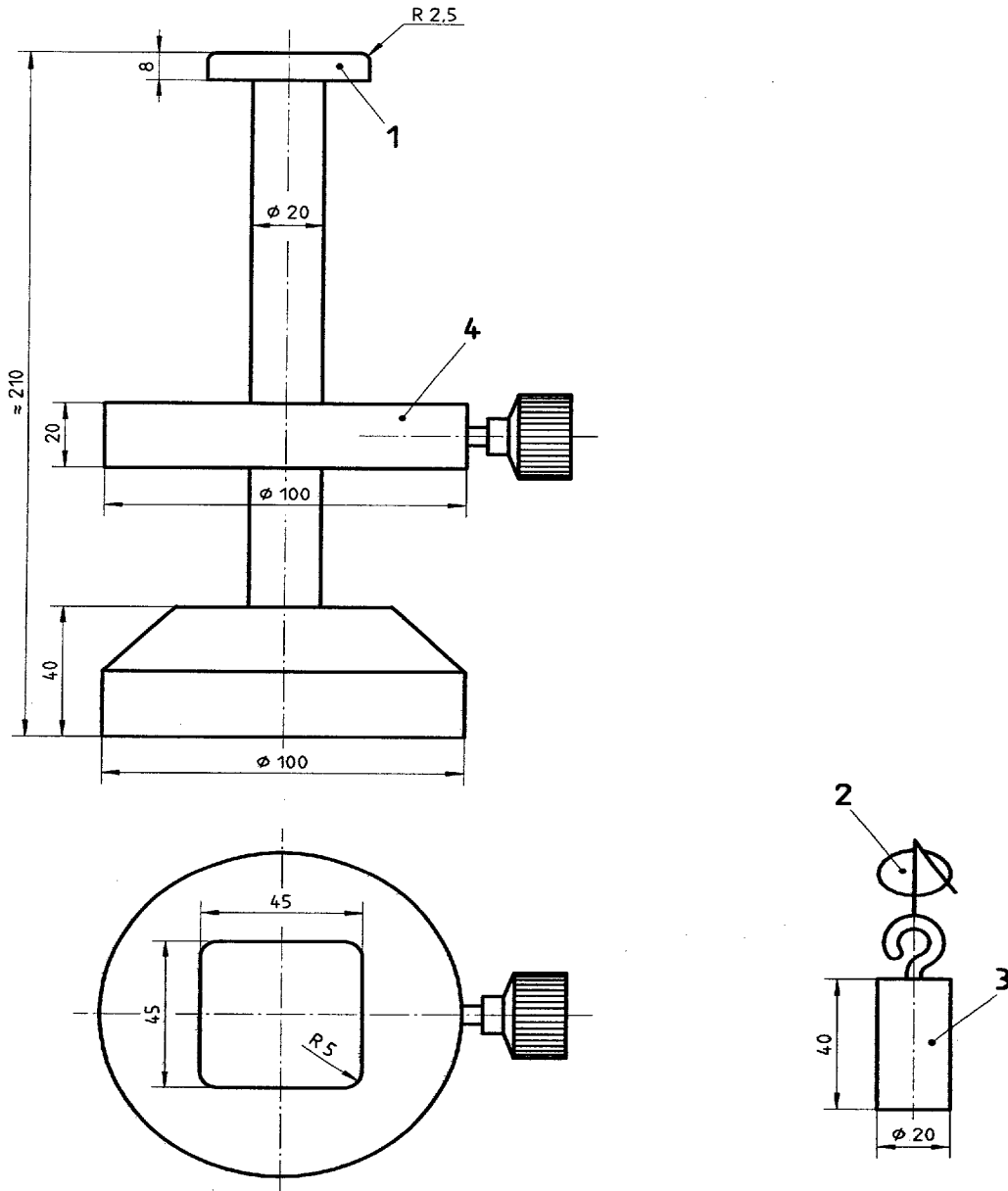
Depending on the construction and quality of the cord or pile fabric, either very little or a significant amount of pile loss could occur during the preparatory treatment and this could influence whether it would be worthwhile continuing with the test. In the event of proceeding with the normal abrasion test, record any notable change after the preparatory treatment in the test report.

The action to be taken in the event of a significant pile loss should be by agreement between the parties concerned and could be based, for example, on an adverse effect on the appearance of the face side of the fabric that is in

excess of agreed limits, or a limit on the loss in mass (in grams or as a percentage) of the area of the fabric subjected to the preparatory abrasion treatment.

The end point for a pile fabric is when the pile is fully worn off.

Dimensions in millimetres



**Key**

- 1 Table mount
- 2 Clamp
- 3 Weight
- 4 Lowering console

**Figure A.1 — Mounting device for easily stretched fabrics**

## Bibliography

- [1] ISO 5725:1986<sup>2)</sup>, *Precision of test methods — Determination of repeatability and reproducibility for a standard test method by inter-laboratory tests.*
- [2] ISO 12947-2:1998, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 2: Determination of specimen breakdown.*
- [3] ISO 12947-3:1998, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 3: Determination of mass loss.*

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2) This International Standard has been superseded by ISO 5725, parts 1 to 6. ISO 5725:1994 is the nearest in relevance to ISO 5725:1986.

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**ICS 59.080.30**

**Descriptors:** textiles, fabrics, tests, abrasion tests, determination, abrasion resistance.

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