SRI LANKA STANDARD 1242 : PART 2 : 2002
ISO 12947-2 : 1998

METHOD FOR DETERMINATION OF THE ABRASION RESISTANCE OF FABRICS BY THE MARTINDALE APPARATUS

PART 2 – DETERMINATION OF SPECIMEN BREAKDOWN

SRI LANKA STANDARDS INSTITUTION

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METHOD FOR DETERMINATION OF THE ABRASION RESISTANCE OF FABRICS BY MARTINDALE APPARATUS PART 2 – DETERMINATION OF SPECIMEN BREAKDOWN

SLS 1242 : Part 2 : 2002
ISO 12947 - 2 : 1998

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Sri Lanka.

Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This standard does not purport to include all the necessary provisions of a contract.

SRI LANKA STANDARD
METHOD FOR DETERMINATION OF THE ABRASION RESISTANCE OF FABRICS BY MARTINDALE APPARATUS
PART 2 – DETERMINATION OF SPECIMEN BREAKDOWN

NATIONAL FOREWORD

This Sri Lanka Standard was approved by the Sectoral Committee on Textiles, Clothing and Leather and was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 2002-12-16.

This Sri Lanka Standard is identical with ISO 12947 - 2 : 1998, Textiles-Determination of abrasion resistance of fabrics by the Martindale Method – Part 2 : Determination of specimen breakdown, published by the International Organization for standardization (ISO).

This is a part in a series of Sri Lanka Standards on determination of abrasion resistance of fabric by Martindale Apparatus. The other parts in the series being;

a) Determination of the abrasion resistance of fabrics by Martindale Apparatus
Part 1 : Martindale Abrasion Testing Apparatus

b) Determination of the abrasion resistance of fabrics by Martindale Apparatus
Part 3 : Determination of mass loss

c) Determination of the abrasion resistance of fabrics by Martindale Apparatus
Part 4 : Assessment of appearance change

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/Publication” appear referring to this standard they should be interpreted as Sri Lanka Standard.

b) The comma has been used 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.

Wherever page numbers are quoted, they are ISO page numbers.

Cross References

For the following international standards referred to in the text, there are corresponding Sri Lanka Standards, and they are listed below.

International Standards	**Corresponding Sri Lanka Standards**
ISO 139 : 1973, Textiles-Standard Atmospheres for conditioning and testing	SLS 16 : 1998, Textiles- Standard Atmospheres for conditioning and testing textiles

INTERNATIONAL STANDARD

ISO 12947-2

First edition
1998-12-15

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

Part 2:
Determination of specimen breakdown

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

Partie 2: Détermination de la détérioration de l'éprouvette

Reference number
ISO 12947-2:1998(E)

Contents

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Printed in Switzerland

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 12947-2 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. Annex B is for information only.

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INTERNATIONAL STANDARD ISO 12947-2:1998
TECHNICAL CORRIGENDUM 1

Published 2002-11-01

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

Part 2:
Determination of specimen breakdown

TECHNICAL CORRIGENDUM 1

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

Partie 2: Détermination de la détérioration de l'éprouvette

RECTIFICATIF TECHNIQUE 1

Technical Corrigendum 1 to ISO 12947-2:1998 was prepared by Technical Committee ISO/TC 38, *Textiles*.

Page 2

6 Conditioning and testing atmosphere, new text to read:

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

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7.4.1: change dimension 38 $^{+0,5}_{0}$ to 38,0 $^{+0,5}_{0}$

7.4.3: change dimension 140 $^{+0,5}_{0}$ to 140 $^{+5}_{0}$

7.4.4: change dimension 38 $^{+0,5}_{0}$ to 38,0 $^{+0,5}_{0}$

ICS 59.080.30 **Ref. No. ISO 12947-2:1998/Cor.1:2002(E)**

Published in Switzerland

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

Part 2:
Determination of specimen breakdown

1 Scope

This part of ISO 12947 is applicable to the determination of the inspection interval to breakdown of specimens covering all textile fabrics including nonwovens apart from fabrics where the specifier indicates the end performance as having a low abrasion wear life.

NOTE Further introductory comments are given in Part 1 of this International Standard.

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:—[1)], *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, as well as the following apply.

3.1
thread
textile yarn, either single or resulting from twisting together two or more single or folded yarns

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

3.2
specimen breakdown
breakdown point which is reached:

— in woven fabrics, when two separate threads are completely broken;

— in knitted fabrics, when one thread is broken causing a hole to appear;

— in pile fabrics, when the pile is fully worn off;

— in nonwovens, when the first hole resulting from the wear is of a diameter at least equal to 0,5 mm.

4 Principle

A circular specimen, mounted in a specimen holder and subjected to a defined load, is rubbed against an abrasive medium (standard fabric) in a translational movement tracing a Lissajous figure, the specimen holder being 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 the inspection interval to breakdown of the specimens.

The specimens are mounted in specimen holders with foam backing. Specimens with a mass per unit area greater than 500 $g \cdot m^{-2}$ are mounted in specimen holders without foam. Pile fabrics and cord fabrics which are tested without foam backing are subjected to a specified preparatory treatment (see 7.5.2).

Two abrasion load parameters are specified. The total effective mass of the abrasion load (i.e. the mass of the specimen holder assembly and the appropriate loading piece) are:

a) (795 ± 7) g for workwear, upholstery, bed linen and fabrics for technical use (nominal pressure of 12 kPa);

b) (595 ± 7) g for apparel and household textiles, excluding upholstery and bed linen (nominal pressure of 9 kPa).

Abrasion testing is continued up to breakdown (see clause 8) of the test specimen.

The inspection interval is determined by the specimen breakdown. The number of rubs is recorded at which specimen breakdown is not yet observed (this number of rubs is the upper limit of the time elapsed before specimen breakdown and at the same time the lower limit of the abrasion interval at which specimen breakdown occurs).

5 Apparatus and materials

5.1 Test apparatus and auxiliary materials, as specified in ISO 12947-1.

5.2 Magnifying glass or **microscope,** e.g. 8 × magnification.

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 ± 2) °C and a relative humidity of (65 ± 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.

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 rules (see 7.1).

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

For patterned fabrics or fabrics with textured surface, take care to ensure 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 diameter of the test specimens shall be $38^{+0,5}_{0}$ mm.

7.4.2 Dimensions of abradant

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

7.4.3 Dimensions of the abradant felt substrate

The diameter of the woven wool felt underlay shall be $140^{+0,5}_{0}$ mm.

7.4.4 Dimensions of the specimen holder foam backing

The diameter of the specimen holder foam backing shall be $38^{+0,5}_{0}$ mm.

7.5 Specimen preparation for specific fabrics

7.5.1 Stretch fabrics

See annex A, clause A.1.

7.5.2 Cord fabrics and pile fabrics

See annex A, clause A.2.

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

7.6.1 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.

7.6.2 Mounting of the specimen

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

Place the test specimen in the specimen holder nut with wear side downward, carefully and centrally. For test specimens having a mass per unit area less than 500 $g \cdot m^{-2}$ place the foam backing on the test specimen.

NOTE Avoid fabric distortion when mounting the test specimen.

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

7.6.3 Mounting of the abradant

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

Place the felt on the abrading tables and place the abradant over the felt.

Fit the abradant so that the two thread systems of the woven fabric lie parallel to the edges of the machine frame.

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

Fit the clamping ring and secure the felt and abradant firmly.

Remove the pressing weight.

7.7 Useful life of auxiliary materials

Renew the abradant for every test. For abrasion tests with more than 50 000 rubs, change abradant every 50 000 rubs.

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

Where foam is used in abrasion testing, use a new piece for every abrasion test.

7.8 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 and place the additional loading piece prescribed for the abrasion test on each specimen holder spindle.

8 Abrasion test procedure

For familiar fabrics select the number of rubs according to the relevant test series given in table 1 and where necessary complete the preparatory treatment of the specimens in accordance with 7.5.2 and the preparations in accordance with clause 7. Start the abrasion tester. Continue the abrasion test without interruption until the preselected number of rubs is reached.

Carefully remove the specimen holder with the mounted specimen from the testing machine and without damaging or disturbing the threads, examine the whole area for signs of breakdown (see 3.2). If no breakdown has yet been established, replace the holders in the machine and start the next test interval. Continue this test and assessment sequence until a breakdown is observed. Inspect the specimen with the aid of the magnifying device (5.2).

If the number of rubs exceeds 50 000, interrupt the test every 50 000 rubs, or earlier if required, in order to renew the abradant. In the case where the interruption is before the completion of 50 000 rubs very carefully remove the specimen holders with mounted test specimens from the testing machine in order to avoid damage.

NOTE For unfamiliar fabrics, a preliminary test is recommended with testing intervals of 2 000 rubs each until the end point is reached.

Continue the abrasion test until all specimens reach the specified end point/breakdown. If pilling is observed on the specimen use one of the following procedures:

a) Continue with test but report this fact in the test report [see item e) of clause 10];

b) Cut off the pills and continue with the test and report this fact in the test report [see item e) in clause 10].

Table 1 — Test intervals for abrasion testing

Test series	Number of rubs at which specimen breakdown occurs	Test interval (rubs)
a	$\leqslant$ 5 000	Every 1 000
b	$>$ 5 000 $\leqslant$ 20 000	Every 2 000
c	$>$ 20 000 $\leqslant$ 40 000	Every 5 000
d	$>$ 40 000	Every 10 000

NOTES

1 For diagnostic purposes the test interval for each test series may be reduced as the end point is approached.

2 Alternative test intervals should be agreed between the interested parties.

9 Results

For each test specimen determine the test interval in which breakdown occurs (see clause 8). From the individual values calculate the mean of the ground weave and pattern floats 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:

a) reference to this part of ISO 12947, i.e. ISO 12947-2;

b) specimen constitution, presentation and technical data for the test sample;

c) the mass and nominal pressure used in the test;

d) specimen preparatory treatment;

e) individual tests or assessment results together with further observations where applicable, e.g.:

- mean
- the confidence limits of the mean;
- whether shade change has been assessed (see clause 9).

f) departures from the procedure (e.g. special agreement on the conditions of testing or assessment);

g) date of test.

NOTE Information on the precision of the test is given in annex B.

Annex A
(normative)

Specimen preparation for specified 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 total mass 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) by the four mass pieces, three times and then 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 mass pieces 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 have a mass per unit area greater than or equal to 500 $g \cdot m^{-2}$ and are tested without foam 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 loading of 595 g and 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.

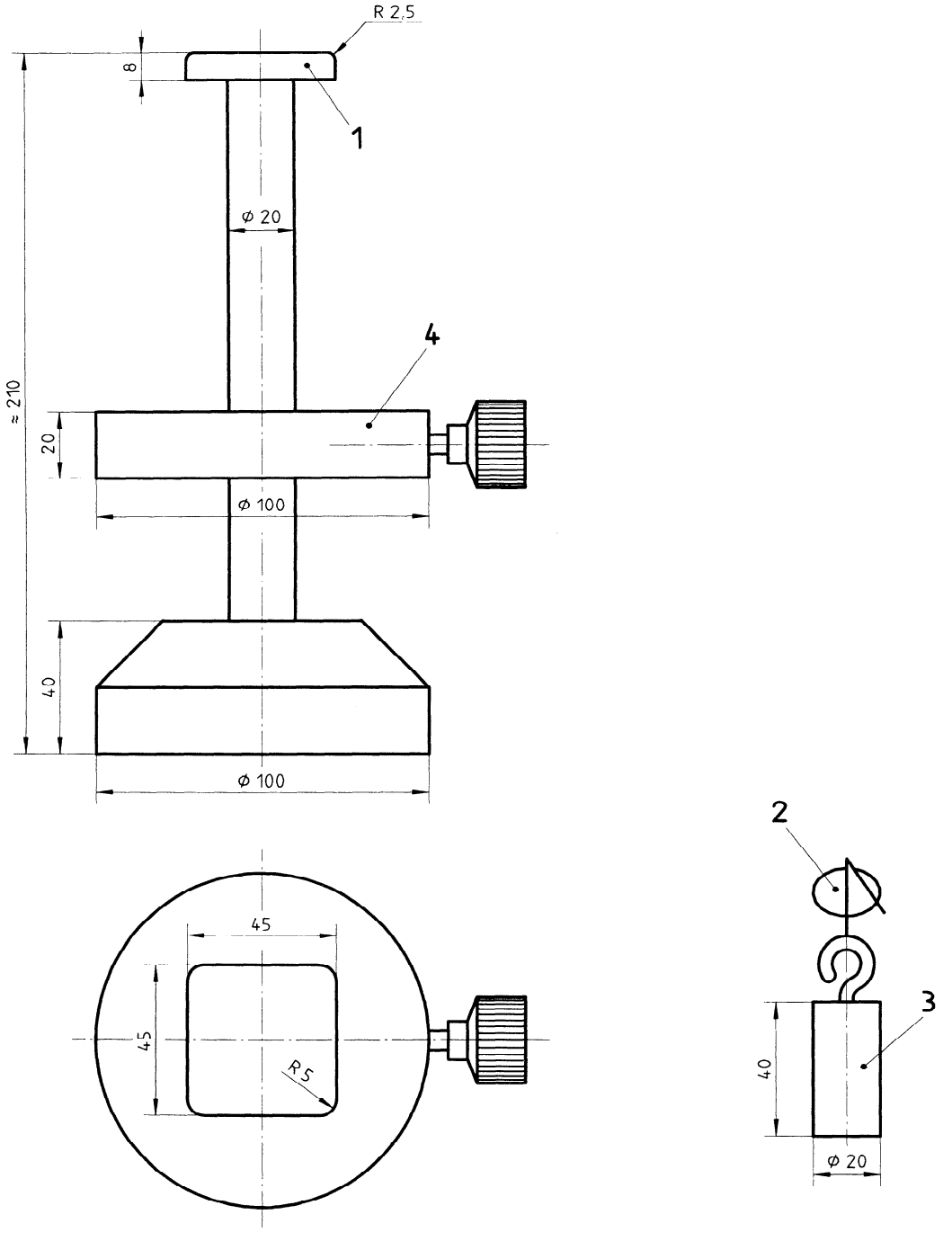
Depending on the construction and quality of the cord or pile fabric, either very little or a significant amount of pile loss could occur during the preparatory treatment and this could influence whether it would be worthwhile continuing with the test. In the event of proceeding with the normal abrasion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

Annex B
(informative)

Precision of the test

The reference abradant specified in 6.1 of ISO 12947-1:1998 has been subjected to intensive testing at one laboratory and has also been tested by means of an interlaboratory trial using 21 laboratories. Both experiments used three different types of wool fabrics and tables B.1 and B.2 show the coefficient of variations for each fabric for the single laboratory trial and the interlaboratory trial.

Tables B.1 and B.2 are based on the standard errors for each fabric and for each experiment. The results for one standard error (67 % confidence level) are quoted in tables B.3 and B.4 and, if it is designed to work to a 95 % confidence level, the figures should be multiplied by two. The above results for the single laboratory trial incorporate both differences within a machine and differences between machines. The results for the interlaboratory trial give the differences between laboratories.

When using limits to define the precision of the test, it is important to consider the following practical influences:

a) variability of fabric under test;

b) the higher the end point, the wider the variation of that end point;

c) the importance of correct conditioning in the laboratory;

d) assessment of end point varies between operators and some fabrics are difficult to assess, e.g. upholstery fabrics made from a polyester/wool blend;

e) the data quoted are based on three 100 % wool fabrics and do not include other fibre types.

Table B.1 — Coefficient of variations (expressed as a percentage) based on one standard error estimates

Sample	Single laboratory trial (10 machines within laboratory)	Interlaboratory trial: 21 laboratories	
		Within laboratory	Between laboratories
Fabric 1	12,3	13,4	20,8
Fabric 2	13,2	12,6	13,2
Fabric 3	7,6	8,0	18,1

Table B.2 — Coefficient of variations (expressed as a percentage of the mean of four samples based on table B1)

Sample	Tested in one laboratory [a]	Tested in any laboratory [b]
Fabric 1	6,2	22,0
Fabric 2	6,6	14,7
Fabric 3	3,8	18,5
Mean	5,5	18,3

[a] Based on single laboratory trial.

[b] Based on interlaboratory trial

Table B.3 — Standard errors calculated

Sample	Single laboratory trial (10 machines within laboratory)	Interlaboratory trial	
	Standard error (SE)	Within-laboratory SE	Between-laboratories SE
1	3 300	3 400	5 100
2	1 300	1 110	1 160
3	1 600	1 700	3 900

Table B.4 — Standard errors of the means of four samples (based on table B.3)

Sample	Tested in one laboratory SE[a]	Tested in any laboratory SE[b]
1	1 660	540
2	670	1 290
3	810	4 000

a Based on single laboratory trial. The results would have nearly been the same if based on within laboratory standard error of interlaboratory trial.

b Based on interlaboratory trial.

NOTE $\text{Standard Error} = \dfrac{\text{Standard Deviation}}{\sqrt{\text{Number of individual results}}}$

Bibliography

[1] ISO 5725:1986[2], *Precision of test methods — Determination of repeatability and reproducibility for a standard test method by inter-laboratory tests.*

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

ICS 59.080.30

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

Price based on 11 pages

SRI LANKA STANDARDS INSTITUTION

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