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Rubber- or plastics-coated fabrics — Determination of abrasion resistance —

Part 2: Martindale abrader

Supports textiles revêtus de caoutchouc ou de plastique — Détermination de la résistance à l'usure —

Partie 2: Appareil d'essai d'abrasion Martindale

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 5470-2 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 4, *Products (other than hoses)*.

ISO 5470 consists of the following parts, under the general title *Rubber- or plastics-coated fabrics — Determination of abrasion resistance*:

— *Part 1: Taber abrader*

— *Part 2: Martindale abrader*

Rubber- or plastics-coated fabrics — Determination of abrasion resistance —

Part 2: Martindale abrader

WARNING — Persons using this part of ISO 5470 should be familiar with normal laboratory practice. This part of ISO 5470 does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any regulatory conditions.

1 Scope

This part of ISO 5470 details two separate methods for determining the resistance of a material to wet and dry abrasion. It is applicable to the coated surface or surfaces of coated fabrics. If the abrasion behaviour of the uncoated surface of a coated fabric is to be determined, use the methods for uncoated textiles described in the various parts of ISO 12947.

2 Normative references

The following referenced documents are indispensable for the application 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 2231:1989, *Rubber- or plastics-coated fabrics — Standard atmospheres for conditioning and testing*

ISO 2286-1:1998, *Rubber- or plastics-coated fabrics — Determination of roll characteristics — Part 1: Methods for determination of length, width and net mass*

ISO 12947-2:1998, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 2: Determination of specimen breakdown*

ISO 12947-3:1998, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 3: Determination of mass loss*

ISO 12947-4:1998, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 4: Assessment of appearance change*

3 Principle

This part of ISO 5470 details two different methods. In method 1, test specimens are clamped in a specimen holder and abraded using pieces of a selected abradant under constant pressure. A variant of this method consists of carrying out the method with a wet abradant. Method 2 reverses the position of the abradant and the specimen. In both cases, the relative movement between the abradant and the specimens forms a complex cyclic pattern (a Lissajous figure) which produces rubbing in all directions. The test is stopped either after a predetermined number of cycles (in which case the damage to each specimen is assessed) or when the specimen has reached a predetermined degree of abrasion (in which case the number of cycles is noted).

4 Apparatus and materials

4.1 Abrasion machine, with one or more test stations, each fitted with the items of equipment specified in 4.1.1 to 4.1.6.

4.1.1 Circular specimen holder, with a clamping ring which grips the specimen around its edge, leaving an exposed raised flat circular portion of area (645 ± 5) mm^2.

4.1.2 Horizontal abradant table, of sufficient size to incorporate a square central test area of side 88 mm. Typically, abradant tables are circular and have a diameter of at least 125 mm.

4.1.3 Means of holding the exposed flat portion of the specimen holder (4.1.1) in contact with the abradant table (4.1.2) whilst allowing the specimen holder to rotate freely in the plane of the abradant table.

4.1.4 Means of producing relative movement between the specimen holder (4.1.1) and the abradant table (4.1.2) which forms a Lissajous figure occupying an area of (60 ± 1) mm × (60 ± 1) mm (see Figure 1). Each Lissajous figure requires 16 elliptical motions (revolutions) of the specimen holder, and the speed of operation of the tester shall be (48 ± 4) revs/min.

The parallelism of the abradant table (4.1.2) and the specimen holder (4.1.1) shall be maintained to within ± 0,05 mm throughout each Lissajous figure. A dial gauge fitted in place of the specimen holder can be used to verify the parallelism of the abradant table.

The circumferential parallelism of the holder (4.1.1) in contact with the abradant table shall be better than ± 0,05 mm. This can be verified by attempting to insert slip gauges of thickness less than 0,05 mm under the edges of the flat face of the specimen holder.

4.1.5 Means of maintaining a constant pressure of (12 ± 0,2) kPa between the specimen holder (4.1.1) and the abradant table (4.1.2). This will be the case if the mass of the specimen holder and its associated fittings is (795 ± 5) g.

4.1.6 Means of counting the number of abrasion cycles completed in terms of revolutions (16 revs per cycle).

4.2 Reference abradant

4.2.1 General

Unless otherwise stated by mutual agreement between the interested parties, this shall be either a wool abradant fabric or a silicon carbide cloth. Results from tests carried out with different abradants are not considered to be comparable. When tests are carried out, by mutual agreement of all parties, using a non-standard abradant, a description of this abradant shall be included in the test report.

4.2.2 Wool abradant fabric

The properties of wool abradant fabric shall be as given in Table 1.

Table 1 — Properties of wool abradant fabric

	Warp	Weft
Linear density of yarn, tex	R63 ± 4/2	R74 ± 4/2
Threads per millimetre	1,7 ± 0,1	1,3 ± 0,1
Singles “Z” twist, turns per metre	540 ± 20	500 ± 20
Two-fold “S” twist, turns per metre	450 ± 20	350 ± 20
Fibre diameter, µm	27,5 ± 2	29 ± 2
Minimum mass per unit area, $g \cdot m^{-2}$	195 ± 5	

The two faces of the wool abradant fabric will not necessarily have the same abrasive characteristics, and when purchased from a supplier it shall be noted which face the supplier recommends for use. This is normally the slightly smoother face of the fabric. Stocks of the fabric shall be controlled to ensure that only this face is used in testing.

4.2.3 Silicon carbide cloth

The properties of silicon carbide cloth shall be as given in Table 2.

Table 2 — Properties of silicon carbide cloth

Abrasive	Fused silicon carbide free from extraneous material
Backing	Cotton cloth of minimum breaking strength 961 N/50 mm width in the warp direction and 392 N/50 mm in the weft direction
Grade	P 180

4.3 Flat weightpiece, of suitable dimensions to place over the entire surface of the abradant table to ensure that the abradant fabric is held flat whilst it is clamped in position. The weightpiece shall apply a pressure of (2 ± 0,2) kPa.

4.4 Cutting device, such as a die cutter, of sufficient size to produce specimens that will be held firmly in the specimen holders (4.1.1). The exact size of the device will depend on the design of the clamping system of the specimen holder.

4.5 Four pieces of wool felt, mass per unit area 575 $g \cdot m^{-2}$ to 800 $g \cdot m^{-2}$, and thickness 2,0 mm to 3,5 mm. Both sides of the felt may be used. The felt used in dry tests may be re-used either until both sides are discoloured or until the thickness has been reduced to less than 2,0 mm, but felt used in wet tests shall not be re-used.

4.6 Polyurethane foam, of thickness (3 ± 1) mm, density (30 ± 2) $kg \cdot m^{-3}$ and indentation hardness (5,8 ± 0,8) kPa.

4.7 Water-jet: a rubber tube with one end restricted and the other attached to a cold-water tap at mains pressure is suitable.

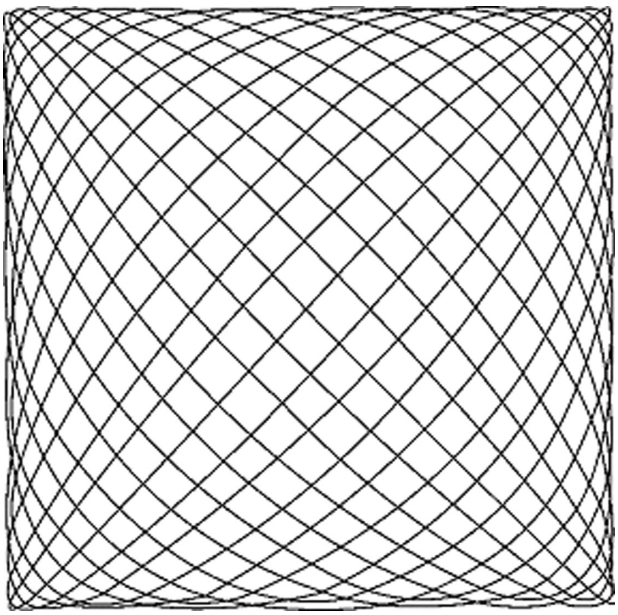

Figure 1 — Lissajous figure

5 Test specimens

5.1 Method 1 — Test specimens clamped in holders

5.1.1 Using the cutting device (4.4), take at least four specimens, of sufficient size for them to be firmly held in the specimen holders (4.1.1), from non-adjacent areas within the usable width of the roll (as defined in ISO 2286-1). With double-coated fabrics, if both surfaces are to be tested, select another set of at least four specimens.

5.1.2 If the material under test has an irregular embossing pattern or irregular printing pattern (patches), take specimens from positions selected so that each part of the pattern is tested. This may mean that more than four specimens are required.

5.1.3 If the result of the test required by the relevant product specification is expressed in terms of mass loss, determine the mass of each specimen.

5.2 Method 2 — Test specimens on the table

5.2.1 Cut at least four specimens, each measuring 125 mm × 125 mm, from non-adjacent areas within the usable width of the roll (as defined in ISO 2286-1).

5.2.2 If the material under test has an irregular embossing pattern or irregular printing pattern (patches), take specimens from positions selected so that each part of the pattern is tested. This may mean that more than four specimens are required.

5.2.3 If the result of the test required by the relevant product specification is expressed in terms of mass loss, determine the mass of each specimen.

6 Conditioning of specimens and wetting of abradant

6.1 For dry tests, place the specimens in a conditioning atmosphere as specified in ISO 2231 for at least 16 h prior to testing and carry out the test in this atmosphere. Specimens for wet tests need not be conditioned prior to test.

6.2 For wet tests, fully saturate the abradant cloth (4.2) and wool felt (4.5) (method 1) or the specimen mounted on the abradant table (method 2) by directing the water-jet (4.7) to and fro over their surfaces until complete saturation can be seen by a uniform darkening in colour.

7 Procedure

7.1 Method 1

7.1.1 Place each specimen in a specimen holder (4.1.1) so that the specimen surface to be abraded is facing outwards. This surface shall not be that of the base fabric.

7.1.2 If testing materials with a mass per unit area of less than 500 $g \cdot m^{-2}$, place a similar-size piece of polyurethane foam (4.6) in each of the specimen holders as backing for the specimen.

7.1.3 Check that the specimen in its holder is not baggy, creased or distorted in any way.

7.1.4 Place a piece of dry or wet felt (4.5) on the abrading table, depending on whether dry or wet test conditions are being used.

7.1.5 Place a corresponding dry or wet piece of the abradant fabric (4.2) over each piece of table felt with the test face uppermost.

7.1.6 Place the weightpiece (4.3) on top of the abradant fabric and clamp the abradant in position so that it is free of wrinkles. When this has been achieved, remove the weightpiece.

7.1.7 Repeat the procedure in 7.1.1 to 7.1.6 for any other test stations.

7.1.8 Fit each filled specimen holder into the abrasion machine so that the specimen is resting on the abradant.

7.1.9 Apply a vertical downwards force to each specimen holder to provide the required pressure between the specimen and the abradant (normally 12 kPa ± 0,2 kPa).

7.1.10 Start the abrasion machine (4.1).

7.1.11 At the numbers of revolutions indicated in Table 3, remove the specimens from their holders and inspect the specimens under bright indirect lighting for signs of damage. If possible, compare each specimen with a piece of the same material which has not been abraded and rate the observed alterations in accordance with Clause 8.

If the damage is rated to be “complete”, stop the test. If the predetermined number of revolutions is reached, note the rating of the damage and stop the test. If the damage has reached a predetermined limit, note the number of revolutions performed and stop the test. Otherwise, note the number of revolutions and the rating of the damage observed.

7.1.12 Return each specimen to the same holder/abradant table and restart the machine.

7.1.13 Stop the machine at each inspection point and repeat the procedure given in 7.1.11.

7.1.14 If appropriate, re-wet the abradant fabric and wool felt or specimen at each wet test station at the points shown in Table 3, as follows. With the fabric and felt still clamped over the abradant table, gradually pour up to 30 g of water on to the surface while lightly rubbing in the water with the finger tips. Stop pouring the water when it stops being absorbed and excess water is seen to accumulate on the surface. Place the weightpiece (4.3) on top of each abradant for (10 ± 2) s and then remove.