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Paints and varnishes — Determination of the resistance to rubbing using a linear abrasion tester (crockmeter)

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Foreword

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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 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.

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.

Paints and varnishes — Determination of the resistance to rubbing using a linear abrasion tester (crockmeter)

1 Scope

This document specifies a method for determining the resistance of a coating to rubbing by means of a loaded abrasive material which is linearly moved over the surface to be tested.

The method can also be applied to different material surfaces, such as plastics and metals.

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 105-F09, *Textiles — Tests for colour fastness — Part F09: Specification for cotton rubbing cloth*

ISO 845, *Cellular plastics and rubbers — Determination of apparent density*

ISO 1514, *Paints and varnishes — Standard panels for testing*

ISO 2808, *Paints and varnishes — Determination of film thickness*

ISO 3270, *Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing*

ISO 4618, *Paints and varnishes — Terms and definitions*

ISO 23321, *Solvents for paints and varnishes — Demineralized water for industrial applications — Specification and test methods*[1)]

ASTM D2240, *Standard Test Method for Rubber Property — Durometer Hardness*

FEPA-Standard 43-2[2)], *Grains of fused aluminium oxide, silicon carbide and other abrasive materials for coated abrasives microgrits P 240 to P 2500*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4618 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/

1) Under preparation. Stage at the time of publication: ISO/FDIS 23321:2019.

2) Federation of European Producers of Abrasives (FEPA). Reference source for FEPA standards: Staatliche Materialprüfungsanstalt Darmstadt, Dr. Ing. P. Hof, Grafenstraße 2, 64283 Darmstadt, Germany, Tel.: +49-6151-16 65 82, Fax: +49-6151-16 60 46, E-Mail: hof@mpa-ifw.tu-darmstadt.de.

4 Principle

A loaded abrasion tool, lined with agreed abrasive material and influenced by an agreed abrasive medium, is moved over the coating using a linear abrasion tester (crockmeter). There are three procedure variations, depending on the agreement and application (see Table 1).

Table 1 — Procedure variations

Abrasion tool	Geometry of abrasion tool	Contact surface to test specimen	Test load	Application
A	Cuboid	Base surface (22 mm × 22 mm)	(22,0 ± 0,5) N	flat test panels
B	Cylinder	Front surface (Ø 16 mm)	(9,0 ± 0,2) N	flat test panels[a]
C		Lateral surface (Ø 44 mm × 25 mm)[b]		flat and curved test specimen

[a] With limitations: Abrasion tool B is the original procedure variation; in most cases abrasion tool A is preferred also for flat test specimen.

[b] The contact surface is a part of the lateral surface, which depends on different parameters, see 5.2.3, Note 3.

The assessment of the friction mark shall be agreed and can be carried out e.g. visually or by means of measuring the change in gloss, haze or brightness.

5 Apparatus and ancillary materials

5.1 Linear abrasion tester (crockmeter)

Linear abrasion tester in accordance with Figure 1, which is specified by the following properties.

5.1.1 The mechanism can be manual (as illustrated in Figure 1) or (electro) motor driven.

5.1.2 For the motoric version, an operation counter for pre-setting the number of double-strokes shall be integrated and the mechanism shall have a stroke frequency of (1,0 ± 0,1) Hz and shall have a constant velocity within the 70 mm measurement area.

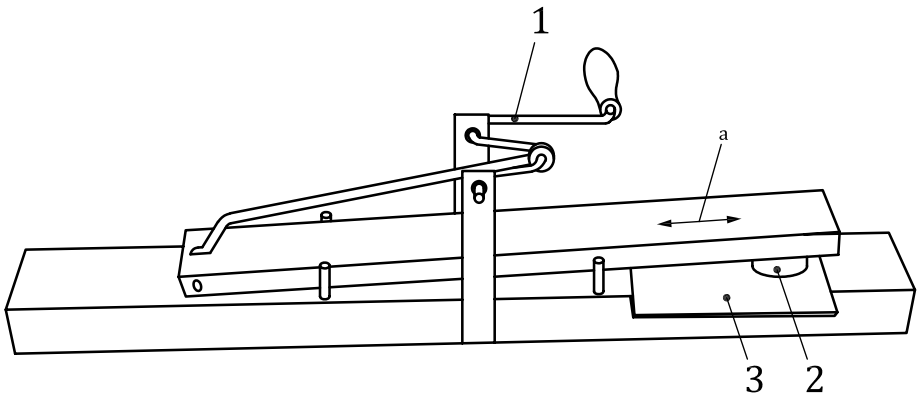
5.1.3 The test load with which the abrasion tool (5.2) is pressed onto the test specimen shall be (9,0 ± 0,2) N (for abrasion tool B and C) and (22,0 ± 0,5) N (for abrasion tool A).

NOTE Test devices intended for a test load of 9,0 N can be converted to a test load of 22,0 N by means of an additional load of 13,0 N (corresponding to an additional weight with a mass of 1,33 kg).

5.1.4 The stroke length shall be selected in such a way that the length of the assessable friction mark is (100 ± 30) mm.

NOTE 1 The assessable friction mark equals the total friction mark, less the expansion of the contact surface of the abrasion tool in the direction of the stroke on both ends (see 7.3.1). Consequently, the stroke length is at least 70 mm + 2 × expansion, in millimetres, of the contact surface of the abrasion tool in the direction of the stroke. For the dimensions of the abrasion tools, see 5.2.

NOTE 2 Some devices exist with a length of the assessable surface less than 70 mm due to technical reasons.



Key

1 crank mechanism (crank handle)

2 abrasion tool B – see 5.2.2

3 test specimen

a Direction of stroke motion.

Figure 1 — Crockmeter (example with manual crank mechanism)

5.2 Abrasion tool

5.2.1 Abrasion tool A, e.g. as shown in Figure 2 a). The felt insert shall have the dimensions (22,0 ± 0,2) mm × (22,0 ± 0,2) mm × 6 mm and a bulk density of 0,44 g/cm^3. The coupling with the crockmeter (5.1) is rigid.

NOTE Despite the rigid coupling a tilting of the front face of the abrasion tool A against the test specimen is impossible due to the elastic felt insert.

5.2.2 Abrasion tool B, designed as a cylinder with a diameter of (16,0 ± 0,1) mm, the front surface of which is facing the test specimen. The coupling with the crockmeter (5.1) is rigid.

NOTE 1 Due to the rigid coupling a tilting of the front surface of the abrasion tool B against the test specimen is generally possible.

NOTE 2 Unlike abrasion tools A and C, abrasion tool B cannot be lined with abrasive material without wrinkling.

5.2.3 Abrasion tool C, e.g. as shown in Figure 2 b). The radius of the tool shall be (19,0 ± 0,5) mm and a width of (25,0 ± 0,3) mm. In the contact area to the test specimen, the lateral surface of the tool shall be covered with a layer of EPDM rubber[3)], e.g. DIM ZK EPDM 21606[4)], with a thickness of (3,0 ± 0,3) mm and a width of (25,0 ± 0,3) mm, and which has the hardness of (60 ± 5) Shore-00 in accordance with ASTM D2240 and a bulk density of (0,16 ± 0,02) g/cm^3 in accordance with ISO 845. The coupling with the crockmeter (5.1) can be moved across the direction of the stroke [see view II in Figure 2 b)].

When lining the abrasion tool with the abrasive material (5.3), the latter is attached tightly to the abrasion tool by means of roll pins which are elastically interconnected by the rubber strips (see view III in Figure 2 b).

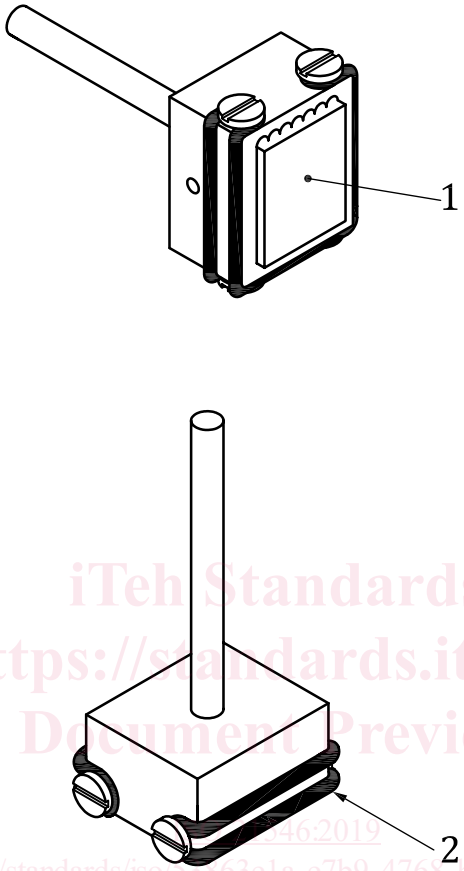
NOTE 1 Due to the EPDM rubber cover the effective diameter of the tool is 44 mm.

3) EPDM: Ethylene-propylene-dien-monomer.

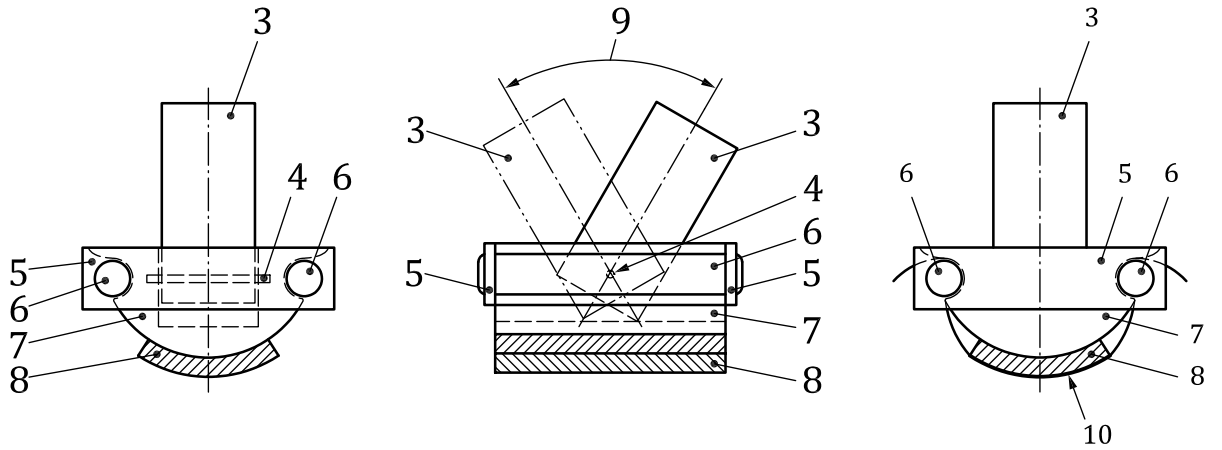
4) DIM ZK EPDM 21606 is the trade name of a product supplied by DIMER. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

NOTE 2 Due to the geometry of the abrasion tool and the movable coupling with the crockmeter, tests can be carried out on curved test specimens by means of abrasion tool C.

NOTE 3 Unlike abrasion tools A and B, the contact surface with the test specimen is geometrically unspecified for abrasion tool C; it is rather defined by the radius of the tool, the elastomer hardness, the test load, and, if applicable, by the properties of the abrasive material.



a) Abrasion tool A



I View across the direction of the stroke (design details)

II View in the direction of the stroke (swivelling range)

III View across the direction of the stroke (lined with abrasive material)

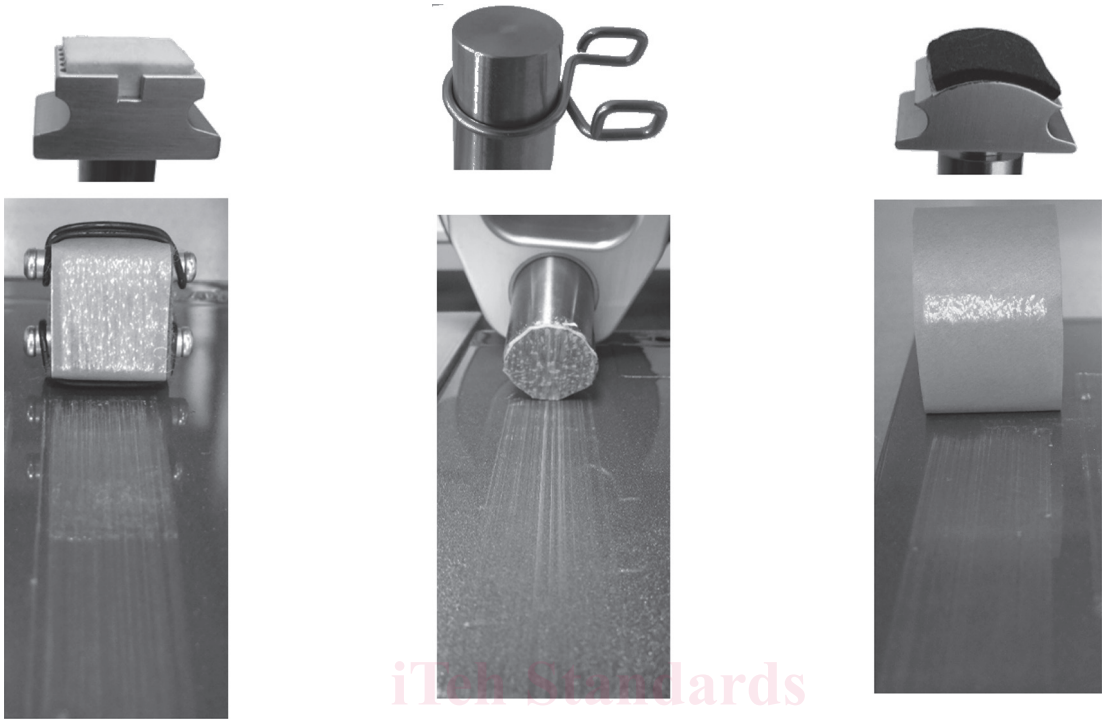
b) Abrasion tool C

Key

1 felt insert
2 o-ring for attaching abrasive material
3 adapter shaft
4 axial pin (swivel axis)
5 rubber strips
6 roll pins (locked in the base 5)
7 base with cylindrical outer contour (radius 19 mm)
8 cellular rubber (20 mm × 25 mm × 3 mm)
9 swivelling range (approximately 60°)
10 abrasive material

Figure 2 — Abrasion tool

5.2.4 Selection of the abrasion tool. The selection of the suitable abrasion tool depends on the type of the sample. Figure 3 shows examples for abrasion tools and the corresponding friction marks.



a) Abrasion tool A **b) Abrasion tool B** **c) Abrasion tool C**

Figure 3 — Examples for abrasion tools and the corresponding friction marks

For flat test panels, abrasion tool A is most suitable, because it produces a uniform, homogeneous friction mark which can be assessed easily.

The original abrasion tool B can also be used on flat test panels, nevertheless it produces a transversal inhomogeneous friction mark [see Figure 3 b)] which is difficult to assess. Therefore the abrasion tool A should be preferred.

For curved test specimen, abrasion tool C shall be used in any case. Care shall be taken to ensure that the strokes are located parallel to the curvature of the sample to obtain a maximum contact area and a friction mark that can be assessed clearly (see Figure 4).

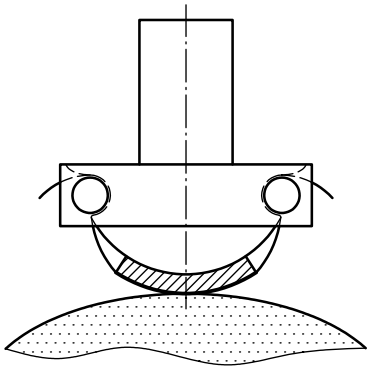


Figure 4 — Position of abrasion tool C on a curved sample surface

