

BS EN ISO 5470-1:2016



BSI Standards Publication

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

Part 1: Taber abrader (ISO 5470-1:2016)

National foreword

This British Standard is the UK implementation of EN ISO 5470-1:2016. It supersedes BS EN ISO 5470-1:1999 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee TCI/69, Footwear, leather and coated fabrics.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Supports textiles revêtus de caoutchouc ou de plastique - Détermination de la résistance à l'usure - Partie 1: Appareil d'essai d'abrasion Taber (ISO 5470-1:2016)

Mit Kautschuk oder Kunststoff beschichtete Textilien - Bestimmung des Abriebwiderstandes - Teil 1: Taber-Abriebprüfgerät (ISO 5470-1:2016)

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European foreword

This document (EN ISO 5470-1:2016) has been prepared by Technical Committee ISO/TC 45 “Rubber and rubber products” in collaboration with Technical Committee CEN/TC 248 “Textiles and textile products” the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2017, and conflicting national standards shall be withdrawn at the latest by June 2017.

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The text of ISO 5470-1:2016 has been approved by CEN as EN ISO 5470-1:2016 without any modification.

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Foreword

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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).

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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html

The committee responsible for this document is ISO/TC 45, *Rubber and rubber products*, SC 4, *Products (other than hoses)*.

This second edition cancels and replaces the first edition (ISO 5470-1:1999) which has been technically revised. The changes are as follows:

- in [Clause 4](#), a non-flexible cardboard support or a solid board equivalent to it for thin sample fixation has been added as [4.9](#) and the part of the body text related to it in the third paragraph of [4.1](#) has also been added accordingly;
- in [Clause 5](#), the test piece diameter has been changed from 114 mm to the range of 105 mm to 115 mm and the key 2 in [Figure 1](#) has been changed accordingly;
- the text in [7.2](#) has been revised.

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*

Introduction

It has long been accepted that some of the parameters associated with the Taber test as given in ISO 5470:1980 needed to be more closely specified if reasonable reproducibility (R) was to be obtained. Much of the work is now completed and has been acknowledged by ISO/TC 61 in publishing ISO 9352, which employs a zinc plate as a means of calibrating the initial abrasive power of the wheels. This does not, however, entirely overcome the problem of clogging or maintaining abrasion properties between and during tests. It may also be regarded as expensive and time-consuming.

This part of ISO 5470 permits the approach in ISO 9352 to be adopted if so desired. However, the major disadvantages of the Taber abrader are that:

- a) end points can be somewhat subjective unless a gravimetric technique is employed;
- b) only a small strip of material is abraded;
- c) because of the velocity of interfacial friction, localized heating of the coating polymer can cause softening and thus be less representative of abrasive wear in service;
- d) the 6 mm diameter hole in the centre of the test piece does not permit post-abrasion assessments of properties such as hydrostatic heat resistance or resistance to chemical reagents.

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

Part 1: Taber abrader

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This International Standard does not purport to address all of the safety problems, 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 national regulatory conditions.

1 Scope

This part of ISO 5470 describes a method of assessing the abrasive wear resistance of coated fabrics using the Taber abrader.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

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

ISO 525, *Bonded abrasive products — General requirements*

ISO 2231, *Rubber- or plastics-coated fabrics — Standard atmospheres for conditioning and testing*

ISO 2286 (all parts), *Rubber- or plastics-coated fabrics — Determination of roll characteristics*

ISO 5084, *Textiles — Determination of thickness of textiles and textile products*

ISO 6103, *Bonded abrasive products — Permissible unbalances of grinding wheels as delivered — Static testing*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

abrasive wheel

small grinding wheel faced with abrasive paper

3.2

abrasive wear

progressive loss of material from the abraded surface of a rubber or plastics material resulting from the cutting or scratching action of an abrasive wheel

4 Apparatus

4.1 Abrasion machine (see [Figures 1](#) and [2](#)), consisting of a housing of compact design, a flat circular turntable designed to carry the test piece, a pair of hinged arms to which abrasive wheels can be attached, a motor for rotating the turntable in the plane of its surface, a counter for indicating the number of revolutions executed by the turntable, a device enabling the test to be stopped automatically after a predetermined number of revolutions, and a suction attachment for removing debris.

The abrasive wheels, which are attached to the free ends of the hinged arms, are free to rotate. Their peripheral surfaces rest on the surface of the test piece. The abrasive wheels are rotated, in opposite directions, by the friction between each wheel and the rotating test piece. At the point of contact between wheel and test piece, the direction of travel of the outer surface of the wheel makes an acute angle with the direction of travel of the test piece, and this angle extends in opposite directions for each wheel. The position of the abrasive wheels relative to the centre of the turntable is shown in [Figure 1 b](#)).

The test piece is clamped to the turntable by means of a central threaded rod with a nut and washer. For measuring thin test pieces the samples can be fixed on a non-flexible supporting cardboard by a double-sided adhesive tape of suitable size. The test piece attached to the cardboard or a solid board equivalent to it can be clamped on the test piece holder of the testing machine and removed easily for weighing. The vertical distance from the centre of the pivot point of the hinged arms to the surface of the turntable is approximately 25 mm.

The turntable shall be flat and fixed to the drive shaft. When the turntable is rotated, no point on a 45 mm radius circle traced on its horizontal surface shall oscillate vertically through more than 0,05 mm about its mean position. The turntable shall have a nominal diameter of 100 mm and its speed of rotation shall be 72 rev/min when a 60 Hz power supply is used and 60 rev/min when a 50 Hz supply is used.

The two arms carrying the abrasive wheels shall be symmetrical and able to oscillate freely about a horizontal axis. The method of attaching the wheels, e.g. by means of ball-bearings, shall permit free rotation. In the test position, the mounting bosses shall be co-axial and positioned in such a way that the vertical projection of their common axis on to the plane of the turntable is $19,1 \text{ mm} \pm 0,1 \text{ mm}$ from a parallel line passing through the axis of the turntable [see [Figure 1 a](#)].

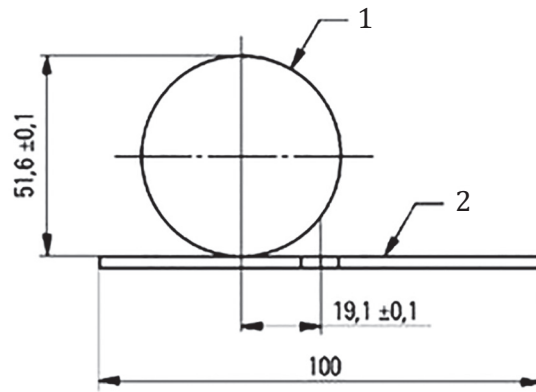
The distance between the inside face of each abrasive wheel and the centre point shall be $26,2 \text{ mm} \pm 0,1 \text{ mm}$.

Each arm shall be constructed in such a way as to permit a counterweight to be fitted to balance the mass of the arm against that of the abrasive wheel and to permit additional weights of known mass to be added (see [4.5](#)).

The arms should preferably be designed so that, without any counterweights or additional masses, each would exert a force of 2,5 N on the test piece.

A rotating-turntable twin-wheel abrader of this kind can be used with a test piece of 105 mm to 115 mm in diameter having a central 6 mm diameter hole, thus making available a 54 mm wide test strip, although the wear zone [see [Figure 1 b](#)] is only approximately 13 mm to 14 mm wide (the width of the wheel plus the effect of the contact angle).

Dimensions in millimetres

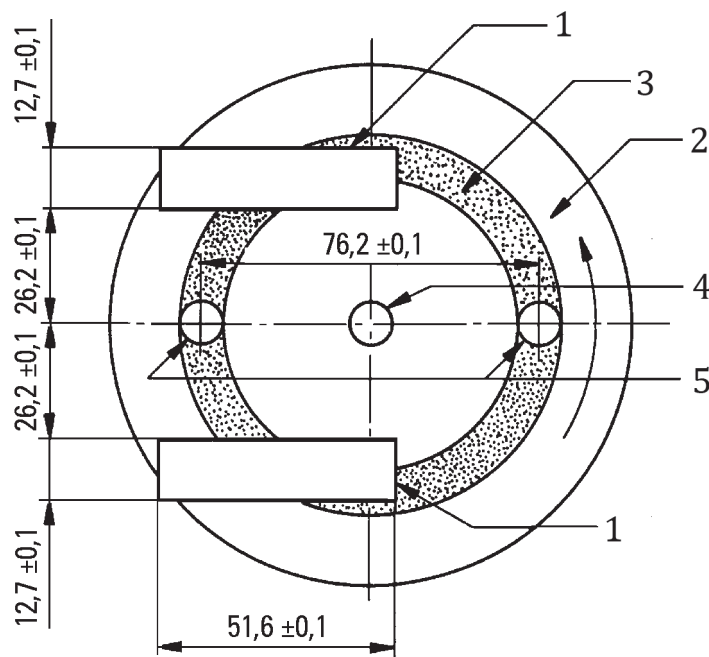


Key

- 1 abrasive wheels
- 2 test piece, diameter 105 mm to 115 mm

a) Side view

Dimensions in millimetres



b) Plan

Key

- 1 abrasive wheels
- 2 test piece, diameter 105 mm to 115 mm
- 3 wear zone
- 4 hole, diameter 6,35 mm
- 5 suction nozzles, diameter $8 \text{ mm} \pm 0,5 \text{ mm}$

Figure 1 — Diagrammatic arrangement of abrasion machine

4.2 Abrasive wheels, containing an axial hole allowing them to be fitted without play to the mounting bosses in the arms. They shall consist of one of the following two alternatives.

- a) An abrasive material (abrasive wheels). The thickness of the wheels shall be $12,7 \text{ mm} \pm 0,1 \text{ mm}$ and their external diameter $51,6 \text{ mm} \pm 0,1 \text{ mm}$ when new, but in no case less than $44,4 \text{ mm}$.
- b) A metal disc with its peripheral surface clad with a 6 mm thick layer of vulcanized rubber of hardness 50 IRHD to 55 IRHD (international rubber hardness degrees as defined in ISO 48) bonded without gaps or overlap to a strip of abrasive paper or cloth of grade 180 silicon carbide complying with ISO 525, unless otherwise stated in the material or product specification. The abrasive wheel shall have a thickness of $12,7 \text{ mm} \pm 0,2 \text{ mm}$ and a diameter of $51,6 \text{ mm} \pm 0,2 \text{ mm}$. The width of the abrasive paper shall be as specified in the relevant material or product specification.

Guidance in selecting suitable abrasive wheels is given in [Table 1](#).

If requested, the abrasive power of the wheels shall be determined by the procedure given in [Annex A](#).

Table 1 — Abrasive-wheel selection chart

Designation of series	Wheel type	Composition	Recommended load range N	Abrasive action	Approximate grit size (number of abrasive particles per cm ²)
CS10	Resilient	Rubber and abrasive grain	4,9 to 9,8	Gentle	1 420
CS10F	Resilient	Rubber and abrasive grain	2,5 to 4,9	Very gentle	1 420
CS17	Resilient	Rubber and abrasive grain	4,9 to 9,8	Harsh	645
H10	Non-resilient	Vitrified	4,9 to 9,8	Coarse	1 160
H18	Non-resilient	Vitrified	4,9 to 9,8	Medium coarse	1 160
H22	Non-resilient	Vitrified	4,9 to 9,8	Very coarse	515
H38	Non-resilient	Vitrified	2,5 ; 4,9 ; 9,8	Very coarse, hard	5 755

NOTE Under normal conditions, the "CS" series wheels are used when testing flexible test pieces, and the "H" series when testing rigid test pieces.

4.3 Suction device, for removing the wear debris, including two suction nozzles above the test piece wear zone. One nozzle shall be located between the abrasive wheels and the other shall be located diametrically opposite (see [Figure 1](#)). The bore of each nozzle shall have an internal diameter of $8 \text{ mm} \pm 0,5 \text{ mm}$ and its distance from the test piece shall be maintained at $1,5 \text{ mm} \pm 0,5 \text{ mm}$. A suction pressure of 2,5 kPa to 2,6 kPa is recommended to remove wear debris effectively.

4.4 Standard zinc plates, for determining the abrasive power of the wheels, if required (see [Annex A](#)).

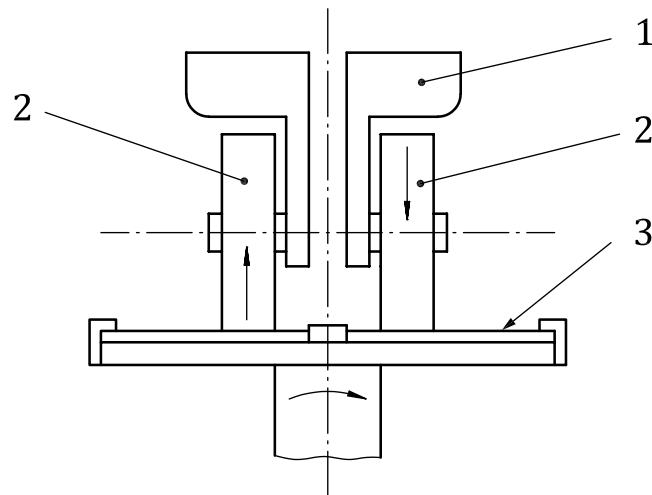
4.5 Additional weights, for loading each abrasive wheel to the requirements of the relevant material or product specification.

4.6 Double-sided adhesive tape.

4.7 Balance, accurate to the nearest 1 mg.

4.8 Apparatus for re-facing the abrasive wheels, the design of the apparatus being such that re-dressed wheels are not out of static balance (in accordance with ISO 6103), that the whole of the wheel surface contacts the test piece and that contact is perpendicular to the test piece.

4.9 Non-flexible cardboard support or a solid board equivalent to it, for thin sample fixation.



Key

- 1 load
- 2 abrasive wheels
- 3 test piece

Figure 2 — Front elevation of abrasion machine

5 Test pieces

Cut from the sample of coated fabric, at non-adjacent positions distributed randomly throughout the sample, two test pieces of diameter ranging from 105 mm to 115 mm, with a central hole of diameter 6,35 mm. In cases of dispute cut three to six test pieces.

6 Atmosphere for conditioning and testing

Condition the test pieces in accordance with ISO 2231.

If silicon carbide paper is used as the abradant rather than silicon carbide abrasive wheels, store the paper away from direct sunlight and away from heat in an atmosphere at approximately 20 °C and 50 % relative humidity, and condition for 1 h in accordance with ISO 2231 before use.

7 Procedure

7.1 Preparation and mounting of test pieces

Carefully apply to the reverse of each test piece double-sided adhesive tape, ensuring that wrinkles or creases are not introduced into the test piece or the adhesive tape and that the adhesive tape does not distort the test piece or cover the central hole. Fix the prepared test piece on a supporting cardboard or a solid board equivalent to it. Determine the mass of each of the supported test pieces to the nearest 1 mg.

Carefully mount a coated-fabric test piece or the supporting board with the test piece on the turntable of the abrader and press in place evenly.

7.2 Preparation of abrasive surface

If silicon carbide abrasive wheels are used, re-dress them before every test and at intervals of 2 000 cycles. Re-dress the wheels by traversing, across the face of each wheel, the tip of a diamond

dressing tool in accordance with the instruction from an abrasive wheel manufacturer. Apply the minimum force necessary to the wheel with the dressing tool to ensure effective re-dressing.

If silicon carbide abrasive paper is used, secure it round the periphery of a solid wheel using a suitable adhesive and butt-joint the two ends. Replace the abrasive paper every 500 cycles.

Adjust the loading of each abrasive wheel to the value specified in the relevant material or product specification, using the counterweights and additional weights (see [4.5](#)).

7.3 Operation

Set the cycle counter to the limit required by the relevant material or product specification. Lower the abrasive wheel on to the surface of the test piece and set the machine in motion.

8 Method of assessment

8.1 Number of cycles to end-point

Determine the end-point in accordance with the relevant material or product specification.

In the absence of such a specification, the following methods of determining the end-point are recommended:

- a) from the change in colour of the abraded portion, assessed by reference to the grey scales for change in colour (in accordance with ISO 105-A02);
- b) from exposure of the substrate or foam layer;
- c) from the total mass loss, expressed in milligrams or as a percentage of the original mass of the test piece;
- d) by reference to a relevant physical property, determined using a recognized method of test (e.g. ISO 2286 or ISO 5084).

8.2 Average rate of loss in mass

Calculate the loss in mass in milligrams per 100 cycles.

9 Precision

The precision of this test method is not known because interlaboratory data are not available. It should be recognized that the precision of the method will depend on the procedure used to assess the extent of the abrasive wear: different results should be expected when evaluating mass loss, volume loss, changes in optical properties, etc. Precision results can also be influenced by failure to maintain the proper gap between the suction nozzles, failure to maintain sufficient suction pressure and improper placement of any counterweights used.

This method may not be suitable for use in specifications or in cases of disputed results as long as interlaboratory data are not available.

10 Test report

The test report shall include the following particulars:

- a) a reference to this part of ISO 5470, i.e. ISO 5470-1;
- b) all details necessary for complete identification of the coated fabric;

- c) the conditioning and test atmosphere and the method of conditioning used;
- d) the load applied to each wheel during the test;
- e) the number of abrasion cycles carried out and the frequency at which they were executed;
- f) complete details of the abrasive used;
- g) details of changes in properties of the coated fabric;
- h) the average rate of loss in mass, expressed in milligrams per 100 cycles;
- i) details of any deviations from the procedure specified, as well as details of any incidents likely to have had an influence on the results.

Annex A (normative)

Determination of the abrasive power of the abrasive wheels

A.1 Principle

The abrasive power of the abrasive wheels is determined under the conditions defined in the relevant material or product specification. It is characterized by the loss in mass of a standard zinc plate reference specimen after a specified number of revolutions.

A.2 Reference test specimen

Prepare the reference specimen from a sheet of pure zinc (purity at least 99 %), with a thickness of 0,7 mm to 0,8 mm, pre-treated at 200 °C for 60 min.

The Vickers hardness of the surface of this sheet, measured in accordance with ISO 6507-1, shall be 42 HV100 – 2 HV100, or the equivalent Brinell hardness value measured in accordance with ISO 6506-1.

A.3 Procedure

Clean the reference specimen with acetone, weigh it to the nearest 1 mg, then subject it to the test in accordance with the procedure described in [Clause 7](#). The applied load and the number of revolutions shall be as specified in the relevant material or product specification. In the absence of any such instructions, use a load of 4,9 N and 1 000 revolutions.

After the test, weigh the specimen again to the nearest 1 mg.

A.4 Expression of results

The abrasive power of the abrasive wheels (or abrasive paper) used is expressed as the loss, calculated for 1 000 revolutions, in mass or volume of the reference specimen, or as specified in the relevant material or product specification.

A.5 Frequency of calibration

A.5.1 In the case of abrasive wheels, it is recommended that the wheels be calibrated on receipt and that this procedure be repeated every 3 months. After each calibration, the wheels shall be re-dressed (see [7.2](#)) before the first test.

A.5.2 In the case of abrasive paper, calibration shall be performed on a representative sample and the first test shall be performed on a fresh (unused) portion of the abrasive paper. It is recommended that the paper be calibrated on receipt and that the procedure be repeated every 3 months, or as specified in the relevant material or product specification.

Bibliography

- [1] ISO 9352, *Plastics — Determination of resistance to wear by abrasive wheels*

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