
**Footwear — Test methods for outsoles
— Abrasion resistance**

*Chaussures — Méthodes d'essai applicables aux semelles d'usure —
Résistance à l'abrasion*

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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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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

This document was prepared by Technical Committee ISO/TC 216, *Footwear*.

This second edition cancels and replaces the first edition (ISO 20871:2001), which has been technically revised.

Footwear — Test methods for outsoles — Abrasion resistance

1 Scope

This document specifies a method for the determination of the abrasion resistance for outsoles, irrespective of the material.

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 2420, *Leather — Physical and mechanical tests — Determination of apparent density and mass per unit area*

ISO 2781, *Rubber, vulcanized or thermoplastic — Determination of density*

ISO 17709, *Footwear — Sampling location, preparation and duration of conditioning of samples and test pieces*

ISO 18454, *Footwear — Standard atmospheres for conditioning and testing of footwear and components for footwear*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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/>

3.1

abrasion resistance

resistance to wear by mechanical action upon a surface

3.2

relative mass loss

M

mass loss of the outsole after being subjected to abrasion by an abrasive cloth will cause the appropriate standard rubber to lose a mass of 200 mg under the preferred conditions, namely a distance of 40 m, a load of 10 N and using a non-rotating test piece

Note 1 to entry: The mass loss is expressed in milligrams.

3.3

relative volume loss

V

volume loss of the test rubber after being subjected to abrasion by an abrasive sheet which will cause a reference compound to lose a defined mass under the same specified conditions of test

Note 1 to entry: The relative volume loss is expressed in cubic millimetres.

4 Apparatus and materials

The following apparatus and material shall be used.

4.1 Abrasion machine.

The test apparatus (see [Figure 1](#)) consists of a laterally movable test piece holder and a rotatable cylindrical drum to which the abrasive cloth ([4.2](#)) is fixed.

The drum shall have a diameter of $150 \text{ mm} \pm 0,2 \text{ mm}$ and a length of about 500 mm and shall be rotated at a frequency of $40 \text{ min}^{-1} \pm 1 \text{ min}^{-1}$, the directions of rotation being as indicated in [Figure 1](#).

The test piece holder shall consist of a cylindrical opening, the diameter of which can be adjusted from 15,5 mm to 16,3 mm, and a device for adjusting the length of the test piece protruding from the opening to $2 \text{ mm} \pm 0,2 \text{ mm}$. The holder shall be mounted on a swivel arm which in turn is attached to a sledge which can be moved laterally on a spindle. The lateral displacement of the holder shall be $4,20 \text{ mm} \pm 0,04 \text{ mm}$ per revolution of the drum.

The centre axis of the holder shall have an inclination of 3° to the perpendicular in the direction of rotation (see [Figure 1](#)), and shall be placed directly above the longitudinal axis of the drum to within $\pm 1 \text{ mm}$.

The swivel arm and test piece holder shall be free from vibration during operation, and disposed such that the test piece is pressed against the drum with a vertical force of $10 \text{ N} \pm 0,2 \text{ N}$ obtained by adding weights to the top of the test piece holder.

The abrasive cloth shall be attached to the drum using three evenly spaced strips of double-sided adhesive tape extending along the complete length of the cylinder. Care shall be taken to ensure that the abrasive cloth is firmly held so as to present a uniform abrasive surface over the whole area of the cylinder. One of the strips shall be placed where the ends of the abrasive cloth meet. Ideally the ends should meet exactly, but any gap left between them shall not exceed 2 mm. The adhesive tape shall be about 50 mm wide and not more 0,2 mm thick.

Placement of the test piece on to the cloth at the beginning of a test run, and its removal after an abrasion run of 40 m (equivalent to 84 revolutions), shall be automatic. In special cases of very high volume loss of the test piece, an abrasion distance of only 20 m (equivalent to 42 revolutions) may be used. If using an abrasion distance of 20 m, a revolution counter or automatic stopping device should be connected to the drum.

To protect the abrasive cloth from damage by the test piece holder, a device for switching off the apparatus just before the lower edge of the test piece holder touches the cloth is recommended.

4.2 Abrasive cloth, made with aluminium oxide of grain size 60, at least 400 mm wide, 473 mm long and 1 mm average thickness, used as the abrasive medium.

This abrasive surface shall cause a mass loss between 180 mg and 220 mg for an abrasion distance of 40 m.

When each new sheet of cloth is first used, the direction of motion shall be indicated on the sheet, as it is important that the same direction be used for all subsequent test runs.

NOTE Suitable paper abrasive cloth is listed in ISO 4649: 2017, Annex A.

4.3 Hollow drill, with a frequency of rotation of the drill at least of $1\,000 \text{ min}^{-1}$ for most outsoles materials.

The specification for the hollow drill is given in detail in [Figure 2](#).

4.4 Balance, of sufficient accuracy to enable the mass loss of a test piece to be determined to $\pm 1 \text{ mg}$.

4.5 Standard rubbers.

Specifications for standard rubbers are given in detail in ISO 4649:2017, B.1.

5 Sampling and conditioning

The test pieces shall be cylindrical in shape, of diameter $16 \text{ mm} \pm 0,2 \text{ mm}$, with a minimum height of 6 mm. If test pieces of the required thickness are not available, the necessary thickness may be obtained by bonding a piece of the outsole to a base element of hardness not less than 80 IRHD. The thickness of these outsole should be not less than 2 mm.

Minimum three test pieces are necessary.

The test pieces to be tested shall be taken in accordance with ISO 17709.

All test pieces shall be conditioned in accordance with ISO 18454 before testing for a minimum of 24 h.

6 Test method

6.1 Procedure

Before each test, any rubber debris left on the abrasive cloth from a previous abrasion test shall be removed with a brush. A strong brush of about 55 mm diameter and about 70 mm length is recommended for this purpose. In some cases, a blank test with a standard rubber will effectively clean the abrasive cloth.

Weigh the test piece to the nearest 1 mg. Fix the test piece in the test piece holder in such a way that a length of $2,0 \text{ mm} \pm 0,2 \text{ mm}$ protrudes from the opening. This length shall be controlled by means of a gauge.

The test piece shall be pressed against the drum with a vertical force of $10 \text{ N} \pm 0,2 \text{ N}$.

Move the test piece holder and sledge to the starting point, place the test piece on the abrasive cloth and set the cylinder in motion. Check for vibration in the test piece holder. This test method does not yield meaningful results if there is abnormal vibration in the test piece holder. The test run is stopped automatically after an abrasion distance of 40 m. For relatively large mass losses the test run may be stopped and the length of exposed test piece reset to $2,0 \text{ mm} \pm 0,2 \text{ mm}$ so that the test can be restarted and completed.

The sample shall not be complete abraded at the end of the test and the test sample carrier shall not be, or any part of it in contact with the abradant paper. If it is, repeat the test using a reduced distance, for example, 20 m or less if it is necessary and then extrapolate the results to 40 m.

This shall be stated in the test report.

6.2 Determination of density

The density of the test material shall be determined in accordance with ISO 2781 or ISO 2420 as appropriate.

6.3 Comparison against standard rubbers

In this document, the test rubbers are compared against standard rubbers.

The test is performed on the following way:

- Test a reference standard rubber piece.
- Test up to three test pieces. It requires at least, three test pieces for each sample.

— Test a reference standard rubber piece again. This is done to check the consistency of the abrasant. Repeat the procedure as many times as needed to test the number of samples required.

7 Expression of results

The relative mass loss, M , in milligrams is given by [Formula \(1\)](#):

$$M = \frac{m \times S_0}{S} \quad (1)$$

where

- m is the mass loss in milligrams;
- S_0 is the value of nominal mass loss of standard rubber (200 mg);
- S is the average mass loss of standard rubber in milligrams.

The relative volume loss in cubic millimetres is given by [Formula \(2\)](#):

$$V = \frac{m \times S_0}{\rho \times S} \quad (2)$$

where

- m is the mass loss in milligrams;
- S_0 is the value of nominal mass loss of standard rubber (200 mg);
- S is the average mass loss of standard rubber in milligrams.
- ρ is the density in mg/mm³.

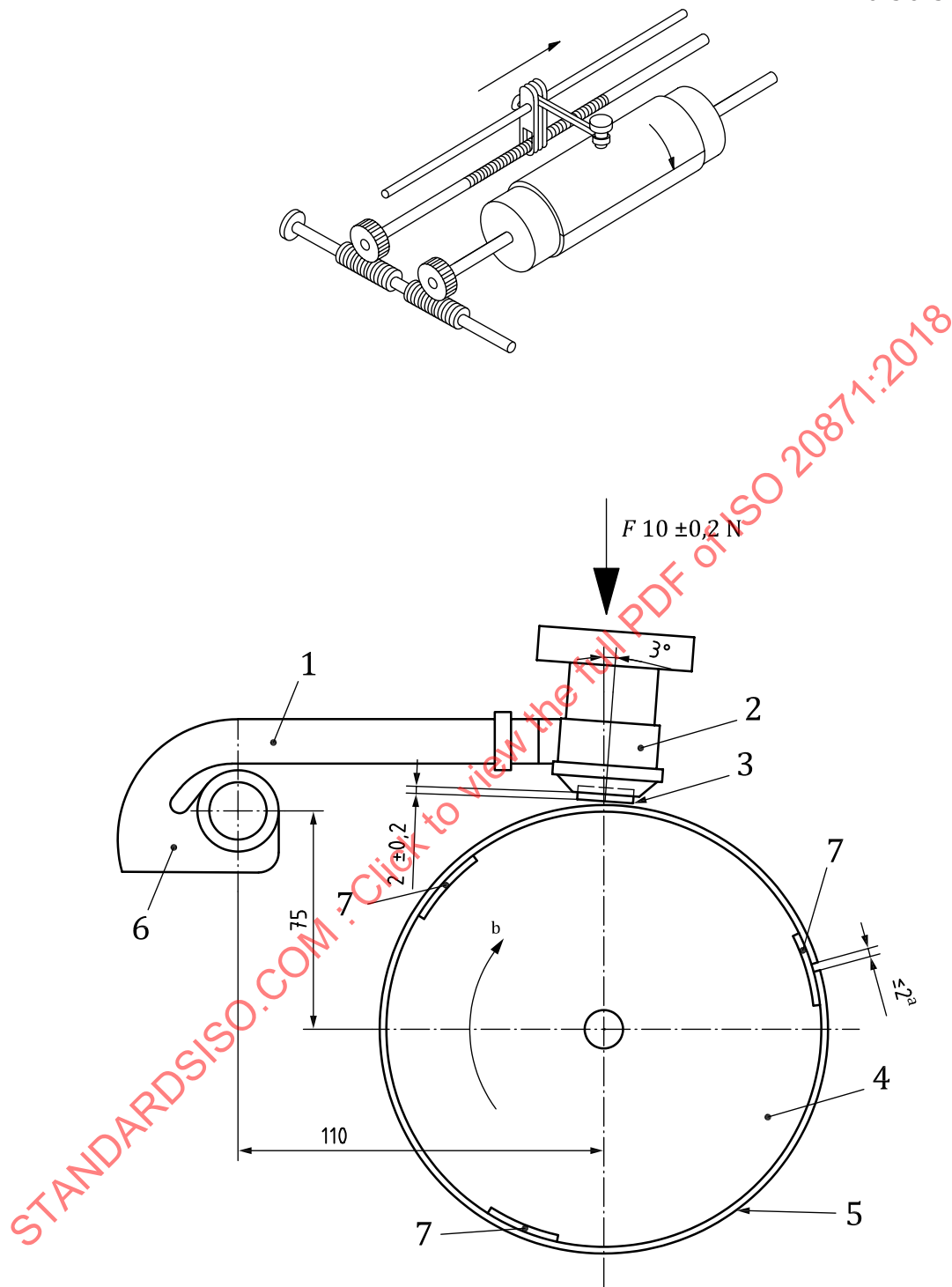
The result will be the average of the three value.

8 Test report

The test report shall include the following information:

- a) a reference to this document, i.e ISO 20871:2018;
- b) a full description of the samples tested including commercial styles, codes, colours, nature, etc.;
- c) the results, expressed in accordance with [Clause 7](#);
- d) any deviations from the test procedure, especially if the test run comprised only half the abrasion distance;
- e) the density;
- f) the date of testing;
- g) the standard atmospheric conditions observed during the test, if not performed at 23 °C/50 % RH.

Dimensions in millimetres



Key

- | | | | |
|---|--|---|-------------------------------|
| 1 | swivel arm | 6 | sledge |
| 2 | sample holder | 7 | double adhesive tape |
| 3 | test piece | a | Gap. |
| 4 | cylinder, $\varnothing 150 \pm 0,2$ length 500 | b | $40 \pm 1 \text{ min}^{-1}$. |
| 5 | abrasive cloth | | |

Figure 1 — Schematic illustration of apparatus