

norm

NEN-ISO 4649 (en)

Rubber, ge vulcaniseerd of thermoplastisch - Bepaling van de slijtweerstand met gebruik van een roterende cilinder (ISO 4649:2002, IDT)

Rubber, vulcanized or thermoplastic - Determination of abrasion resistance using a rotating cylindrical drum device (ISO 4649:2002, IDT)

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- ISO 4649:2002, IDT

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**Rubber, vulcanized or thermoplastic —
Determination of abrasion resistance using
a rotating cylindrical drum device**

*Caoutchouc vulcanisé ou thermoplastique — Détermination de la
résistance à l'abrasion à l'aide d'un dispositif à tambour tournant*

Preview



Reference number
ISO 4649:2002(E)

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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 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.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 4649 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analyses*.

This second edition cancels and replaces the first edition (ISO 4649:1985), which has been technically revised.

Annexes A and B form a normative part of this International Standard.

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Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This 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 International Standard specifies two methods for the determination of the resistance of rubber to abrasion by means of a rotating cylindrical drum device.

The methods involve determination of the volume loss due to the abrasive action of rubbing a test piece over a specified grade of abrasive sheet. Method A is for a non-rotating test piece and method B for a rotating test piece. For each method, the result can be reported as a relative volume loss or an abrasion resistance index.

NOTE 1 Users of previous editions of this International Standard should be aware that method A and method B in this edition have been changed. In this edition, method A (non-rotating test piece) with the calculation of relative volume loss (see 3.2) corresponds to method A of the previous editions. Method A (non-rotating test piece) and method B (rotating test piece) with calculation of abrasion resistance index (see 3.3) were both included in method B in the previous editions.

Because factors such as the grade of abrasive sheet, the type of adhesive used in the manufacture of the sheet and contamination and wear caused by previous testing lead to variations in the absolute values of abrasion loss, all tests are comparative. Runs with a reference compound are included so that the results may be expressed either as a relative volume loss compared to a calibrated abrasive sheet or an abrasion resistance index compared to a reference compound.

NOTE 2 The abrasion loss is often more uniform using the rotating test piece because the whole surface of the test piece is in contact with the abrasive sheet over the duration of the test. However, there is considerable experience using the non-rotating test piece.

These test methods are suitable for comparative testing, quality control, specification compliance testing, referee purposes, and research and development work. No close relation between the results of this abrasion test and service performance can be inferred.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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 471:1995, *Rubber — Temperatures, humidities and times for conditioning and testing*

ISO 2393:1994, *Rubber test mixes — Preparation, mixing and vulcanization — Equipment and procedures*

ISO 2781:1988, *Rubber, vulcanized — Determination of density*

ISO 5725-2:1994, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

ISO 7619:1997, *Rubber — Determination of indentation hardness by means of pocket hardness meters*

ISO 9298:1995, *Rubber compounding ingredients — Zinc oxide — Test methods*

3 Terms and definitions

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

3.1

abrasion resistance

the resistance to wear by mechanical action upon a surface

NOTE For the purposes of this International Standard, the abrasion resistance is expressed either as a relative volume loss compared to an abrasive sheet calibrated using a standard reference compound, or as an abrasion resistance index compared to a reference compound.

3.2

relative volume loss

the volume loss, in cubic millimetres, 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 A value of 200 mg has been established as the mid-point of the calibration range (see B.2.4.3) for the abrasive sheet using method A with standard reference compound No. 1 (see B.2) and considerable experience has been accumulated using the relative volume loss calculation in 9.2. A relative volume loss can be calculated for method B (rotating test piece), or with either test method with another reference compound, if the defined mass loss is known [(150 mg) has been indicated as a possible value for method B with standard reference compound No. 2 (see B.3) but its accuracy has not been documented to the degree of the value (200 mg) using method A with standard reference compound No. 1 (see B.2)].

3.3

abrasion resistance index

the ratio of the volume loss of a reference compound to the volume loss of the test rubber measured under the same specified conditions of test and expressed as a percentage

NOTE A smaller number indicates a lower abrasion resistance.

4 Principle

A cylindrical rubber test piece is made to slide over an abrasive sheet of specified abrasive grade at a specified contact pressure over a given distance. The test piece may be non-rotating or rotating during the test.

Abrasion takes place over one of the end surfaces of the cylindrical test piece (see Figure 1). The abrasive sheet is attached to the surface of a rotating cylindrical drum against which the test piece is held and across which it is traversed.

The loss in mass of the test piece is determined and the volume loss is calculated from the density of the material used for the test piece. The volume loss of the test piece is compared to that of a reference compound tested under the same conditions.

A very important part of this method is the preparation of the abrasive sheet and its calibration using standard reference compound No. 1 (see B.2) with a non-rotating test piece.

Dimensions in millimetres

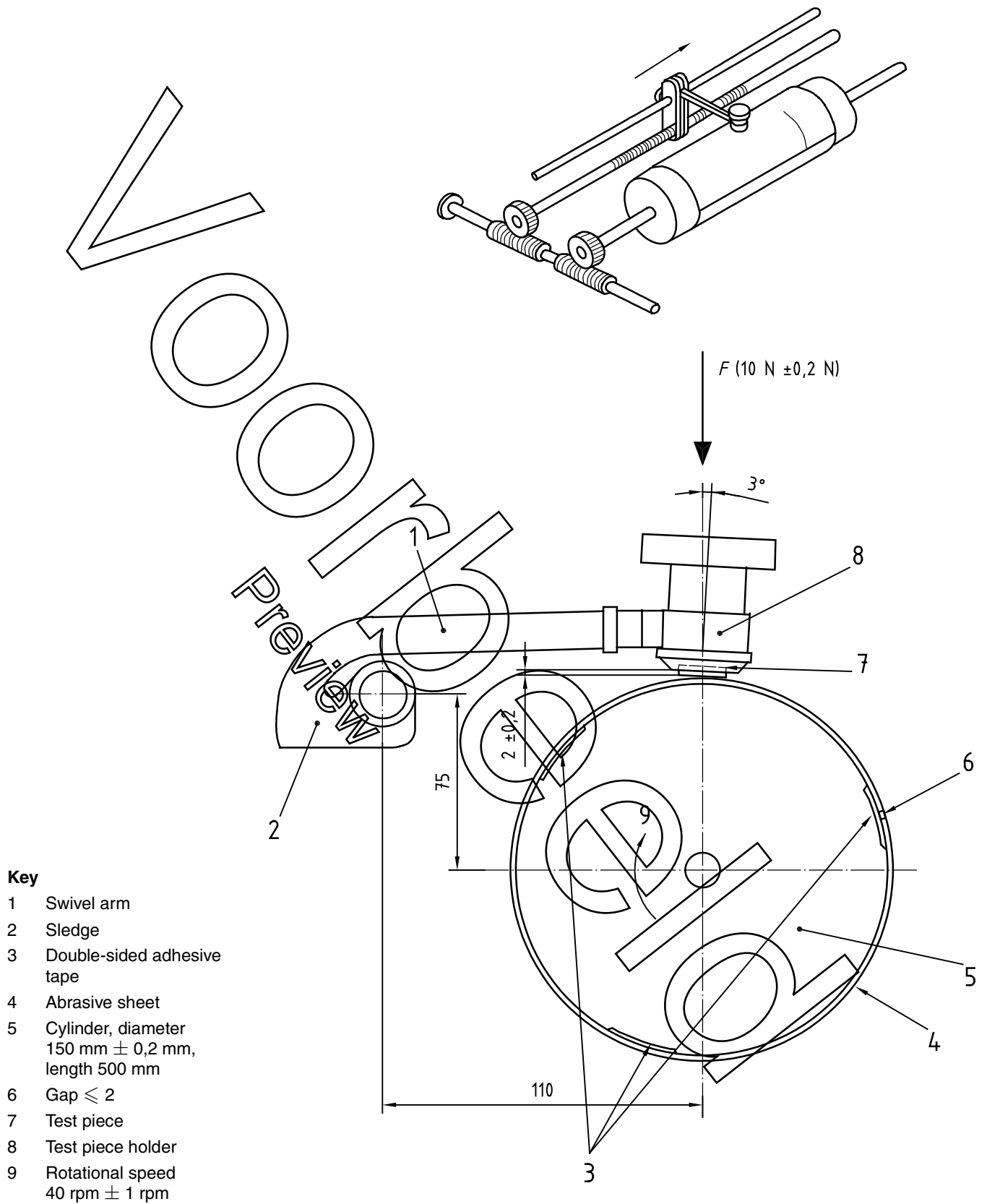


Figure 1 — Schematic illustration of apparatus

5 Apparatus and materials

5.1 Abrasion machine

The test apparatus (see Figure 1) consists of a laterally movable test piece holder and a rotatable cylinder to which the abrasive sheet (5.2) is fixed.

The cylinder 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 speed of $40 \text{ rpm} \pm 1 \text{ rpm}$, the direction of rotation being as indicated in Figure 1.

The test piece holder shall have 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 that, in turn, is attached to a sledge that 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 (see note 1). Suitable attachments may be provided to rotate the test piece during the test run by rotation of the test piece holder (method B), preferably at the rate of 1 revolution per 50 revolutions of the drum.

NOTE 1 With this lateral movement, the test piece passes over any one area of the abrasive sheet four times.

The central 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 cylinder to within $\pm 1 \text{ mm}$.

The swivel arm and test piece holder shall be free from vibration during operation, and so disposed 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. For special purposes, a force of $5 \text{ N} \pm 0,1 \text{ N}$ may be used.

NOTE 2 A force of 5 N is typically used for rubbers softer than approx. 40 IRHD.

The abrasive sheet shall be attached to the drum using three evenly spaced strips of double-sided adhesive tape extending along the complete length of the drum. The width of the margins that are not touched by the test piece shall be equal. Care shall be taken to ensure that the abrasive sheet 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 sheet 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 than 0,2 mm thick.

Placement of the test piece on the sheet at the beginning of a test run, and its removal after an abrasion run of $40 \text{ m} \pm 0,2 \text{ m}$ (equivalent to 84 revolutions), shall be automatic. In special cases of very high volume loss of the test piece, the abrasion distance may be reduced to $20 \text{ m} \pm 0,1 \text{ m}$ (equivalent to 42 revolutions). In that case, a revolution counter or automatic stopping device should preferably be used.

NOTE 3 For rubbers with very high mass loss, a distance of 10 m has been used.

To protect the abrasive sheet 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 sheet is recommended.

The test machine may be equipped with a vacuum hose and a brush to aid in the removal of debris from the machine.

5.2 Abrasive sheet

Abrasive sheet made with aluminium oxide of grain size 60, at least 400 mm wide, $474 \text{ mm} \pm 1 \text{ mm}$ long and 1 mm average thickness, shall be used as the abrasive medium.

In a test using a non-rotating test piece of standard reference compound No. 1 (see B.2), this abrasive sheet shall cause a mass loss of between 180 mg and 220 mg for an abrasion distance of 40 m.

When each new sheet 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.

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