
**Rubber, vulcanized or thermoplastic —
Rubber sheets and rubber-coated
fabrics — Determination of transmission
rate of volatile liquids (gravimetric
technique)**

*Caoutchouc vulcanisé ou thermoplastique — Feuilles de caoutchouc
et supports textiles revêtus de caoutchouc — Détermination du taux
de transmission des liquides volatils (technique gravimétrique)*



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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 6179 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This fourth edition cancels and replaces the third edition (ISO 6179:1998), of which it constitutes a minor revision intended to update the normative references (ISO 471 and ISO 4648 have been replaced by ISO 23529).

Rubber, vulcanized or thermoplastic — Rubber sheets and rubber-coated fabrics — Determination of transmission rate of volatile liquids (gravimetric technique)

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.

CAUTION — Certain procedures specified in this International Standard may involve the use or generation of substances, or the generation of waste, that could constitute a local environmental hazard. Reference should be made to appropriate documentation on safe handling and disposal after use.

1 Scope

This International Standard specifies two methods for determining, by measurement of the transmission rate, the permeability of rubber to volatile liquids diffusing into open air.

It is applicable only to materials in sheet form and to coated fabrics having thicknesses between 0,2 mm and 3,0 mm.

It is restricted to transmission rates of more than 0,1 g/m²·h.

The methods are particularly useful for comparing the relative transmission rates of one liquid through different materials, or of several liquids through one material.

Method A, with refilling, is used when testing mixtures of liquids which give different transmission rates.

Method B, with no refilling, is used for a single-component liquid.

NOTE A method for the determination of water vapour transmission rate is given in ISO 2528, *Sheet materials — Determination of water vapour transmission rate — Gravimetric (dish) method*.

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 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

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

ISO 2286-3, *Rubber- or plastics-coated fabrics — Determination of roll characteristics — Part 3: Method for determination of thickness*

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

3 Terms and definitions

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

3.1

transmission rate

mass, in grams, of a volatile liquid which permeates through each square metre of a rubber test sheet of a given thickness per hour under the test conditions specified in this International Standard

4 Apparatus

4.1 Container assembly, consisting of a container for the test liquid, a suitable clamping device for the test piece which does not impose a shearing force on the test piece, and a suitable support for the container, so that the test piece and the test liquid are in contact at all times (with the apparatus inverted after filling), and such as to permit free circulation of air across the surface of the test piece.

The container shall have a volume of 60 cm³ to 100 cm³ and an inlet valve for filling and refilling.

NOTE For method B, an inlet valve is not necessary when introducing the test liquid before mounting the test piece in place.

The mass of the container, the clamping ring, the test piece and 50 cm³ of the test liquid shall not exceed the capacity of the balance (4.2).

The open end of the container and the hole in the clamping ring shall have a diameter such that approximately 10 cm² of the surface of the test piece is exposed on each side.

A suitable apparatus is shown in Figure 1.

When testing materials without fabric and with a high transmission rate or when testing at high test temperatures, a circular piece of stainless-steel wire mesh of aperture size 1 mm (in accordance with ISO 3310-1) shall be mounted together with the test piece so as to support the latter on its outer surface during the test.

4.2 Balance, with a capacity of at least 200 g and accurate to 1 mg.

4.3 Cabinet oven, complying with the requirements of ISO 188, for tests performed at elevated temperatures.

5 Test pieces

5.1 Preparation

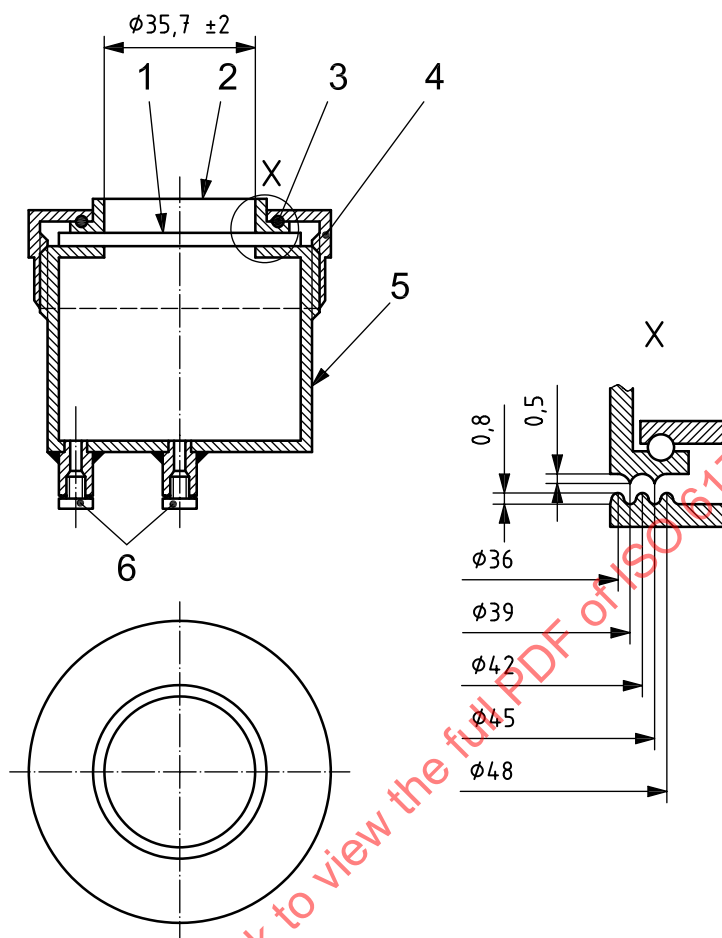
The standard test piece shall be circular and cut from a flat sheet in the way specified in ISO 23529. The surface shall be flat, smooth and free from defects.

Each test piece shall be of a suitable size to fit the container assembly and to be securely clamped in position.

The thickness of each test piece shall be 2 mm ± 0,2 mm. The difference in the mean thickness of test pieces used for comparison tests shall not be more than 0,05 mm.

Test pieces may also be cut from finished products made from sheets or coated fabrics. In this case, the thickness shall not be less than 0,2 mm and not more than 3,0 mm.

Dimensions in millimetres

**Key**

- 1 test piece
- 2 non-rotating clamp
- 3 ball bearing
- 4 screw top
- 5 liquid container (volume 60 cm³ to 100 cm³)
- 6 filling valve(s)

Figure 1 — Test apparatus**5.2 Thickness measurement**

Measure the thickness of the test pieces in accordance with ISO 2286-3 or ISO 23529, as appropriate.

5.3 Number of test pieces

Use at least three test pieces for each test.

6 Time-interval between vulcanization and testing

The requirements of ISO 23529 shall apply.

7 Conditioning

Before the test, condition the test pieces in accordance with ISO 23529 (or in the case of coated fabrics ISO 2231), i.e. at $23\text{ °C} \pm 2\text{ °C}$ and $(50 \pm 5)\%$ relative humidity or $27\text{ °C} \pm 2\text{ °C}$ and $(65 \pm 5)\%$ relative humidity, depending on national practice.

8 Test conditions

8.1 Temperature

The normal test temperature is $23\text{ °C} \pm 2\text{ °C}$ or $27\text{ °C} \pm 2\text{ °C}$ (see Clause 7).

If, for technical reasons, an elevated temperature is required, choose it from the following list of temperatures:

$40\text{ °C} \pm 1\text{ °C}$

$55\text{ °C} \pm 1\text{ °C}$

$70\text{ °C} \pm 1\text{ °C}$

$85\text{ °C} \pm 1\text{ °C}$

$100\text{ °C} \pm 1\text{ °C}$

If an elevated test temperature is used, a pressure will be generated within the container, which might have some effect on the results of the determination.

Irrespective of the test temperature, carry out all weighing operations at $23\text{ °C} \pm 2\text{ °C}$ or $27\text{ °C} \pm 2\text{ °C}$.

8.2 Length of test

The preferred test period is $24\text{ h} \pm 2\text{ h}$.

Alternatively, for materials having high transmission rates, a shorter test period of 8 h or 16 h is recommended. For materials having low transmission rates, a test period of 3 days or 7 days is recommended.

NOTE In the case of mixtures of liquids, the test period can be limited by a component with a low concentration and high partial transmission rate. This can cause a rapid change in the composition of the liquid and therefore of the transmission rate.

Each test period commences immediately after the container has been weighed and placed so that the liquid is in contact with the inner surface of the test piece. If the test is carried out at elevated temperature, the test period commences immediately after placing the apparatus in the oven, which shall be not more than 30 min after weighing, and the container shall be allowed to cool to standard laboratory temperature ($23\text{ °C} \pm 2\text{ °C}$ or $27\text{ °C} \pm 2\text{ °C}$) at the end of each test period before it is weighed. This cooling period (which is not included in the test period) shall not exceed 1 h.

9 Procedure

9.1 Preliminary operations

Measure the thickness of a test piece, with an accuracy of 0,01 mm, at four points along the circumference of the area exposed to the test liquid and at the centre as specified in ISO 2286-3 or ISO 23529, as appropriate. If any two measurements differ by more than 0,05 mm, discard the test piece. Report the mean value.

Put the test piece on the open end of the container, together with the stainless-steel wire mesh if necessary (see 4.1), and close the container with the clamping ring.

Take care to avoid damaging or displacing the test piece. If it is not tightly sealed, glue or paste may be used.

Using a pipette or funnel, introduce into the container through one of the filling valves about 50 cm³ of the test liquid.

Weigh the container to the nearest 1 mg, place on a suitable support (see 4.1) with the filling valves uppermost and maintain at the test temperature with the test liquid in contact with the inner surface of the test piece for 24 h ± 2 h.

Reweigh at the end of this period (see 8.2).

Excessive loss in mass indicates that leakage has occurred due to improper sealing. In such cases, discard the test piece.

Carry out all weighing operations at a standard laboratory temperature of 23 °C ± 2 °C or 27 °C ± 2 °C.

9.2 Method A

After the preliminary operations described in 9.1, empty the container through the filling valves and refill it with approximately 50 cm³ of test liquid.

After conditioning for 1 h, weigh the container to the nearest 1 mg, making sure that it is clean and dry on the outside surfaces, to obtain the mass m_1 .

Maintain the container with the test liquid in contact with the test piece at the test temperature for a period t of 24 h ± 2 h. Reweigh at the end of this period (see 8.2) to obtain the new mass m_2 .

Calculate the change in mass per unit time, k , in milligrams per hour, for the test piece as follows:

$$k = (m_1 - m_2) / t$$

Repeat the operations until the value of k for any one of three consecutive 24 h ± 2 h test periods does not differ by more than 10 % from the mean value k_m for the three test periods.

NOTE Depending on the transmission rate, other test periods might be more suitable (see 8.2).

Repeat the procedure with the remaining test pieces, starting in each case at the beginning of 9.1.

The mean values k_m obtained for the three test pieces shall be within 15 % of their median value K_M . If this is not the case, repeat the determination and use the full set of data from both determinations to calculate the result (see Clause 10).

9.3 Method B

Determine the rate of change in mass in accordance with 9.1 and 9.2 but without emptying and refilling the container between successive weighings.