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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)

Reference number
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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 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This fifth edition cancels and replaces the fourth edition (ISO 6179:2010), which has been technically revised to include a calibration schedule in Annex A.

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

WARNING 1 — Persons using this document should be familiar with normal laboratory practice. This document 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.

WARNING 2 — Certain procedures specified in this document might 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 document 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/m^2·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.

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 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 18899:2013, *Rubber — Guide to the calibration of test equipment*

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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
transmission rate
mass of a volatile liquid which permeates through a rubber test sheet of a given thickness under the test conditions specified in this document

Note 1 to entry: It is expressed in grams per square metre per hour ($g/m^2 \cdot h$).

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 cm^3 to 100 cm^3 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 cm^3 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 cm^2 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 Calibration

The requirements for calibration of the test apparatus are given in Annex A.

6 Test pieces

6.1 Preparation

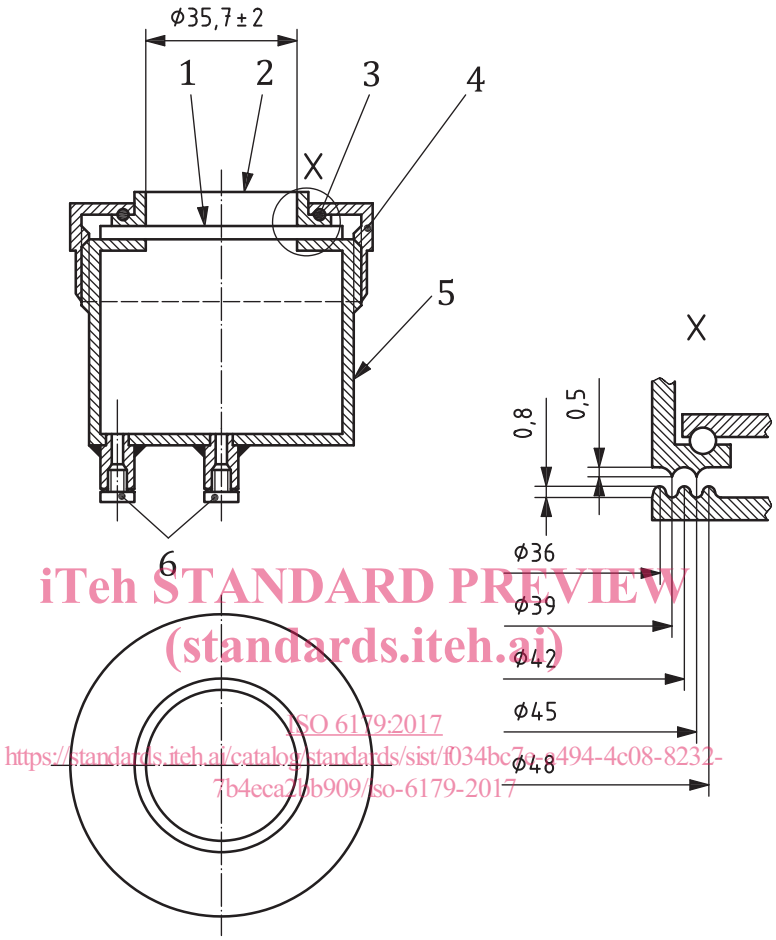
The standard test piece shall be circular and cut from a flat sheet in the way specified in ISO 23529. The surface shall be flat, smooth and free from defects.

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 cm^3 to 100 cm^3)
6 filling valve(s)

Figure 1 — Test apparatus

6.2 Thickness measurement

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

6.3 Number of test pieces

Use at least three test pieces for each test.

7 Time-interval between vulcanization and testing

The requirements of ISO 23529 shall apply.

8 Conditioning

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

9 Test conditions

9.1 Temperature

The usual test temperature is 23 °C ± 2 °C or 27 °C ± 2 °C (see Clause 8).

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

40 °C ± 1 °C

55 °C ± 1 °C

70 °C ± 1 °C

85 °C ± 1 °C

100 °C ± 1 °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 °C ± 2 °C or 27 °C ± 2 °C.

9.2 Duration of test

The preferred test period is 24 h ± 2 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 °C ± 2 °C or 27 °C ± 2 °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.

10 Procedure

10.1 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 (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 cm^3 of the test liquid.

Weigh the container to the nearest 1 mg, place on a suitable support (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 9.2).

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.

10.2 Method A

After the preliminary operations described in 10.1, empty the container through the filling valves and refill it with approximately 50 cm^3 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 9.2) 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 shown in Formula (1):

$$k = (m_1 - m_2)/t \tag{1}$$

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 9.2).

Repeat the procedure with the remaining test pieces, starting in each case at the beginning of 10.1.

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 11).

10.3 Method B

Determine the rate of change in mass in accordance with 10.1 and 10.2 but without emptying and refilling the container between successive weighings.