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Vulcanized rubber sheet, and fabrics coated with vulcanized rubber — Determination of transmission rate of volatile liquids (Gravimetric technique)

Feuilles de caoutchouc vulcanisé et supports textiles revêtus de caoutchouc vulcanisé — Détermination du taux de transmission des liquides volatils (Technique gravimétrique)

Reference number
ISO 6179 : 1989 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 6179 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*.

This second edition cancels and replaces the first edition (ISO 6179 : 1981), of which it constitutes a minor revision.

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Vulcanized rubber sheet, and fabrics coated with vulcanized rubber — Determination of transmission rate of volatile liquids (Gravimetric technique)

1 Scope

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

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

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 of different transmission rates.

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

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 188 : 1982, *Rubber, vulcanized — Accelerated ageing or heat-resistance tests.*

ISO 471 : 1983, *Rubber — Standard temperatures, humidities and times for the conditioning and testing of test pieces.*

ISO 1826 : 1981, *Rubber, vulcanized — Time-interval between vulcanization and testing — Specification.*

ISO 2231 : 1989, *Rubber- or plastics-coated fabrics — Standard atmospheres for conditioning and testing.*

ISO 2286 : 1986, *Rubber- or plastics-coated fabrics — Determination of roll characteristics.*

ISO 3310-1 : 1982, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth.*

ISO 4648 : 1978, *Rubber, vulcanized — Determination of dimensions of test pieces and products for test purposes.*

ISO 4661-1 : 1986, *Rubber, vulcanized — Preparation of samples and test pieces — Part 1: Physical tests.*

NOTE — A method for the determination of water vapour transmission rate is given in ISO 2528 : 1974, *Sheet materials — Determination of water vapour transmission rate — Dish method.*

3 Apparatus

3.1 Container assembly (see figure 1), 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.

The mass of the container, the clamping ring and 50 cm^3 of the test liquid shall not exceed the capacity of the balance (see 3.2).

The open end of the container and the hole of the clamping ring shall have a diameter such that the exposed surface area of the test piece is approximately 1 000 mm^2 on each side.

When testing in accordance with method A, the container shall have two inlet valves on the back for refilling purposes. Such valves are shown in figure 1.

When testing materials without fabric, 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.

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

3.3 Test chamber, complying with the requirements of ISO 188, for tests performed at elevated temperature.

4 Test pieces

4.1 Preparation

4.1.1 The standard test piece shall be circular and cut from a flat sheet in accordance with ISO 4661-1. 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 between test pieces for comparison tests shall not be more than 0,05 mm.

4.1.2 Test pieces may, alternatively, be cut from finished articles made from sheets or coated fabrics.

The thickness shall be not less than 0,2 mm and not more than 3,0 mm.

4.2 Thickness measurement

The thickness of the test pieces shall be measured in accordance with ISO 2286 or ISO 4648, as appropriate.

4.3 Number of test pieces

At least three test pieces shall be used for each test.

5 Time-interval between vulcanization and testing

The requirements of ISO 1826 shall apply.

6 Conditioning

The test piece shall be conditioned immediately before the test in one of the atmospheres specified in ISO 471 or ISO 2231, as appropriate.

7 Duration and temperature of test

7.1 Duration of test

The duration of test depends on the method used (see clause 8).

Each test period commences immediately after the container is 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 commmences 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 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.

7.2 Test temperature

The test temperature shall be 23 °C ± 2 °C or 27 °C ± 2 °C.

If, for technical reasons, another temperature is required, it shall be chosen 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 may have some effect on the results of the determination.

Irrespective of the test temperature, all weighing operations shall be carried out at 23 °C ± 2 °C or 27 °C ± 2 °C.

8 Procedure

8.1 Preliminary operations

8.1.1 Measure the thickness of the 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 or ISO 4648, as appropriate. If any two measurements differ by more than 0,05 mm, discard the test piece. Report the mean value.

8.1.2 With the valves closed, pour about 50 cm^3 of the test liquid into the open container.

8.1.3 Put the test piece on the open end of the container [together with the stainless steel wire mesh, if necessary (see 3.1)] and close the container with the clamping ring.

8.1.4 Weigh the container, place on a suitable support (see 3.1) 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. Reweigh at the end of this period (see 7.1). Excessive loss in mass indicates that leakage has occurred due to improper sealing.

Maintain the container at the test temperature with the test liquid in contact with the test piece for a further 72 h.

8.2 Method A

8.2.1 After the operations described in 8.1.4, empty the container through the inlet valves and refill it with approximately 50 cm^3 of test liquid.

8.2.2 Weigh the container to the nearest 1 mg, after having made sure that it is clean and dry on the outside surfaces.

8.2.3 Maintain the container with the test liquid in contact with the inner surface of the test piece at the test temperature for a period of 24 $^{0}_{-2}$ h. Reweigh at the end of this period (see 7.1).

8.2.4 Repeat the operations specified in 8.2.1, 8.2.2 and 8.2.3 as required until the change in mass occuring during any one of three consecutive 24 $^{0}_{-2}$ h test periods does not differ by more than 10 % from the mean of the three changes.

All weighing operations shall be carried out at standard temperature.

8.3 Method B

After the operations specified in 8.1.4, weigh the container (see 8.2.2) and maintain it with the test liquid in contact with the inner surface of the test piece at the test temperature for 72 $^{0}_{-2}$ h. Reweigh at the end of this period (see 7.1).

9 Expression of results

9.1 Method of calculation

The rate of transmission of volatile liquid, expressed as the mass, in grams, of volatile liquid diffusing through each square metre of the rubber per hour, is given by the formula

$$\frac{m_1 - m_2}{A \times t} \times 10^6$$

where

m_1 is the mass, in grams, of the test liquid, container and test piece before the test period;

m_2 is the mass, in grams, of the test liquid, container and test piece after the test period;

A is the exposed area, in square millimetres, of the test piece;

t is the duration of the test, in hours.

9.1.1 Method A

The average of the results for the last three consecutive test periods for each test piece shall be calculated and the median value of the average results for the individual test pieces shall be reported.

9.1.2 Method B

The median value of the results for the individual test pieces shall be reported.

9.2 Repeatability

The mean results for individual test pieces shall be within 15 % of the overall mean. If any individual mean value differs from the overall mean by more than 15 %, the test shall be repeated and the full set of results from both tests shall be used to compute the median value.

10 Test report

The test report shall include the following particulars:

a) a reference to this International Standard;

b) identification of the test pieces;

c) the mean thickness of each test piece and the method of measurement;

d) identification of the test liquid;

e) the method used (A or B);

f) the median value of the transmission rate, expressed in grams per square meter per hour;

g) the test temperature.

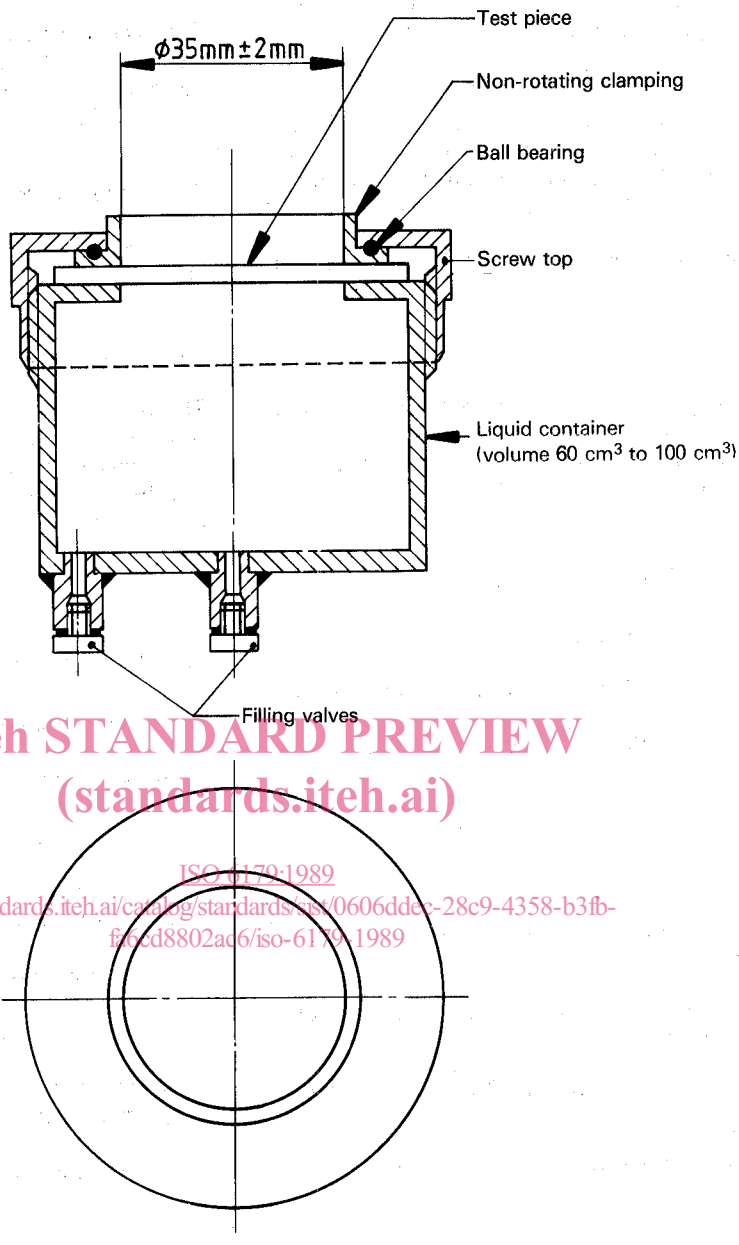

Figure 1 — Test apparatus

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Descriptors : rubber, vulcanized rubber, fabrics, coated fabrics, sheets, tests, permeability, gas permeability tests, measurement, vapour transmission, gravimetric analysis, test equipment, test specimens.

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