BS 903 : Part A46 : 1984
ISO 6179-1981
UDC 678.4.063 : 678.01 : 539.217.5.08



British Standard

# Methods of testing vulcanized rubber

## Part A46. Determination of vapour transmission rate of volatile liquids through rubber sheet and rubber coated fabrics

[ISO title : Fabrics coated with vulcanized rubber — Determination of vapour transmission rate of volatile liquids (Gravimetric technique)]

Méthodes d'essai des elastomères vulcanisé
Partie A46. Détermination du taux de transmission des liquides volatiles à travers les feuilles en caoutchouc et supports textiles revêtus de caoutchouc

Prüfverfahren für vulkanisierte Kautschuk
Teil A46. Bestimmung der Dampfdurchlässigkeitsrate von flüchtigen Flüssigkeiten bei Kautschukfell und gummierten Geweben



British Standards Institution

## Contents



## National foreword

This British Standard has been prepared under the direction of the Rubber Standards Committee. It is identical with ISO 6179-1981 'Fabrics coated with vulcanized rubber — Determination of vapour transmission rate of volatile liquids (Gravimetric technique)' published by the International Organization for Standardization (ISO).

**Terminology and conventions.** The text of the international standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

The comma has been used as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Wherever the words 'International Standard' appear, referring to this standard, they should be read as 'British Standard'.

**Cross-references**

| International standard | Corresponding British Standard |
|---|---|
| ISO 188-1982 | BS 903 Methods of testing vulcanized rubber<br>*Part A19 : 1975 Heat resistance and accelerated air ageing tests*<br>(Requirements for the test chamber (oven) are technically equivalent) |
| ISO 471-1977 | BS 903 : Part A35 : 1978 Standard temperatures, humidities and times for the conditioning and testing of test pieces<br>(Identical) |
| ISO 1826-1981 | BS 903 : Part A35 : 1978 Standard temperatures, humidities and times for the conditioning and testing of test pieces<br>*(National appendix A is technically equivalent)* |
| ISO 2231-1973 | BS 3424 Testing coated fabrics<br>Part 2 : 1982 Conditioning and selection of test specimens<br>(Relevant details are technically equivalent) |
| ISO 3310/1-1982 | BS 410 : 1976 Specification for test sieves<br>(Requirements for stainless steel wire cloth sieves of 1 mm nominal aperture are technically equivalent) |
| *ISO 4648-1978* | *BS 903 : Part A38 : 1978 Determination of dimensions of test pieces and products for test purposes*<br>(Identical) |
| ISO 4661-1977 | BS 903 : Part A36 : 1978 Preparation of test pieces<br>(Identical) |
| ISO 5084-1977 | BS 2544 : 1967 Method for the determination of thickness of textile fabric<br>(Technically equivalent) |

*There is no corresponding British Standard for ISO 2528* but this is referred to for information only (see clause **2**).

**Additional information.** In UK practice, the standard atmospheres for conditioning test pieces are a temperature of 23 ± 2 °C and 50 ± 5 % relative humidity for vulcanized rubber sheet and a temperature of 20 ± 2 °C and 65 ± 5 % relative humidity for rubber coated fabrics (see clause **6**). In UK practice, the standard temperature for testing vulcanized rubber is 23 ± 2 °C (see **7.2**, paragraph 1).

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

British Standard

# Methods of testing vulcanized rubber

Part A46. Determination of vapour transmission rate of volatile liquids through rubber sheet and rubber coated fabrics

## 1 Scope and field of application

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 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 References

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

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

ISO 1826, *Rubbers — Time-lapse between vulcanization and testing.*

ISO 2231, *Fabric coated with rubber or plastics — Standard atmospheres for conditioning and testing.*

ISO 3310/1, *Test sieves — Technical requirements and testing — Part 1 : Metal wire cloth.*

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

ISO 4661, *Rubber — Preparation of test pieces.*

ISO 5084, *Textiles — Determination of thickness of woven and knitted fabrics (other than textile floor coverings).*

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

## 3 Apparatus

### 3.1 Container assembly.

The test apparatus shall consist 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 to 100 $cm^3$. A suitable apparatus is shown in the figure.

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 according to method A, the container shall have two inlet valves on the back for refilling purposes. Such valves are shown in the figure.

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 0,001 g.

### 3.3 Test chamber

For tests performed at elevated temperature, a test chamber complying with the requirements of ISO 188 shall be used.

## 4 Test piece

### 4.1 Preparation

**4.1.1** The standard test piece shall be circular and cut from a flat sheet according to ISO 4661. The surface shall be flat, smooth and free from defects.

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

The thickness of the test piece shall be 2 ± 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** The test piece may, alternatively, be cut from finished articles of sheets and 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 according to ISO 4648 or ISO 5084, 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 test temperature

### 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 exposed 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 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 should be 23 ± 2 °C or 27 ± 2 °C.

If, for technical reasons, another temperature is required, it shall be chosen from the following list of standard temperatures :

40 ± 1 °C
55 ± 1 °C
70 ± 1 °C
85 ± 1 °C
100 ± 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 the standard laboratory temperature.

## 8 Procedure

**8.1** Measure the thickness of the test piece, with an accuracy of 0,01 mm, at four points along its exposed circumference and at one point in the centre as specified in ISO 4648 or ISO 5084, as appropriate. If any two measurements differ by more than 0,05 mm, discard the test piece. Report the mean value.

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

**8.3** 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.

**8.4** 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 exposed 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.

### 8.5 Method A

**8.5.1** After the operations described in 8.4, empty the container through the inlet valves and refill it with approximately 50 $cm^3$ of test liquid.

**8.5.2** Weigh the container to the nearest 0,001 g, after having made sure that it is clean and dry on the outside surfaces.

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

**8.5.4** Repeat the operations specified in 8.5.1, 8.5.2 and 8.5.3 as required until the change in mass occuring during any one of three consecutive 24 $_{-2}^{0}$ 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 laboratory temperature.

### 8.6 Method B

After the operations specified in 8.4, weigh the container (see 8.5.2) and maintain it with the test liquid in contact with the exposed surface of the test piece at the test temperature for 72 $_{-2}^{0}$ h. Reweigh at the end of this period (see 7.1).

## 9 Expression of results

**9.1** The transmission rate of volatile liquid, expressed as the mass 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.

### 9.2 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 these average results for the individual test pieces shall be reported.

### 9.3 Method B

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

**9.4** 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) reference to this International Standard;

b) identification of the test pieces;

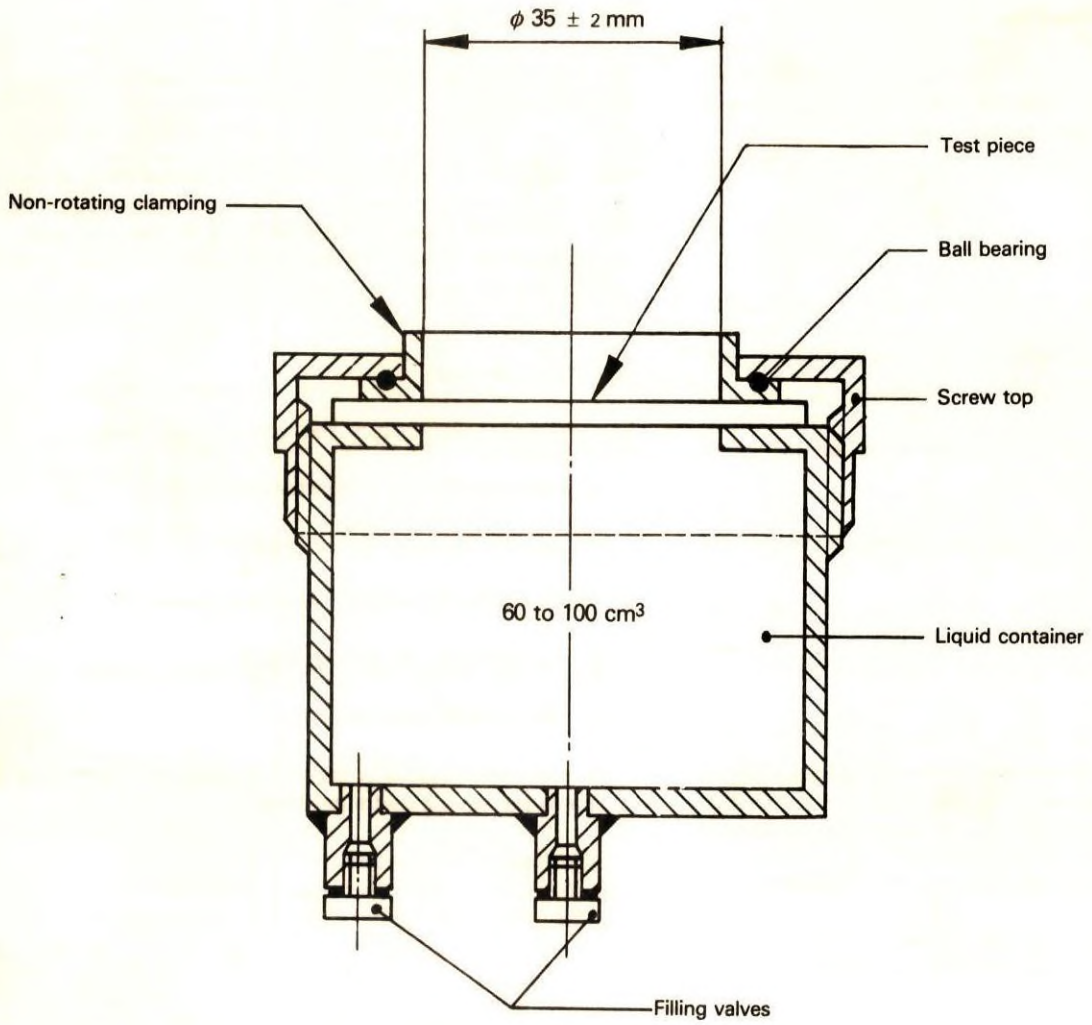
c) the mean thickness of each test piece;

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 metre per hour;

g) the test temperature.



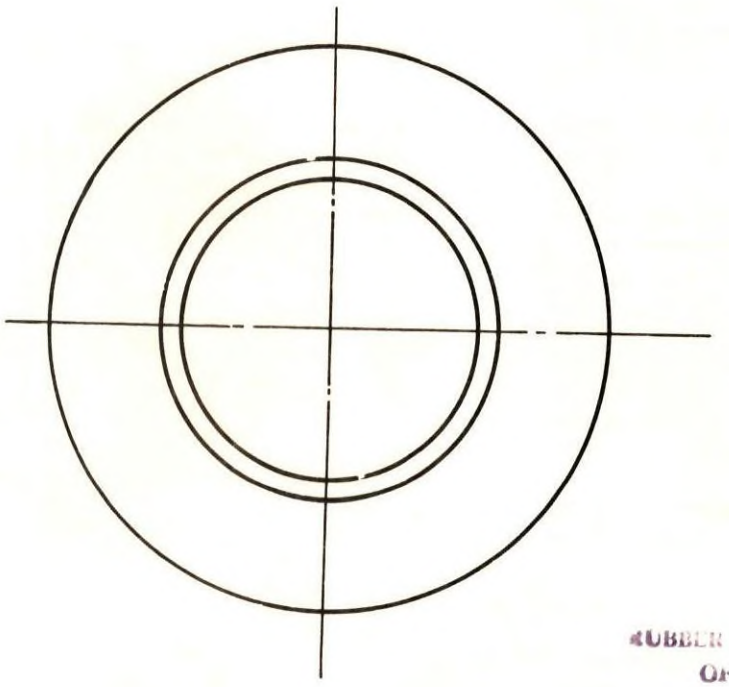



Figure — Test apparatus

## Publications referred to

See national foreword.

# BS 903 : Part A46 : 1984
# ISO 6179-1981

This British Standard, having been prepared under the direction of the Rubber Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 January 1984.



ISBN 0 580 13655 8

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The following BSI references relate to the work on this standard:
Committee reference RUC/36 Draft for comment 79/52458 DC

## Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Rubber Standards Committee (RUC/-) to Technical Committee RUC/36 upon which the following bodies were represented:

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Coopted member

Amendments issued since publication

| Amd. No. | Date of issue | Text affected |
|---|---|---|
| | | |
| | | |
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BS 903 : Part A46 : 1984
ISO 6179-1981