

Methods of testing vulcanized rubber —

Part A16: Determination of the effect of liquids

[ISO title: Rubber, vulcanized — Determination of the effect of
liquids]

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Committees responsible for this British Standard

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

- British Railways Board
- British Rubber Manufacturers' Association
- ERA Technology Ltd.
- GAMBICA (BEAMA Ltd.)
- Institution of Mechanical Engineers
- Institution of Water Engineers and Scientists
- Malaysian Rubber Producers' Research Association
- Ministry of Defence
- National College of Rubber Technology
- Rubber and Plastics Research Association of Great Britain
- SATRA Footwear Technology Centre

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Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
0 Introduction	1
1 Scope and field of application	1
2 References	1
3 Test liquids	2
4 Time-interval between vulcanization and testing	2
5 Conditioning of test pieces	2
6 Temperature of immersion	2
7 Period of immersion	3
8 Determination of change in volume, change in mass or change in dimensions	3
9 Determination of extracted soluble matter	7
10 Determination of change in physical properties after immersion	7
11 Determination of change in physical properties after immersion and drying	8
12 Test with liquid on one surface only	9
13 Test report	11
Annex A Test liquids	12
Figure — Apparatus for tests on one surface only	11
Table 1	12
Table 2	12
Table 3	13
Table 4	14
Publications referred to	Inside back cover

National foreword

This revision of this Part of BS 903, which has been prepared under the direction of the Rubber Standards Committee, is identical with ISO 1817:1985 “*Rubber, vulcanized — Determination of the effect of liquids*” published by the International Organization for Standardization (ISO), and supersedes BS 903-A16:1971 which is withdrawn.

The major changes in this revision compared with the 1971 edition are as follows.

- a) The addition of a gravimetric method as a measure of absorption (see clause 8).
- b) The deletion of the surface absorption method now in limited use.
- c) Modifications to standard test liquids as follows.
 - 1) “Pure liquids” are now designated as “standard simulated fuels”, with liquids A, B and C being unchanged, liquid D becoming liquid E in order to permit inclusion of two new hydrocarbon liquids, and with the addition of four other liquids designed to simulate the behaviour of alcohol-containing gasolines.
 - 2) “Service” liquids now designated as “simulated service liquids”, with the deletion of liquid 100, replacement of liquid 100A by liquid 102 and inclusion of liquid 103 for simulation of phosphate-ester hydraulic oils.

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 “Part of BS 903”.

Cross-references

International Standard	Corresponding British Standard
	BS 903 <i>Methods of testing vulcanized rubber</i>
ISO 37:1977	Part A2:1971 <i>Determination of tensile stress-strain properties</i> (Technically equivalent)
ISO 48:1979	Part A26:1969 <i>Determination of hardness</i> (Technically equivalent)
ISO 471:1983	Part A35:1985 <i>Temperatures, humidities and times for conditioning and testing of test pieces</i> (Identical)
ISO 1826:1981	Part A19:1986 <i>Heat resistance and accelerated ageing tests</i> (National appendix A is technically equivalent)
ISO 2592:1973	BS 4689:1980 <i>Method for determination of flash and fire points of petroleum products: Cleveland open cup method</i> (Identical)
ISO 3675:1976	BS 4714:1980 <i>Method for laboratory determination of density or relative density of crude petroleum and liquid petroleum products (hydrometer method)</i> (Identical)
ISO 4661:1977	BS 903 <i>Methods of testing vulcanized rubber</i> Part A36:1978 <i>Preparation of test pieces</i> (Identical)

The Technical Committee has reviewed the provisions of ISO 175:1981, ISO 2977:1974, ISO 3104:1976, ISO 5282:1982 and ISO 5661:1983, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard. A related British Standard to ISO 3104:1976 is BS 188:1977 *Methods for determination of the viscosity of liquids*. A related British Standard to ISO 5282:1982 is BS 135:1977, BS 458:1977, BS 805:1977 *Specifications for benzene, xylenes and toluenes*.

Additional information. In UK practice, the standard laboratory temperature is 23 ± 2 °C which as a test temperature should also be used in preference to 20 ± 2 °C or 27 ± 2 °C.

For information on the availability of standard test liquids, apply to Enquiry Section, BSI, Linford Wood, Milton Keynes, MK 14 6LE, enclosing a stamped addressed envelope for reply.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 14, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

0 Introduction

The action of a liquid on a vulcanized rubber may generally result in

- a) absorption of liquid by the rubber;
- b) extraction of soluble constituents from the rubber;
- c) chemical reaction with the rubber.

The amount of absorption [a)] is usually greater than that of extraction [b)] so that the net result is an increase in volume, commonly termed “swelling”. The absorption of liquid can profoundly alter physical and chemical properties and hence change tensile strength, extensibility and hardness, of the rubber, so that it is important to measure these properties of the rubber after treatment. The extraction of soluble constituents, especially plasticizers and antidegradants, can likewise alter the physical properties and chemical resistance shown by the rubber after drying out the liquid (assuming this to be volatile); physical tests on the rubber after immersion and drying are therefore required. The methods described in this International Standard accordingly comprise determinations of:

- change in volume, dimensions and mass;
- extracted soluble matter;
- tensile stress-strain properties of the rubber after immersion;
- hardness of the rubber after immersion;
- tensile stress-strain properties of the rubber after drying out the test liquid;
- hardness of the rubber after drying out the test liquid.

Although, in some respects, these tests may closely simulate service conditions, no direct correlation with service behaviour is implied; thus, the rubber giving the lowest change in volume is not necessarily the best in service. The thickness of the rubber must be taken into account since the rate of penetration of liquid is time-dependent and the bulk of a very thick rubber product may remain unaffected for the whole of the projected service life. It is known, moreover, that the action of a liquid on rubber, especially at high temperature, can be markedly affected by the presence of atmospheric oxygen. The tests described in this International Standard, however, can provide valuable information on the suitability of a rubber for use with a given liquid, and, in particular, constitute a useful control when used comparatively for developing rubbers resistant to oils, fuels, or other liquids.

1 Scope and field of application

This International Standard describes methods of evaluating the resistance of vulcanized rubbers to the action of liquids by measurement of properties of the rubbers before and after immersion in selected test liquids. The liquids considered include petroleum derivatives, organic solvents and chemical reagents.

2 References

- ISO 37, *Rubber, vulcanized — Determination of tensile stress-strain properties.*
- ISO 48, *Vulcanized rubbers — Determination of hardness (Hardness between 30 and 85 IRHD).*
- ISO 175, *Plastics — Determination of the effects of liquid chemicals, including water.*
- ISO 471, *Rubber — Standard temperatures, humidities and times for the conditioning and testing of test pieces.*
- ISO 1826, *Rubber, vulcanized — Time-interval between vulcanization and testing — Specification.*
- ISO 2592, *Petroleum products — Determination of flash and fire points — Cleveland open cup method.*
- ISO 2977, *Petroleum products and hydrocarbon solvents — Determination of aniline point and mixed aniline point.*
- ISO 3104, *Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity.*
- ISO 3675, *Crude petroleum and liquid petroleum products — Laboratory determination of density or relative density — Hydrometer method.*
- ISO 4661, *Rubber — Preparation of test pieces.*
- ISO 5282, *Aromatic hydrocarbons — Determination of sulfur content — Pitt-Ruprecht reduction and spectrophotometric method.*