

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 1817

VULCANIZED RUBBERS

METHODS OF TEST FOR RESISTANCE TO LIQUIDS

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BRIEF HISTORY

The ISO Recommendation R 1817, *Vulcanized rubbers – Methods of test for resistance to liquids*, was drawn up by Technical Committee ISO/TC 45, *Rubber*, the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1817, which was circulated to all the ISO Member Bodies for enquiry in March 1969. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	Hungary	Spain
Austria	India	Sweden
Brazil	Israel	Switzerland
Canada	Italy	Turkey
Ceylon	Netherlands	U.A.R.
Czechoslovakia	New Zealand	United Kingdom
France	Poland	U.S.A.
Germany	Romania	U.S.S.R.
Greece	South Africa, Rep. of	Yugoslavia

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

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INTRODUCTION

The action of a liquid on a vulcanized rubber generally results in

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

Usually (a) is greater than (b) so that the net result is an increase in volume, commonly termed "swelling". The absorption of liquid can profoundly alter the physical and chemical properties of the rubber such as tensile strength, extensibility and hardness, so that it is important to measure these properties of the rubber after treatment. The extraction of soluble constituents, especially plasticizers, can likewise alter the physical and chemical properties 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 below accordingly comprise determinations of

- change in volume or dimensions;
- soluble matter extracted;
- 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 immersion liquid;
- hardness after drying out the immersion liquid.

Although in some respects these tests may simulate service conditions closely, no direct correlation with service behaviour is implied; thus, the rubber giving the lowest change in volume is not necessarily the best in service. It is known, moreover, that the action of a liquid on rubber, especially at high temperatures, can be markedly affected by the presence of atmospheric oxygen. The tests described here, 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

This ISO Recommendation describes methods of test for 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.

2. TEST LIQUIDS

The selection of the test liquid depends on the purpose of the test :

- 2.1 When information is required on the *probable service behaviour* of a rubber in contact with a particular liquid, this liquid should preferably be used in the test. Commercial liquids, however, are not always constant in composition, and the test should therefore, whenever practicable, include a control rubber of known change in volume characteristics; abnormal results due to unsuspected variations in the commercial liquid will thus be made apparent. It may be found essential to set aside a bulk supply of the liquid for a particular series of tests.

Mineral oil based fluids and fuels are liable to vary appreciably in aromatic content even when supplied to a recognized specification. The aniline point of a mineral oil gives some indication of its aromatic content and helps to characterize the action of the oil on rubber, though aniline point alone is not sufficient to characterize a mineral oil; other things being equal, the lower the aniline point the more severe is the action. The report should therefore include the density, refractive index, and the aniline point or aromatic content of the oil or fuel, if this is used as the immersion liquid. For the standardized mineral oils given in the Appendix, mineral oil raffinates are employed. Service liquids having similar fluid characteristics to standard liquids Nos.1 to 3 (see Appendix) will not necessarily have the same effect on rubber as the latter.

- 2.2 As commercial liquids may not have an entirely constant composition the test should, whenever possible, be made in well-defined chemical products, used alone or as mixtures. These should be as representative as possible of the effect of the commercial products on the rubber. Examples of such chemicals are : toluene, alcohols, esters, cyclohexane, acetone.
- 2.3 For use in systems of *classification of vulcanized rubbers*, or for quality control, a standard immersion liquid should be used; suitable liquids are recommended in the Appendix.

3. TIME LAPSE BETWEEN VULCANIZATION AND TESTING

Unless otherwise specified for technical reasons the following requirements for time lapses should be observed.

- 3.1 For all test purposes the minimum time between vulcanization and testing should be 16 hours.
- 3.2 For non-product tests the maximum time between vulcanization and testing should be 4 weeks and for evaluations intended to be comparable, the tests, as far as possible, should be carried out after the same time interval.
- 3.3 For product tests, whenever possible, the time between vulcanization and testing should not exceed 3 months. In other cases tests should be made within 2 months of the date of receipt by the customer of the product.

4. CONDITIONING OF TEST PIECES

Test pieces required for test in the "as received" condition should be conditioned for not less than 3 hours in one of the standard laboratory atmospheres of ISO Recommendation R 471, *Standard atmospheres for the conditioning and testing of rubber test pieces*, namely : $20 \pm 2^\circ\text{C}$, $65 \pm 5\%$ relative humidity; $23 \pm 2^\circ\text{C}$, $50 \pm 5\%$ relative humidity; or $27 \pm 2^\circ\text{C}$, $60 \pm 5\%$ relative humidity. The same temperature should be used throughout any one test or any series of tests intended to be comparable.