National Standards Authority of Ireland

IRISH STANDARD

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RUBBER, VULCANIZED - DETERMINATION OF THE EFFECT OF LIQUIDS

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Údarás um Chaighdeáin Náisiúnta na hÉireann

DECLARATION

OF

SPECIFICATION

ENTITLED

RUBBER, VULCANIZED - DETERMINATION OF THE EFFECT OF LIQUIDS

AS

THE IRISH STANDARD SPECIFICATION FOR

RUBBER, VULCANIZED - DETERMINATION OF THE EFFECT OF LIQUIDS

NSAI in exercise of the power conferred by section 16 (3) of the National Standards Authority of Ireland Act, 1966 (No. 28 of 1996) and with the consent of the Minister for Enterprise, Trade and Employment, hereby declares as follows:

1. This instrument may be cited as the Standard Specification (Rubber, vulcanized - Determination of the effect of liquids) Declaration,1986.

2. (1) The Specification set forth in the schedule to this declaration is hereby declared to be the standard specification for Rubber, vulcanized - Determination of the effect of liquids. The Schedule comprises the text of ISO 1817 : 1985.

(2) The said standard specification may be cited as Irish Standard ISO 1817 : 1986 or as I.S. ISO 1817 : 1986.

Rubber, vulcanized — Determination of the effect of liquids

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.*

ISO 5661, *Petroleum products — Hydrocarbon liquids — Determination of refractive index.*

3 Test liquids

3.1 The selection of the test liquid depends on the purpose of the test.

3.2 When information is required on the probable service behaviour of a vulcanized 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 material 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 oils and fuels are liable to vary appreciably in chemical composition 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, but 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. If a mineral oil is used as the test liquid, therefore, the test report should include the density, refractive index, viscosity and the aniline point or aromatic content of the oil. For the standard mineral oils described in the annex, mineral oil raffinates are employed. Service oils, having similar fluid characteristics to the standard oils (see the annex, clauses A.1 to A.3), will not necessarily have the same effect on the material as the latter. Some fuels, particularly gasoline, vary widely in composition and, in the case of some possible constituents, minor variations can have a large influence on the effect on rubber. Full details of the composition of the fuel used should therefore be included in the test report.

3.3 As commercial liquids may not have an entirely constant composition, a standard immersion liquid consisting of well defined chemical compounds or mixtures of compounds should be used for the purposes of classification of vulcanized rubbers or quality control; some suitable liquids are recommended in the annex.

When testing to determine the effect of chemical solutions, the concentration of the solutions should be appropriate to the proposed application.

4 Time-interval between vulcanization and testing

Unless otherwise specified for technical reasons, the following requirements, in accordance with ISO 1826 for time-intervals, shall be observed.

4.1 For all test purposes, the minimum time between vulcanization and testing shall be 16 h.

4.2 For non-product tests, the maximum time between vulcanization and testing shall be four weeks and, for evaluations intended to be comparable, the tests, as far as possible, should be carried out after the same time-interval.

4.3 For product tests, whenever possible, the time between vulcanization and testing shall not exceed three months. In other cases, tests shall be made within two months of the date of receipt of the product by the customer.

5 Conditioning of test pieces

Test pieces of rubber required for test in the "as received" condition shall be conditioned for not less than 3 h in one of the standard laboratory temperatures specified in ISO 471. The same temperatures shall be used throughout any one test or any series of tests intended to be comparable.

6 Temperature of immersion

The immersion should preferably be carried out at one or more of the following standard temperatures listed in ISO 471:

-70 ± 1, -55 ± 1, -40 ± 1, -25 ± 1, -10 ± 1, 0 ± 1 °C

20 ± 2, 23 ± 2, 27 ± 2 °C

40 ± 1, 55 ± 1, 70 ± 1, 85 ± 1, 100 ± 1 °C

125 ± 2, 150 ± 2, 175 ± 2, 200 ± 2, 225 ± 2, 250 ± 2 °C

As elevated temperatures greatly increase oxidation of the rubber, volatilization or decomposition of the immersion liquid, and also the effects of any chemically active additives in the liquid (for example in "service liquids"), appropriate selection of the test temperature and of the degree of access of air is very important.

In tests intended to simulate service conditions, and using the actual liquid with which the rubber will be used, the test conditions should approximate to those found in service using the lowest standard temperature equal to or higher than the service temperature.

7 Period of immersion

Since the rate of penetration of liquids into rubbers depends on the particular material, liquid and temperature, the adoption of one standard period of immersion is precluded. For acceptance purposes, it is recommended that determinations should be made and recorded after several periods of immersion, so as to indicate the change of volume, mass or dimensions with time; the total period should, if possible, extend well beyond the point of maximum absorption. For control purposes, it may not be necessary to reach maximum absorption; in such cases, a single period of immersion may suffice and one of the following should then be used:

$22 \pm 0{,}25$ h	$72\ ^{0}_{-2}$ h
7 days $\pm$ 2 h	multiples of 7 days $\pm$ 2 h.

In tests for change in volume, mass or dimensions, in which the period of immersion used is insufficient for maximum absorption to be reached, the test piece shall be of substantially constant thickness (see note 2 to 8.2.2).