INTERNATIONAL STANDARD

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Rubber- or plastics-coated fabrics — Determination of resistance to liquids

Supports textiles revêtus de caoutchouc ou de plastique — Détermination de la résistance aux liquides

Reference number
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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 6450 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 4, *Products (other than hoses)*.

Rubber- or plastics-coated fabrics — Determination of resistance to liquids

1 Scope

This International Standard specifies two methods (methods 1 and 2) of evaluating the resistance of fabrics coated with plastics or with vulcanized rubber to the action of liquids by measurement of selected properties of the materials before and after immersion in selected liquids.

The difference between the two methods is as follows:

— In method 1, excess liquid is removed from the test pieces, after immersion, by wiping.

— In method 2, the test pieces are immersed in a volatile liquid and excess liquid is subsequently removed by drying in an oven.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 2286-1, *Rubber- or plastics-coated fabrics — Determination of roll characteristics — Part 1: Methods for determination of length, width and net mass*

3 Principle

This International Standard provides a procedure for exposing test pieces to the influence of liquids under defined conditions of temperature and time. Selected properties are determined in accordance with the relevant test method standards. Test pieces are then immersed in selected liquid(s) and the properties determined again. The percentage change or the values before and after immersion are measures of the resistance of the material to the selected liquid(s).

4 Test liquids for methods 1 and 2

SAFETY PRECAUTIONS — Appropriate safety precautions should be taken when preparing and handling test liquids, especially those known to be toxic, corrosive or flammable. Products giving off fumes should be handled only under an efficiently ventilated hood, corrosive products should not be allowed to come into contact with the skin or ordinary clothing, and flammable products should be kept away from any source of ignition.

In addition, attention is drawn to the damage which can be caused by corrosive test liquids to test equipment (e.g. clamps or jaws).

As commercial liquids may not have an entirely constant composition, a standard immersion liquid consisting of a well-defined chemical compound or a mixture of such compounds should preferably be used. Suitable liquids are given in Annex A.

If a commercial liquid is used, the test report shall mention all the available information about its origin, composition, properties, e.g. viscosity, aniline point, etc., and batch number.

NOTE For test purposes, it is usually desirable to use the liquid(s) with which the coated fabric will come into contact during use. When determining the effect of solutions of chemicals, the concentration of the solution should be appropriate to the proposed application.

5 Test conditions for methods 1 and 2

5.1 Temperature

Where appropriate, use an immersion temperature T approximating to that encountered during use. Maintain the immersion temperature at $T \pm 2$ °C.

Preferred immersion temperatures are given in Annex B.

5.2 Immersion period

The following immersion periods are recommended:

22 h ± 0,25 h; 46 h ± 0,25 h; 72 h ± 2 h; 168 h ± 2 h; multiples of 7 days ± 2 h

NOTE When determining changes in physical properties, it is advisable to use a period of immersion which is long enough to ensure that equilibrium is reached. To determine this equilibrium point, it is recommended that preliminary measurements be carried out using several different periods of immersion, recording the results as a function of time. Whenever practicable, the total period of immersion should extend well beyond the point at which the change in a property reaches its maximum value.

5.3 Light

Immersion tests shall be conducted in the absence of direct light.

5.4 Time lapse between manufacturing and testing

The minimum time lapse between manufacturing and testing shall be 16 h.

6 Conditioning atmosphere for methods 1 and 2

Before immersion, test pieces shall be conditioned in one of the atmospheres defined in ISO 2231, unless otherwise specified in the standard relevant to the property to be determined.

7 Apparatus for methods 1 and 2

The apparatus to be used is determined by the temperature of immersion, the volatility of the test liquid, the dimensions of the test pieces and the number required for determining the selected property. At temperatures appreciably below the boiling point of the test liquid, use a stoppered vessel, e.g. a glass bottle or tube, of such dimensions that the test pieces remain completely immersed in the specified volume of test liquid and all surfaces are completely exposed to the liquid without any restriction. At temperatures near the boiling point of the test liquid, fit the vessel with a reflux condenser, or other suitable means of minimizing evaporation of the test liquid, instead of the stopper.

8 Method 1 — Immersion and subsequent removal of excess liquid by wiping

8.1 Preparation of test pieces

Select properties that are considered relevant to the end-use (for example, tensile strength, coating adhesion, mass per unit area, tear resistance and/or low-temperature properties).

For each property, cut from the usable width of the roll (as defined in ISO 2286-1) two sets of test pieces as specified in the relevant test method standard (some commonly used test method standards are given in the Bibliography).

Condition all the test pieces in accordance with Clause 6.

8.2 Determination of original properties before immersion

Determine the selected properties on the first set of test pieces using the relevant test method standards.

8.3 Immersion

Place the test pieces, suitably separated, in a vessel as described in Clause 7, with a volume of test liquid (see Clause 4) that is at least 15 times the combined volume of the test pieces and sufficient to keep them totally immersed. If the conditions of the test do not necessitate the use of a reflux condenser, stopper the vessel. Maintain the test liquid at the test temperature T, within a tolerance of $\pm$ 2 °C, during the whole of the exposure period.

8.4 Preparation of test pieces for redetermination of properties

At the end of the immersion period, bring the test pieces, if necessary, to the test temperature, preferably by quickly transferring them to a fresh portion of test liquid at this temperature and allowing to stand for 5 min to 10 min.

Take the test pieces out of the test liquid and remove any liquid remaining on the surface of the test pieces using a suitable method. The method of removing the liquid may vary with the nature of the liquid. When mobile, volatile liquids like iso-octane and toluene are used, wipe the test pieces with a filter paper or a piece of lint-free fabric. Some difficulty may be experienced in removing viscous, non-volatile liquids completely by this method, and it may be necessary to dip the test pieces quickly in a suitable volatile liquid such as methanol and wipe them again with filter paper or lint-free fabric.

Visually assess the appearance of the test pieces against a piece of non-immersed material. Note whether any change has occurred or not and describe any changes observed.

8.5 Determination of properties after immersion

Immediately after removal of the liquid, measure the selected physical properties in accordance with the relevant standards.

8.6 Expression of results

Report the values measured before and after immersion or report the change in the values as a percentage of the original value determined before immersion.

9 Method 2 — Immersion in a volatile test liquid and subsequent drying of the test pieces

9.1 Preparation of test pieces

Prepare the test pieces as specified in 8.1.

9.2 Determination of original properties before immersion

Determine the original properties as specified in 8.2.

9.3 Immersion

Immerse the test pieces as specified in 8.3.

9.4 Drying of test pieces

At the end of the specified immersion period, remove the test pieces and hang them in a circulating-air oven at a temperature of 70 °C ± 2 °C for a period of 2 h ± 0,1 h. At the end of this drying period, remove the test pieces from the oven and allow them to cool to room temperature.

9.5 Determination of properties after immersion and drying

The time interval between removal of the test pieces from the oven and testing shall not be less than 1 h and not more than 2 h. Measure the selected physical property in accordance with the relevant standard.

9.6 Expression of results

Report the values measured before and after immersion or report the change in the values as a percentage of the original value determined before immersion.

10 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) the date of the test;

c) the conditioning and test atmosphere;

d) all details necessary for identification of the coated fabric tested;

e) a description of the test liquid (see Clause 4);

f) the method used (method 1 or method 2);

g) the immersion temperature;

h) the immersion period;

i) a description of the appearance of the test pieces after immersion;

j) the values of the measured properties before and after immersion, or the percentage changes in the properties;

k) any deviation from the specified procedure.

Annex A
(informative)

Reference liquids

WARNING — Appropriate safety precautions should be taken when preparing and handling test liquids, especially those known to be toxic, corrosive or flammable. Products giving off fumes should be handled only under an efficiently ventilated hood, corrosive products should not be allowed to come into contact with the skin or ordinary clothing, and flammable products should be kept away from any source of ignition.

A.1 Standard simulated fuels

Commercial fuels vary widely in composition even within the same grade (i.e. knock rating) and from the same source. There are hydrocarbon-based fuels with and without oxygen compounds as well as alcohol-based fuels. The grade of gasoline is improved by adding aromatic or oxygen-containing compounds, but these additives increase the effect of fuels on normally fuel-resistant rubbers. The composition varies with the situation on the gasoline market and with the geographical area and can change rapidly. Hence, several test liquids which are used in practice are recommended in Tables A.1 and A.2 to cover the range of different compositions. They may also serve as guidelines for the formulation of other suitable test liquids. Analytical reagent quality materials shall be used in making up the test liquids. Test liquids containing alcohol shall not be used if the fuels involved are known to be free of alcohol.

Table A.1 — Standard simulated fuels without oxygen compounds

Liquid	Constituents	Content % (by volume)
A	2,2,4-Trimethylpentane	100
B	2,2,4-Trimethylpentane Toluene	70 30
C	2,2,4-Trimethylpentane Toluene	50 50
D	2,2,4-Trimethylpentane Toluene	60 40
E	Toluene	100
F	Straight-chain paraffins (C_{12} to C_{18}) 1-Methylnaphthalene	80 20
NOTE Liquids B, C and D simulate petroleum-derived fuels without oxygen compounds. Liquid F is intended to simulate diesel fuel, domestic heating oils and similar light furnace oils.		

Table A.2 — Standard simulated fuels containing oxygen compounds (alcohols)

Liquid	Constituents	Content % (by volume)
1	2,2,4-Trimethylpentane	30
	Toluene	50
	Di-isobutylene	15
	Ethanol	5
2	2,2,4-Trimethylpentane	25,35 [a]
	Toluene	42,25 [a]
	Di-isobutylene	12,68 [a]
	Ethanol	4,22 [a]
	Methanol	15,00
	Water	0,50
3	2,2,4-Trimethylpentane	45
	Toluene	45
	Ethanol	7
	Methanol	3
4	2,2,4-Trimethylpentane	42,5
	Toluene	42,5
	Methanol	15
5	2,2,4-Trimethylpentane	43
	Iso-octane	43
	Methyl tert-butyl ether	10
	Ethanol	2
	Methanol	2

[a] These four constituents together are equivalent to 84,5 % (by volume) of liquid 1 above.

A.2 Reference oils

A.2.1 General descriptions

A.2.1.1 Oil No. 1 (ASTM oil No. 1)

This is a “low volume increase” oil consisting of a closely controlled blend of mineral oils comprising a solvent-extracted, chemically-treated dewaxed paraffinic residuum and neutral oil.

A.2.1.2 Oil No. 2 (IRM 902)

This is a “medium volume increase” oil obtained by solvent extraction and by acid and clay treatment of a high-viscosity distillate from selected naphthenic (Gulf Coastal) crude oils.

A.2.1.3 Oil No. 3 (IRM 903)

This is a “high volume increase” oil consisting of a closely controlled blend of two lubricating-oil fractions obtained by vacuum distillation of selected naphthenic (Gulf Coastal) crude oils.

A.2.1.4 Intended use

These reference oils are representative of low-additive mineral oils. Reference oils for high-additive or synthetic oils are in preparation.

A.2.2 Requirements

The oils shall contain no additives except, possibly, a trace (approximately 0,1 %) of a pour-point depressant, and shall have the properties specified in Table A.3. The properties given in Table A.4 are typical of the oils but cannot be guaranteed by suppliers.

When these reference oils are required as test liquids, only those obtained from recognized suppliers shall be used for referee purposes and they shall be available for general use. However, in the event that they are not available, alternative oils can be used for routine testing only, provided that they comply with the requirements of Table A.3 and also have shown to give results similar to those obtained with the reference oils when testing rubbers of the same type of composition as those on which the routine tests are to be carried out.

Table A.3 — Specifications of reference oils

Property	Requirements			Method of test
	Oil No. 1	Oil No. 2	Oil No. 3	
Aniline point, °C	124 ± 1	93 ± 3	70 ± 1	ISO 2977
Kinematic viscosity, m^2/s ($\times 10^{-6}$)	20 ± 1 [a]	20 ± 1 [a]	33 ± 1 [b]	ISO 3104
Flash point, °C, min.	243	240	163	ISO 2592
Density at 15 °C, g/cm^3	0,886 ± 0,002	0,933 ± 0,006	0,921 ± 0,006	ISO 3675
Viscosity-gravity constant	—	0,865 ± 0,005	0,880 ± 0,005	
Naphthenics content, c_N, %	—	⩾ 35	⩾ 40	
Paraffinics content, c_P, %	—	⩽ 50	⩽ 45	

[a] Measured at 99 °C.

[b] Measured at 37,8 °C.

Table A.4 — Typical properties of reference oils

Property	Requirements			Method of test
	Oil No. 1	Oil No. 2	Oil No. 3	
Pour point, °C	—	− 12	− 31	ISO 3016
Refractive index at 20 °C	1,486 0	1,510 5	1,502 6	ISO 5661
Aromatics content, c_A, %	—	12	14	
Sulfur content, %	0,3	0,3	0,3	ISO 5282

NOTE Reference oils No. 1, No. 2 and No. 3 are identical to reference oils specified in ASTM D 471-95, *Standard Test Method for Rubber Property — Effect of Liquids*, as ASTM oil No. 1, IRM 902 and IRM 903, respectively. Reference oils IRM 902 and IRM 903 replace reference oils No. 2 and No. 3, respectively, from the former edition ASTM D 471-91. These "old" oils were identical with the reference oils No. 2 and No. 3 in the now withdrawn ISO 1817:1985, while oil No. 1 is unchanged.

Tables A.3 and A.4 give specifications and properties of the reference oils, but the critical parameter is the effect of the oils on physical properties of rubbers after immersion. Some tests have shown that the effect of "new" oils No. 2 and No. 3 can be less severe that the effect of "old" oils. Therefore, if specification testing is carried out with "old" reference oils No. 2 and No. 3, test programmes which make a direct comparison of the effect of "old" versus "new" reference oils on particular compounds and products are highly recommended.

A.3 Simulated service liquids

A.3.1 Liquid 101

Liquid 101 is intended to simulate synthetic diester-type lubricating oils. It is a blend comprising 99,5 % (by mass) of di-2-ethylhexyl sebacate and 0,5 % (by mass) of phenothiazine.

A.3.2 Liquid 102

Liquid 102 is intended to simulate certain high-pressure hydraulic oils.

It is a blend comprising 95 % (by mass) of oil No. 1 and 5 % (by mass) of a hydrocarbon-compound oil additive containing 29,5 % to 33 % (by mass) of sulfur, 1,5 % to 2 % (by mass) of phosphorus and 0,7 % (by mass) of nitrogen. A suitable additive is commercially available.

A.3.3 Liquid 103

Liquid 103 is intended to simulate phosphate-ester hydraulic oils used in aircraft. It is tri-*n*-butyl phosphate.

A.4 Chemical reagents

Tests with chemical reagents shall be carried out using the same chemicals at the same concentrations as those to be encountered in the intended use of the product. For general purposes, where no specification is known, the list of chemical reagents given in ISO 175 can be useful.