INTERNATIONAL STANDARD

ISO 277

Second edition
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Binders for paints and varnishes — Raw tung oil — Requirements and methods of test

Liants pour peintures et vernis — Huiles de bois de Chine brutes — Exigences et méthodes d'essai

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 277 was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 10, *Test methods for binders for paints and varnishes*.

This second edition cancels and replaces the first edition (ISO 277:1983), which has been technically revised. The major changes are that the determinations of odour and mineral-acid content have been deleted. Determination of the iodine number, assessment of sediment and clarity, and gas-chromatographic determination of the fatty-acid composition have been introduced, together with a table giving typical values of the contents of the fatty acids in raw tung oil. In addition, some of the requirements have been changed.

Binders for paints and varnishes — Raw tung oil — Requirements and methods of test

1 Scope

This International Standard specifies the requirements and the corresponding methods of test for two types of raw tung oil suitable for paints and varnishes. It is not intended to apply to tung oils which are wholly or partly solidified as a result of polymerization.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 150:1980, *Raw, refined and boiled linseed oil for paints and varnishes — Specifications and methods of test*

ISO 654:1980, *Short solid-stem thermometers for precision use*

ISO 2114:2000, *Plastics (polyster resins) and paints and varnishes (binders) — Determination of partial acid value and total acid value*

ISO 2811-1:1997, *Paints and varnishes — Determination of density — Part 1: Pyknometer method*

ISO 3681:1996, *Binders for paints and varnishes — Determination of saponification value — Titrimetric method*

ISO 4630:1997, *Binders for paints and varnishes — Estimation of colour of clear liquids by the Gardner colour scale*

ISO 5508:1990, *Animal and vegetable fats and oils — Analysis by gas chromatography of methyl esters of fatty acids*

ISO 5509:2000, *Animal and vegetable fats and oils — Preparation of methyl esters of fatty acids*

ISO 5661:1983, *Petroleum products — Hydrocarbon liquids — Determination of refractive index*

ISO 10336:1997, *Crude petroleum — Determination of water — Potentiometric Karl Fischer titration method*

ISO 15528:2000, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

3 Terms and definitions

For the purposes of this International Standard, the following terms and definitions apply.

3.1
raw tung oil
the product obtained directly by expression or extraction from the seeds of different species of the genus *Aleurites* (family Euphorbiaceae) only

3.2
type F oil
raw tung oil derived substantially from seeds of the species *Aleurites fordii* Hemsley

3.3
type M oil
raw tung oil derived substantially from seeds of the species *Aleurites montana* Wilson

4 Requirements and test methods

The two types of raw tung oil shall meet the requirements given in Table 1.

5 Methods of test

5.1 General

During the analyses, use only reagents of recognized analytical grade, and only distilled water or water of equivalent purity.

5.2 Sampling

Take a representative sample of the oil to be tested, as described in ISO 15528.

5.3 Determination of gelation time

5.3.1 Apparatus

Ordinary laboratory apparatus and glassware, together with the following:

5.3.1.1 **Glass test-tubes**, 150 mm long and 16 mm nominal diameter, of wall thickness not greater than 1 mm.

Each tube shall have a cork, having a hole through which a glass rod of diameter 3 mm to 4 mm can move freely.

5.3.1.2 **Electric heating block**.

5.3.1.3 **Thermometer**, STC/0,5/245/305 complying with the requirements of ISO 654.

5.3.1.4 **Stop-clock**.

5.3.1.5 **Glass rods**, of diameter 3 mm to 4 mm.

Table 1 — Required characteristics and test methods for raw tung oil

Characteristic			Requirement		Test method
			Type F tung oil	Type M tung oil	
Density	at 20 °C	g/ml	0,935 to 0,940	0,930 to 0,940	ISO 2811-1
	at 23 °C[a]	g/ml	0,933 to 0,938	0,928 to 0,938	
Refractive index	at 20 °C		1,517 to 1,521	1,510 to 1,518	ISO 5661
	at 23 °C[b]		1,516 to 1,521	1,509 to 1,517	
Colour (Gardner)			max. 8[c]	max. 8[c]	ISO 4630
Acid number[d]		mg KOH/g	max. 5	max. 5	ISO 2114
Saponification number		mg KOH/g	189 to 195	189 to 195	ISO 3661
Unsaponifiable-matter content		% (by mass)	max. 1	max. 1	ISO 150:1980, Annex
Iodine number		g iodine/100 g	—	min. 205	e
Gelation time		minutes	max. 15	max. 22	Subclause 5.3
Volatile-matter (water) content		% (by mass)	max. 0,5	max. 0,5	ISO 10336
Insoluble-bromide content			Negative result	Negative result	Subclause 5.4
Sediment and turbidity			No insoluble sediment is allowed after 24 h storage; the raw tung oil shall be clear.	No insoluble sediment is allowed after 24 h storage; the raw tung oil shall be clear.	—
Fatty-acid composition	% (by mass) of each fatty acid		To be agreed between the interested parties[f]	To be agreed between the interested parties[f]	ISO 5508 and ISO 5509

a The change in density per degree Celsius is 0,000 68.

b The change in refractive index per degree Celsius is 0,000 35.

c This corresponds to an iodine colour number of 20.

d The free-acid content, calculated as oleic acid, shall not exceed 2,5 % (by mass).

e Calculate the iodine number from the number of double bonds as given by the fatty-acid composition.

f Typical values of the contents of the fatty acids in raw tung oil are given in Table 2.

5.3.2 Preparation of sample

Mix the sample of oil thoroughly by shaking.

5.3.3 Procedure

Carry out the determination in duplicate.

Pour 5 ml of the mixed sample into one of the test-tubes (5.3.1.1) and fit the test-tube with its cork and a glass rod (5.3.1.5).

Place the test-tube in the heating block (5.3.1.2), heated to a temperature of 275 °C to 277 °C. Support the test-tube so that its bottom is approximately 15 mm above the base of the heating block. Similarly, support the thermometer (5.3.1.3) with the bottom of its bulb approximately 15 mm above the base of the heating block, adjacent to the test-tube.

Start the stop-clock (5.3.1.4) and, when the test portion has been in the heating block for 12 min, raise the glass rod approximately 10 mm at intervals of 15 s. Record the time when the test sample has gelled, as shown by the test-tube rising with the rod.

If the results of the two determinations differ by more than 30 s, repeat the test on another two 5 ml test samples of the oil.

5.4 Insoluble-bromide test

5.4.1 Reagents

5.4.1.1 Diethyl ether.

5.4.1.2 Bromine.

5.4.2 Preparation of sample

Mix the sample of oil thoroughly by shaking.

5.4.3 Procedure

Dissolve 1 ml of the mixed sample in 20 ml of diethyl ether (5.4.1.1) in a test-tube or a small flask, mix the solution well and place the test-tube or small flask in cold water.

Add bromine (5.4.1.2) from a fine pipette, drop by drop, avoiding vigorous shaking, until a considerable excess is present, as indicated by a persistent strong red colour. Shake the test-tube or flask well, allow to stand in cold water for 15 min and examine the solution. If the solution is clear, this indicates that no insoluble bromide has been formed.

6 Typical values of fatty-acid contents

Table 2 gives typical values of the fatty-acid contents of raw tung oil, determined by gas-chromatographic analysis as described in ISO 5508 and ISO 5509.

Table 2 — Typical values of fatty-acid contents of raw tung oil

Fatty acid		Content % (by mass)
Palmitic acid	C16:0	2 to 3
Stearic acid	C18:0	1,5 to 2,5
Oleic acid	C18:1	4,5 to 8
Linoleic acid	C18:2	6 to 9
Linolenic acid	C18:3	0,1 to 0,3
α-Eleostearic acid	C18:3	64 to 80
β-Eleostearic acid	C18:3	4 to 15
Others (not identified)		0,3 to 1

7 Test report

The test report shall contain at least the following information:

a) a reference to this International Standard (ISO 277);

b) all details necessary for complete identification of the product tested (manufacturer, trade name, batch number, etc.);

c) the results of the tests, and whether or not the product complies with the relevant specification limits;

d) any deviation, by agreement or otherwise, from the test methods specified;

e) any specific agreements between the interested parties;

f) the dates of the tests.

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