

Indian Standard

SPECIFICATION FOR

VARNISH, FINISHING, EXTERIOR, SYNTHETIC,
AIR-DRYING

(*Second Revision*)

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

Indian Standard

SPECIFICATION FOR VARNISH, FINISHING, EXTERIOR, SYNTHETIC, AIR-DRYING

(*Second Revision*)

Paints and Allied Products Sectional Committee, CDC 8

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Indian Standard

SPECIFICATION FOR VARNISH, FINISHING, EXTERIOR, SYNTHETIC, AIR-DRYING (*Second Revision*)

0. FOREWORD

0.1 This Indian Standard (Second Revision) was adopted by the Indian Standards Institution on 30 September 1983, after the draft finalized by the Paints and Allied Products Sectional Committee had been approved by the Chemical Division Council.

0.2 This standard was first issued as a tentative standard in 1954, due to non-availability of authentic technical data on durability of this material. It was revised in 1968 on the basis of experimental data and experience gained through use of the standard. In the first revision, the requirements of JSS 3056 'Varnish, exterior, synthetic' issued by Directorate of Standardization, Ministry of Defence, Government of India, had been considered and incorporated.

0.2.1 In addition, modifications in evaluating performance test and their assessments was also introduced in the first revision. Stripping test was elaborated by stipulating definite time intervals after which the test is to be performed.

0.2.2 The requirements for undercoating varnish were covered in IS : 339-1952* but the concerned technical committee responsible for preparation of this standard was of the opinion that instead of using one coat of undercoating varnish conforming to this IS : 339-1952* and another coat of finishing varnish conforming to this specification, two coats of the latter may be used with improved performance and comparable cost. The committee, therefore, decided to withdraw IS : 339-1952* and recommended to use two coats of the material conforming to this specification in place of one coat of undercoating and an other coat of finishing. IS : 339-1952* was, therefore, withdrawn.

*Specification for Varnish, undercoating, exterior, synthetic resin (*with drawn*).

0.3 The second revision had been undertaken in order to make the existing standard applicable for the use of railways also, the largest consumers of the stores in the country. The material can be used either directly or in conjunction with enamel.

0.3.1 In this revision a specific limit of the phthalic anhydride content is given as an additional requirement for railways.

0.4 This standard is one of a series of Indian Standards on varnishes.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the requirements and the methods of sampling and test for varnish, finishing, exterior, synthetic, air-drying and is used in painting systems, for protection and decoration, for example, for railway coaches and similar other uses.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 1303-1963† and the one given below shall apply.

2.2 Registered Sample — Sample supplied in advance by a prospective supplier and registered by the approved testing authorities after testing it to all the requirements of this standard. A complete record of its performance shall be kept in respect of all tests.

3. REQUIREMENTS

3.1 Composition — The material shall be based on oil modified alkyd resin and shall be free from natural resins or their derivatives or their modifications, in any form, when tested in accordance with 19 of IS : 197-1969‡. It shall be of such a composition as to satisfy the requirements of this standard. The composition of the bulk supply shall be similar to that of the registered sample within the permissible limits specified in this standard.

*Rules for rounding off numerical values (*revised*).

†Glossary of terms relating to paints (*revised*).

‡Methods of sampling and test for varnishes and lacquers (*first revision*).

3.1.1 Additional Requirement for Railways — The phthalic anhydride content of the non-volatile vehicle in the bulk supply shall not deviate by more than ± 10 percent by mass of the recorded data on the registered sample when estimated by the method prescribed in **17.6** of IS : 354-1976*. Furthermore, in the material the phthalic anhydride content shall, in no case, be less than 20 percent by mass of the non-volatile vehicle when tested as prescribed in **17.6** of IS : 354-1976*.

NOTE — Due allowance may be given to the repeatability of the method for the determination of phthalic anhydride content as prescribed in **17.6** of IS : 354-1976*.

3.1.2 The material shall be capable of being thinned with petroleum hydrocarbon solvent, 145/205 low aromatic grade (See IS : 1745-1978 †).

3.2 Durability

3.2.1 Registered Sample

3.2.1.1 When prepared and tested for normal outdoor exposure as prescribed under **A-3**, a general breakdown of the film prepared from the sample for registration shall not occur in less than 9 months.

3.2.1.2 A film of the material for registration shall be prepared and tested as prescribed under **A-4**, in an accelerated weathering apparatus for a period of 15 days and a complete record of its performance maintained.

NOTE—As a precaution against inadvertent accidents, the outdoor exposure test (**A-3**) and the accelerated weathering test (**A-4**) shall be carried out in duplicate.

3.2.2 Sample from Bulk Supply — A film of the material prepared from a representative sample from bulk supply as described in Appendix A and tested in the accelerated weathering apparatus (**A-4**) shall be not materially different in performance as compared with the record of the film of the registered sample. The film shall be examined daily for a period of 15 days.

3.3 Resistance to Acid — The material, when tested as prescribed in Appendix B, shall be not inferior in performance as compared with the record of the film of the registered sample.

3.4 Resistance to Alkali — The material, when tested as prescribed in Appendix C, shall be not inferior in performance as compared with the record of the film of the registered sample.

3.5 Resistance to Water — The material, when tested as prescribed in Appendix D, shall be not inferior in performance as compared with the record of the film of the registered sample.

*Methods of sampling and test for resins and paints (*first revision*).

†Specification for Petroleum hydrocarbon solvents (*second revision*).

3.6 The material shall also comply with the requirements given in Table 1.

**TABLE 1 REQUIREMENTS FOR VARNISH, FINISHING,
EXTERIOR, SYNTHETIC, AIR-DRYING**

SL No.	CHARACTERISTIC	REQUIREMENT	METHOD OF TEST, REF TO CL No. IN IS : 197-1969*
(1)	(2)	(3)	(4)
i)	Drying time, <i>Max</i> :		
	a) Surface dry	6 hours }	7:2 (Method I)
	b) Hard dry	12 hours }	
	c) Tack free	24 hours }	
ii)	Finish	Smooth and glossy	8
iii)	Colour	Not darker than a combination of 39 yellow units and 3·3 red units	9
iv)	Scratch hardness after 96 hours air-drying	No such scratch as to show the bare metal	10
v)	Flexibility and adhesion after 96 hours air-drying	No visible damage or detachment of the film	11 (Method II)
vi)	Stripping test after 96 hours air-drying	Scratches free from jagged edges	12
vii)	Flash point	Not below 30°C	13
viii)	Volatile matter content, percent by weight, <i>Max</i>	60·0	14
ix)	Viscosity at 30°C	1·5 to 3·0 stokes	16
x)	Keeping properties	Not less than one year from date of manufacture	19

*Methods of sampling and test for varnishes and lacquers (*first revision*).

4. PACKING AND MARKING

4.1 **Packing** — The material shall be packed as agreed to between the purchaser and the supplier.

4.2 Marking — Each container shall be marked with the following:

- a) Name of the material;
- b) Name of the manufacturer, and/or his recognized trade-mark, if any;
- c) Volume of the material;
- d) Month and year of manufacture; and
- e) Batch No. or lot No. in Code or otherwise.

4.2.1 The containers may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1936 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

5. SAMPLING

5.1 Preparation of Test Samples

5.1.1 For Registration — The sample shall be submitted in three different containers, each containing not less than 500 ml of the material.

5.1.1.1 As testing to the requirements of material covered by this standard involves a period of more than 9 months, the supplier is advised to submit samples for registration sufficiently in advance.

5.1.2 Tender Sample — The supplier may dispense with sending a tender sample provided that he declares that the material for which the tender is given is of the same quality as the sample previously registered in his name.

5.1.3 Bulk Supply Sample — Representative samples of the material shall be drawn and treated as prescribed under 3 of IS : 197-1969*.

6. TEST METHODS

6.1 Tests shall be conducted as prescribed in IS : 197-1969* and in Appendices A to D. References to relevant clauses of IS : 197-1969* are given in col 4 of Table 1 and to appendices in 3.2 to 3.5.

*Methods of sampling and test for varnishes and lacquers (*first revision*).

6.2 Quality of Reagents — Unless specified otherwise, pure chemicals and distilled water (*see* IS : 1070-1977*) shall be employed in tests.

NOTE—'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

6.3 Comparison with the performance of the registered sample shall be carried out on the basis of records maintained for the registered sample (*see* 3.2.1.2).

A P P E N D I X A

(*Clause* 3.2.2)

DETERMINATION OF DURABILITY

A-0. GENERAL

A-0.1 Outline of the Method — The durability of the varnish is determined by ascertaining actual behaviour of suitably prepared test panels in normal outdoor exposure test for a specified period and evaluating the results of this exposure by a suitable method of rating for various characteristics of the varnish film. Apart from this, the varnish is also evaluated by an accelerated weathering test wherein a prepared panel is subjected to controlled exposure of heat, light and water in an artificial weathering apparatus.

A-1. TEST PANELS

A-1.1 The panels shall be of seasoned teakwood conforming to the requirements of 5.4 of IS : 197-1969†. Panels for outdoor exposure shall be 300 × 150 × 25 mm in size, and for the accelerated weathering test 150 × 75 × 12 mm. The panels shall be bevelled at the edges and shall be smoothed by rubbing down with fine emery paper, the back being protected with a suitable paint.

A-2. PREPARATION OF TEST PANELS

A-2.1 In the painting procedure outlined under A-2.2, the air-drying shall be done at the room temperature as defined under 2.8 of IS : 197-1969† and at a relative humidity of not more than 70 percent.

*Specification for water for general laboratory use (*second revision*).

†Methods of sampling and test for varnishes and lacquers (*first revision*).

A-2.2 The surface of the test panels to be exposed shall be prepared as follows:

- a) Apply one coat of liquid, transparent wood filler (conforming to IS : 345-1952*) and remove the excess after it has dried to touch, by rubbing across the grains with jute fibres or hessian cloth, and allow it to air-dry for 24 hours.
- b) Rub down with emery paper No. 220/240 and wipe off the dust, apply one coat of varnish, gold size (conforming to IS : 198-1978†) and allow to air-dry for 24 hours.
- c) Rub down with waterproof emery paper No. 220/240, wash and wipe off water, and when dry, apply one coat of finishing varnish and allow to air-dry for 24 hours.
- d) Rub down with waterproof emery paper No. 320, wash and wipe off water, and when dry, apply second coat of the finishing varnish, and allow to air-dry for 48 hours.
- e) Rub down with waterproof emery paper No. 320, wash and wipe off water, and when dry, apply a third coat of the finishing varnish, and allow to air-dry for 7 days.

A-3. NORMAL OUTDOOR EXPOSURE TEST

A-3.0 Subject the sample for registration and the tender samples, if supplied, to normal outdoor exposure test in the manner described under **A-3.1**.

A-3.1 Expose in open the test panels, prepared in the manner prescribed under **A-1** and **A-2** in duplicate, in a vertical position facing South. Commence the exposure not earlier than the last week of January and not later than the first week of March.

A-3.1.1 Examine the condition of the exposed films at monthly intervals for gloss retention and at bimonthly intervals for other characteristics, as given below:

- a) Checking, and
- b) Blooming and spotting.

A-3.1.2 For the above examinations, clean half the surface of the two test panels with a sponge dipped in water and wipe it dry with a piece of soft cotton cloth or chamois leather (see IS : 1017-1983‡). Prior to

*Specification for wood filler, transparent, liquid.

†Specification for varnish, gold size (*first revision*).

‡Specification for chamois leather (*second revision*).

examination examine the same half of the test panels at each examination. As an aid to the examination, a magnifying glass may be used, but the evaluation shall be based on an assessment with the unaided eye. At the end of the stipulated period for durability, examine both halves of the test panels and base the evaluation for rating (see A-3.3) on the condition of the unwiped half of the test panels, which shall be wiped before the visual examination.

A-3.2 Method of Rating — The film of an unexposed test panel shall be rated with the following basic values for the respective characteristics:

a) Possessing high gloss	40
b) Freedom from checking	45
c) Freedom from blooming and spotting	15
	100

NOTE—The initial rating of film may be 100 or less according to the condition of gloss the rating for freedom from checking, blooming and spotting being always the maximum in the case of unexposed films.

A-3.3 Evaluation of Exposed Films — In recording the condition of exposed films at each examination, express the observed relative values of different characteristics in percentages of the basic value allotted to each characteristic under A-3.2. The allotment of performance value should be multiples of 10. For arriving at an assessment, multiply the basic value for each characteristic (see A-3.2) by the percentage awarded for the performance in the test and divide the product so obtained by 100 to obtain the percentage award for the observed value of each characteristic. Take the sum total of these resulting values as the overall assessment.

A-3.3.1 The following table is intended to serve as an example for the assessment of a varnish film after exposure:

<i>Characteristic</i>	<i>Basic Value</i>	<i>Performance Value</i>	<i>Assessment Value</i>
(1)	(2)	(3)	(4)
	Percent	Percent	Percent
a) Possessing high gloss	40	100	40
b) Freedom from checking	45	50	22.5
c) Freedom from blooming and spotting	15	20	3
			65.5

A-3.4 Results of Exposure — Reckon the period for the general breakdown of the exposed film from the date of commencement of exposure to

the time when the overall assessment falls below 50 percent or when the performance value of any one characteristic except for gloss which shall be 50 percent, falls below 25 percent of the basic value adopted for that characteristic. In the example given under **A-3.3.1**, although the overall assessment is 65.5 percent, yet the film is to be regarded as generally having broken down, because the performance value of blooming and spotting has fallen below 25 percent of its basic value.

A-4. ACCELERATED WEATHERING TEST

A-4.1 Accelerated Weathering Apparatus — An artificial weathering apparatus of the carbon arc type for uniform and controlled exposure to the effects of heat, light and water.

A-4.2 Samples for registration shall be tested in duplicate in a suitable accelerated weathering apparatus (see **A-4.1**) and samples drawn from bulk supply shall be tested in a similar manner. The test panels shall be prepared as described under **A-2.2**. The requirements of this test shall be taken to have been satisfied if the performance of the film is not materially different as compared with the record of the film of the registered sample.

A P P E N D I X B

(Clause 3.3)

DETERMINATION OF RESISTANCE TO ACID

B-0. GENERAL

B-0.1 Outline of the Method — A test panel coated with the varnish, after specified drying period, is immersed in a definite concentration of sulphuric acid for 2+ hours after which it is washed, dried and compared in performance with a panel prepared with the registered sample.

B-1. PROCEDURE

B-1.1 Apply a coat of the varnish, as specified under **6.4** of IS : 101-1964*, on a 150 × 50 mm clean glass panel to give a dry film weight commensurate with the weight in kg/10 litres of the material. Allow the panel to air-dry in a horizontal position for 48 hours under specified laboratory drying conditions (see **7.3.1** of IS : 101-1964*). Protect the edges of the panel by applying a coat of wax. Immerse the panel in a 2 percent (*w/v*) solution of concentrated sulphuric acid (sp gr 1.84

*Methods of test for ready mixed paints and enamels (second revision).

conforming to IS : 266-1977*) for 24 hours at room temperature. Remove the panel, wash in running fresh water and allow to dry for an hour.

B-1.2 The film shall not show signs of disintegration and loss of gloss to a greater extent than those recorded for the registered sample.

A P P E N D I X C

(Clause 3.4)

DETERMINATION OF RESISTANCE TO ALKALI

C-0. GENERAL

C-0.1 Outline of the Method — The film of the material is tested with a solution of laundry soap followed by a solution of sodium carbonate by the procedure specified under **C-1**.

C-1. PROCEDURE

C-1.1 Immerse a panel prepared as described in Appendix B in a one percent (*w/v*) solution of laundry soap, grade 1 (conforming to IS : 285-1974†) for half an hour at a temperature of $27 \pm 2^{\circ}\text{C}$. Remove, wash in running water, dry for an hour and examine the film and then subject to test as prescribed under **C-1.2**.

C-1.2 Immerse the panel in a solution of sodium carbonate analytical reagent grade (conforming to IS : 296-1974‡) containing two percent (*w/v*) of sodium carbonate (Na_2CO_3) for half an hour at a temperature of $27 \pm 2^{\circ}\text{C}$. Remove, wash in running water, dry for an hour and examine the film.

C-1.3 After each of the tests described under **C-1.1** and **C-1.2**, the film shall not show signs of disintegration to a greater extent than those recorded for the registered sample.

*Specification for sulphuric acid (*second revision*).

†Specification for laundry soaps (*second revision*).

‡Specification for sodium carbonate, anhydrous (*second revision*).

APPENDIX D*(Clauses 3.5)***DETERMINATION OF RESISTANCE TO WATER****D-0. GENERAL**

D-0.1 Outline of the Method — The varnish coated panel, after specified drying period, is immersed in distilled water for 48 hours at room temperature and examined for any signs of deterioration and change in gloss.

D-1. PROCEDURE

D-1.1 Apply a coat of material to a glass panel prepared as prescribed under 5.3 of IS : 101-1964* to give a dry film weight commensurate with weight per 10 litres of the material as specified in 6.4 of IS : 197-1969†. Allow the varnish to air-dry in a horizontal position for 48 hours. Immerse the panel in distilled water at room temperature for 48 hours. Remove it from water and examine after 4 hours.

D-1.2 The film shall show no greater signs of deterioration than those recorded for the registered sample.

*Methods of test for ready mixed paints and enamels (*second revision*).

†Methods of sampling and test for varnishes and lacquers (*first revision*).

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²

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