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Jawaharlal Nehru
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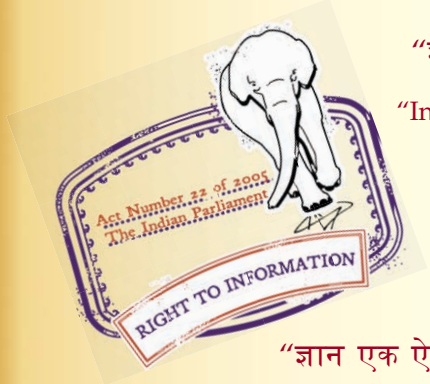
IS 8662 (2004): Enamel, synthetic, exterior : (a) undercoating (b) finishing for railway coaches [CHD 20: Paints, Varnishes and Related Products]



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"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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भारतीय मानक

इनेमल संश्लेषित बाहरी सतह पर प्रयुक्त रेल के डिब्बों के (क) अधलेपन (ख) परिसज्जा के लिए — विशिष्टि

(दूसरा पुनरीक्षण)

Indian Standard

ENAMEL, SYNTHETIC EXTERIOR: (a) UNDERCOATING (b) FINISHING, FOR RAILWAY COACHES — SPECIFICATION

(Second Revision)

ICS 25.220.50;45.080

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

October 2004 **Price Group 7**

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Paints, Varnishes and Related Products Sectional Committee had been approved by the Chemical Division Council.

Indian Railways are one of the largest consumers of synthetic enamels in the country. In consultation with the Railways, IS 8662 was published in 1978. The requirements for phthalic anhydride content, gloss retention values and change of colour after 3, 6 and 12 months had been specified in addition to those covered in IS 2932 : 1974 'Specification for enamel, synthetic exterior: (a) undercoating, (b) finishing (*first revision*)'. For more objective assessment of characteristics like freedom from checking, cracking, flaking, chalking, spotting, blistering and corrosion, various stages of these defects had been quantified. The requirement and the test for durability for 12 months had been prescribed wherein test panels were exposed at an angle of 45° instead of usual practice of vertical exposure to make the test more rigorous and reduce the testing period.

In first revision composition, mass in kg/10 litres had been quantified and an additional accelerated storage stability test was incorporated.

In this revision, a clause on condition in container has been added. The artificial weathering apparatus of carbon arc type has been deleted and QUV accelerated weathering test has been specified alongwith testing period. In normal outdoor exposure test, specular gloss at 45° has been deleted and gloss value at 60° incorporated. The condition of the exposed film in respect of gloss and colour after 3, 6 and 12 months and checking , cracking, flaking, chalking and spotting after 12 months have been specified. Wet opacity requirement for all 30 colour categories has been specified in line with IS 2932 : 2003 'Enamel, synthetic, exterior: (a) undercoating (b) finishing — Specification (*third revision*)'.

This specification is intended to meet the specific needs of consumers like Railways. The material to this specification may also be used for other purposes where high gloss and better quality enamels are required.

The composition of the Committee responsible for the preparation of this standard is given in Annex G.

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 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

ENAMEL, SYNTHETIC EXTERIOR: (a) UNDERCOATING (b) FINISHING, FOR RAILWAY COACHES — SPECIFICATION

(Second Revision)

1 SCOPE

This standard prescribes requirements, methods of sampling and test for the material commercially known as enamel, synthetic, exterior (a) undercoating (b) finishing, colour as required used in painting system for protection and decoration of railway coaches and other similar uses.

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated at Annex A.

3 TERMINOLOGY

3.1 For the purpose of this standard, the definitions given in IS 1303 and the following shall apply.

3.1.1 *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.

4 CLASSES

The material shall be supplied in brushing consistency but shall be suitable for application by brushing and air/airless spraying after thinning with petroleum hydrocarbon solvent to grade 145/205, low aromatic grade (*see* IS 1745). The odour of the material shall not be objectionable during application.

5 COLOUR CATEGORIES

For the purpose of registration of the samples of the material, the colour categories given in Table 1 shall be employed.

Table 1 Colour Categories and Wet Opacity Requirements
(*Clause* 5)

Colour Category No.	Colour Shade	ISC No. as per IS 5	Shade Recommended for Registration of Samples	Wet Opacity Requirement *Min* $m^2/10\,l$
(1)	(2)	(3)	(4)	(5)
1.	White	—	White	130
2.	Black	—	Black	260
3.	Dark violet	796	Dark violet	80
4.	i) Sky blue	101		
	ii) Turquoise blue	102		
	iii) Oriental blue	174	Turquoise blue	160
	iv) Light admiral grey	697		
	v) Phirozi	176		
	vi) Satin blue	177		
5.	i) Eau-de-nil	216		
	ii) Opaline green	275		
	iii) Apple green	281	Apple green	210
	iv) Bus green	299		
6.	i) Peacock blue	103		
	ii) Azure blue	104	Traffic blue	200
	iii) Traffic blue	169		
7.	i) Oxford blue	105	Oxford blue	100
	ii) Navy blue	106		
8.	Aircraft blue	108	Aircraft blue	170
9.	French blue	166	French blue	150
10.	i) Sea green	217	Sea green	170
	ii) Verdigris green	280		
11.	i) Sage green	219	Sage green	160
	ii) Light olive green	278		
	iii) Aircraft grey green	283		
12.	i) Grass green	218		
	ii) Traffic green	267	Traffic green or	150
	iii) India green	284	Grass green	
	iv) Brilliant green	221		
13.	i) Light brunswick green	225		
	ii) Middle Brunswick green	226	Middle brunswick green	220
	iii) Deep brunswick green	227		
	iv) Lincoln green	276		
	v) Cypress green	277		
	vi) Forest green	282		
14.	i) Olive green	220		
	ii) Light bronze green	222		
	iii) Middle bronze green	223		

Table 1 (*Continued*)

Colour Category No.	Colour Shade	ISC No. as per IS 5	Shade Recommended for Registration of Samples	Wet Opacity Requirement *Min* $m^2/10\ l$
(1)	(2)	(3)	(4)	(5)
	iv) Deep bronze green	224	Olive green	220
	v) Steel furniture green	279		
	vi) Scamic	294		
	vii) Olive drab	298		
15.	Canary yellow	309	Canary yellow	100
16.	i) Lemon	355	Golden yellow	100
	ii) Golden yellow	356		
17.	i) Pale cream	352		
	ii) Deep cream	353		
	iii) Light stone	361		
	iv) Portland stone	364		
	v) Vellum	365	Pale cream or	110
	vi) Light straw	384	deep cream	
	vii) Light biscuit	385		
	viii) Champagne	386		
	ix) Sunshine	387		
	x) Beige	388		
	xi) Jasmine yellow	397		
	xii) Light salmon pink	442		
	xiii) Salmon pink	443		
18.	Primrose	354	Primrose	100
19.	Light buff	358	Light buff	160
20.	i) Middle buff	359		
	ii) Deep buff	360	Deep buff	200
	iii) Middle stone	362		
21.	i) Dark stone	363		
	ii) Light brown	410		
	iii) Middle brown	411	Light brown	140
	iv) Golden brown	414		
	v) India brown	415		
	vi) Leaf brown	489		
22.	i) Dark brown	412		
	ii) Orange brown	439		
	iii) Venetian red	445		
	iv) Red oxide	446	Gulf red	200
	v) Deep Indian red	448		
	vi) Light purple brown	449		
	vii) Gulf red	473		
	viii) Beech brown	490		
23.	i) Nut brown	413		
	ii) Chocolate	451	Nut brown	220
	iii) Service brown	449		
24.	Terra cotta	444	Terra cotta	160
25.	i) Fire red	536		
	ii) Signal red	537		
	iii) Post office red	538	Post office red	60
	iv) Crimson	540	or Signal red	
	v) International orange	592		
26.	Maroon	541	Maroon	130
27.	i) Traffic yellow	368		
	ii) Light orange	557	Deep orange	120
	iii) Traffic red	570		
	iv) Deep orange	591		
28.	India saffron	574	India saffron	120
29.	i) Silver grey	628		
	ii) Quaker grey	629		
	iii) French grey	630		
	iv) Light grey	631		
	v) Dark admiral grey	632	Light grey or	200
	vi) Smoke grey	692	aircraft grey	

Table 1 (*Concluded*)

Colour Category No.	Colour Shade	ISC No. as per IS 5	Shade Recommended for Registration of Samples	Wet Opacity Requirement *Min* $m^2/10\ l$
(1)	(2)	(3)	(4)	(5)
	vii) Aircraft grey	693		
	viii) Dove grey	694		
30.	i) AF blue grey	633		
	ii) Slate	634		
	iii) Lead	635	AF blue grey	230
	iv) Middle graphite	671		
	v) Dark blue grey	695		

NOTE—The wet opacity values on the bulk supply shall be within − 10 to + 20 % of the wet opacity requirement specified above for different colour categories.

6 REQUIREMENTS

6.1 Composition

The material shall be based on oil modified synthetic alkyd resin, free from natural resins or their derivatives or modifications in any form when tested in accordance with Annex B. It shall be of such a composition as to satisfy the requirements of this standard.

6.2 Condition in Container

6.2.1 *At Delivery*

At the time of delivery the paint shall be in such a condition that manual stirring readily produces a uniform product.

6.2.2 *During Storage*

During the 12 months storage period, the rating for degree of settling shall not drop to zero, when tested as per IS 101 (Part 6/ Sec 2).

6.2.3 *Freedom from Coarse Particles*

The paint shall be free from coarse aggregates, suspended particles of gel and foreign matter, when tested as per IS 101 (Part 1/ Sec 2).

6.2.4 *Skin Formation*

The undercoat or finishing paint shall show no skin formation, when examined visually.

6.2.5 *Thinning Properties*

The undercoat/finishing paint shall be capable of being readily mixed with the petroleum hydrocarbon solvent (*see* IS 1745) without showing any precipitation.

6.2.6 *Application Properties*

The undercoat or finishing paint shall normally be supplied in a condition suitable for application by brushing, either as supplied or when thinned with

approximate 5 percent by volume of petroleum hydrocarbon solvent (*see* IS 1745) and by spraying when thinned with approximate 20 percent by volume of the same thinner.

6.3 Durability

6.3.1 *Registered Sample*

6.3.1.1 When prepared and tested as prescribed under **C-3** up to a period of 12 months preferably at National Test House, Kolkata or any approved testing authority, a film prepared from the sample for registration of the material shall satisfy the requirements of the test.

6.3.1.2 A film of the sample for registration shall be prepared and tested as per **C-4**, in xenon arc accelerated weathering apparatus for 500 h or QUV accelerated weathering apparatus for 250 h and examined every third day for a period indicated above shall satisfy the requirements as given in **C-4.3**.

6.3.1.3 The test cycle recommended for QUV accelerated weathering apparatus is 4 h of UV exposure using UVB wavelength of 295-325 nm followed by 4 h of condensation.

6.3.1.4 QUV apparatus may be used as an alternate when tested with an approved sample for a period of 200 h.

NOTE — As a precaution against inadvertent accidents, it is recommended that the outdoor exposure test (*see* **C-3**) and the accelerated weathering test (*see* **C-4**) are carried out in duplicate.

6.3.2 *Sample from Bulk Supply*

The characteristics of a film of the material prepared from a representative sample of the bulk supply as prescribed in **C-2** tested in the accelerated weathering apparatus (*see* **C-4**) and examined every third day for a period as indicated at **6.3.1.2** shall not deviate from the limits specified at **C-4**.

6.4 Resistance to Acid (for Finishing Only)

A film of the material, when tested at 27 ± 2°C prescribed in Annex D shall not show signs of disintegration or change of colour to a rating not less than 8, taking the original colour as 10. The loss of gloss shall not be more than 50 percent of the original gloss.

6.5 Resistance to Alkali (for Finishing Only)

A film of the material, when tested at 27 ± 2°C prescribed in Annex E shall not show signs of disintegration or change of colour to a rating not less than 8, taking the original colour as 10. The loss of gloss shall not be more than 50 percent of the original gloss.

6.6 The material shall also comply with the requirements given in Table 2.

7 PACKING AND MARKING

7.1 Packing

Unless otherwise agreed to between the purchaser and the supplier, the enamel shall be packed in metal containers conforming to IS 1407 or IS 2552.

7.2 Marking

7.2.1 Each container may also be marked with the following:

a) Name of the material and indication whether undercoating or finishing,
b) Indication of the source of manufacture,
c) Volume of the material,
d) Batch number or lot number in code or otherwise, and
e) Month and year of manufacture.

7.2.2 *BIS Certification Marking*

The product may also be marked with the Standard Mark.

7.2.2.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Table 2 Requirements for Enamel, Synthetic, Exterior (a) Undercoating (b) Finishing, for Railway Coaches
(*Clause* 6.6)

Sl No.	Characteristics	Requirements		Methods of Test	
				Ref to IS 101	Annex of This Standard
		Undercoating	Finishing		
(1)	(2)	(3)	(4)	(5)	(6)
i)	a) Consistency	Smooth, uniform and suitable for brushing without appreciable drag on the brush and for airless spraying		(Part 1/Sec 5)	—
	b) Viscosity by Ford cup No. 4	1. 80-120 s for both 2. The material may be thinned to 50-60 s for brushing and 35-40 s for spraying		do	
ii)	Mass, in kg/10 litres, *Min*	12.0	9.0	(Part 1/Sec 7)	—
iii)	Drying time, h, *Max*			(Part 3/Sec 1)	—
	a) Surface dry	2	4		
	b) Hard dry	8	12		
	c) Hard dry at 70°C with 15 min flash-off time	1	1		
	d) Tack free	24	24		
iv)	a) Finish	Smooth and matt to low gloss	Smooth and glossy	(Part 3/Sec 4)	—
	b) Gloss, 60°	0-20	Above 61	(Part 4/Sec 4)	—
v)	Fineness of grind, microns, *Max*	40	15	(Part 3/Sec 5)	—
vi)	Colour	Approximate match to ISC No. 385 or 635	Close match to the specified IS colour or to an agreed colour	(Part 4/Sec 2)	—
vii)	Water content (if suspected to be present), percent by mass, *Max*	0.5	0.5	(Part 2/Sec 1)	—
viii)	Scratch hardness after 48 h air drying (1 000 g weight)	No such scratch as to show the bare metal		(Part 5/Sec 1)	—
ix)	Flexibility and adhesion	No visible damage or detachment of the film after: 48 h air drying	96 h air drying followed by cooling for 5 h at 0°C (*see* Note)	(Part 5/Sec 2)	—
x)	Flash point	Not below 30°C	Not below 30°C	(Part 1/Sec 6)	—
xi)	Composition:				
	a) Volume solids, percent, *Min*	40	35	(Part 8/Sec 6)	—
	b) Phthalic anhydride content of non-volatile vehicle, percent by mass, *Min*	22	22	(Part 8/Sec 4)	—
xii)	Accelerated storage stability test, at 60°C, 96 h	Shall pass the test	Shall pass the test	—	F
xiii)	Keeping properties	Not less than one year	Not less than one year	(Part 6/Sec 2)	—

NOTE — The test shall be carried out on the cold film, care being taken that the temperature of the panel and the rod does not exceed 0°C during the bending operation.

8 SAMPLING

8.1 Preparation of Test Samples

8.1.1 *For Registration*

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

8.1.1.1 As testing to the requirements of this standard covers a period of more than 12 months, the supplier is advised to submit samples for registration sufficiently in advance within the period from October to December of the year, so that outdoor exposure test can be started during the period stipulated in **C-3.1**.

8.1.2 *Bulk Supply Sample*

Representative samples of the materials shall be drawn and treated as prescribed in IS 101 (Part 1/Sec 1).

8.2 Criteria for Conformity

A lot shall be declared as conforming to the requirements of this standard, if the test results of the composite sample satisfy the requirements given in **6**.

9 TEST METHODS

9.1 Test shall be conducted according to the methods prescribed in various parts and sections of IS 101 and various Annexes to this standard. Reference to the relevant clauses of these standards are given in col 5 of Table 2 and to various Annexes in **6.1**, **6.3**, **6.4** and **6.5**.

9.2 Quality of Reagents

Unless specified otherwise, pure chemicals and distilled water (*see* IS 1070) shall be employed in tests.

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

9.3 Comparison with the performance of the registered sample shall be carried out on the basis of records maintained for the registered sample (*see* **6.3.1**).

9.4 For match against Indian Standard Colours, IS 5 shall be used.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
5 : 1994	Colours for ready mixed paints and enamels (*fourth revision*)
101	Methods of sampling and test for paints, varnishes and related products
(Part 1/Sec 1) : 1986	Test on liquid paints (general and physical), Section 1 Sampling (*third revision*)
(Part 1/Sec 2) : 1987	Test on liquid paints (general and physical), Section 2 Preliminary examination and preparation of samples for testing (*third revision*)
(Part 1/Sec 3) : 1986	Test on liquid paints (general and physical), Section 3 Preparation of panels (*third revision*)
(Part 1/Sec 5) : 1989	Test on liquid paints (general and physical), Section 5 Consistency (*third revision*)
(Part 1/Sec 6) : 1987	Test on liquid paints (general and physical), Section 6 Flash point (*third revision*)
(Part 1/Sec 7) : 1987	Test on liquid paints (general and physical), Section 7 Mass per 10 litres (*third revision*)
(Part 2/Sec 1) : 1988	Test on liquid paints (chemical examination), Section 1 Water content (*third revision*)
(Part 3/Sec 1) : 1986	Tests on paint film formation, Section 1 Drying time (*third revision*)
(Part 3/Sec 4) : 1987	Tests on paint film formation, Section 4 Finish (*third revision*)
(Part 3/Sec 5) : 1987	Tests on paint film formation, Section 5 Fineness of grind (*third revision*)
(Part 4/Sec 1) : 1988	Optical tests on paint films, Section 1 Opacity (*third revision*)
(Part 4/Sec 2) : 1989	Optical tests on paint films, Section 2 Colour (*third revision*)
(Part 4/Sec 4) : 1988	Optical tests on paint films, Section 4 Gloss (*third revision*)
(Part 5/Sec 1) : 1988	Mechanical tests on paint films, Section 1 Hardness tests (*third revision*)
(Part 5/Sec 2) : 1988	Mechanical tests on paint films, Section 2 Flexibility and adhesion (*third revision*)
(Part 6/Sec 1) : 1988	Durability tests on paint films, Section 1 Resistance to humidity under conditions of condensation (*third revision*)
(Part 6/Sec 2) : 1989	Durability tests on paint films, Section 2 Keeping properties (*third revision*)
(Part 8/Sec 4) : 1993	Tests for pigments and other solids, Section 4 Phthalic anhydride
(Part 8/Sec 6) : 1993	Tests for pigments and other solids, Section 6 Volume solids
266 : 1993	Sulphuric acid (*third revision*)
285 : 1992	Laundry soaps (*third revision*)
296 : 1986	Sodium carbonate, anhydrous (*third revision*)
513 : 1994	Cold-rolled low carbon steel sheets and strips (*fourth revision*)
1017 : 1983	Chamois leather (*second revision*)
1070 : 1992	Reagent grade water (*third revision*)
1303 : 1983	Glossary of terms relating to paints (*second revision*)
1407 : 1980	Round paint tins (*second revision*)
1745 : 1978	Petroleum hydrocarbon solvents (*second revision*)
2074 : 1992	Ready mixed paint, air drying, red oxide-zinc chrome, priming (*second revision*)
2552 : 1989	Steel drums (galvanized and ungalvanized) (*third revision*)

ANNEX B

(*Clause* 6.1)

TEST METHOD FOR TOTAL ROSIN ACIDS CONTENT OF COATING VEHICLES

B-0 GENERAL

Liebermann starch test or Halphen-Hicks test for detection of rosin also gives colouration with bleeding pigments (for example, Post Office Red) which may be confused with the presence of rosin. If the rosin content estimated by method described herein is less than 1 percent , the paint sample should be considered free from rosin. The method covers the determination of total rosin acids content of rosin esters, varnishes and alkyd resins, unmodified by such materials as maleic or fumaric acid or phenols. Total rosin acids determined include free rosin, esterified rosin and metallic salts of rosin.

NOTE — This method is primarily designed for material containing 0.5 to 5 percent rosin on non-volatile basis.

B-0.1 Outline of the Method

B-0.1.1 The sample of separated vehicle is saponified with potassium hydroxide-ethylene glycol reagent and acidified with hydrochloric acid. Heat is applied to hydrolyze metallic driers. This is necessary when metallic rosinates are present.

B-0.1.2 The mixture described in **B-0.1.1** is extracted with toluene. The rosin and fatty acids and unsaponifiables pass into the toluene layer. The aqueous layer will contain certain dibasic acids, polyhydric alcohols and other water-soluble products of saponification.

B-0.1.3 The toluene is removed by evaporation, the residue weighed and the rosin acids are determined by a selective esterification and titration method.

B-1 APPARATUS

B-1.1 Air condenser, 700 mm, with a 24/40 standard taper joint.

B-1.2 Burette — Automatic type having a capacity of 25 ml, for the standard potassium hydroxide solution, fitted with soda-lime trays to protect against absorption of atmospheric carbon dioxide.

B-1.3 Erlenmeyer Flasks — 250-and 500-ml capacity with 24/40 ground joints.

B-1.4 Separating Funnels — Three of one litre capacity.

B-1.5 Steam Bath — Located in a fume hood for evaporation of volatile solvents.

B-1.6 Moisture Collection Trap — Constructed according to details shown in Fig. 1. Wrap with 12.7 mm asbestos tape.

B-1.7 Pipette — Automatic, 50-ml capacity.

B-2 REAGENTS

B-2.1 Toluene

B-2.2 Butyl Alcohol Sulphuric Acid Esterification Reagent — Add 500 ml of *n*-butyl alcohol, 500 ml of toluene and 3.3 ml (6 g) of sulphuric acid to a 2-litre round bottom flask with ground joint, connect to a moisture trap and condenser and reflux on a hot plate for 30 min to distil out the water and to form butyl-sulphuric acid. Cool and store in a glass-stoppered bottle.

B-2.3 Ethyl Alcohol

B-2.4 Hydrochloric Acid, Concentrated, Sp gr 1.19.

B-2.5 Potassium Hydroxide-Ethylene Glycol Solution (132 g/l) — Dissolve 132 g of potassium hydroxide pellets in 1 litre of ethylene glycol in a 2-litre Erlenmeyer flask. Insert a thermometer and boil to eliminate water until the temperature of the liquid reaches 190 to 195°C. Cool and store in a rubber-stoppered bottle.

B-2.6 Potassium Hydroxide, Alcoholic Standard Solution (13.3 g/l) — Dissolve 13.3 g of potassium hydroxide pellets in 1 litre of alcohol. Standardize against potassium acid phthalate primary standard.

B-2.7 Sulphuric Acid, Concentrated

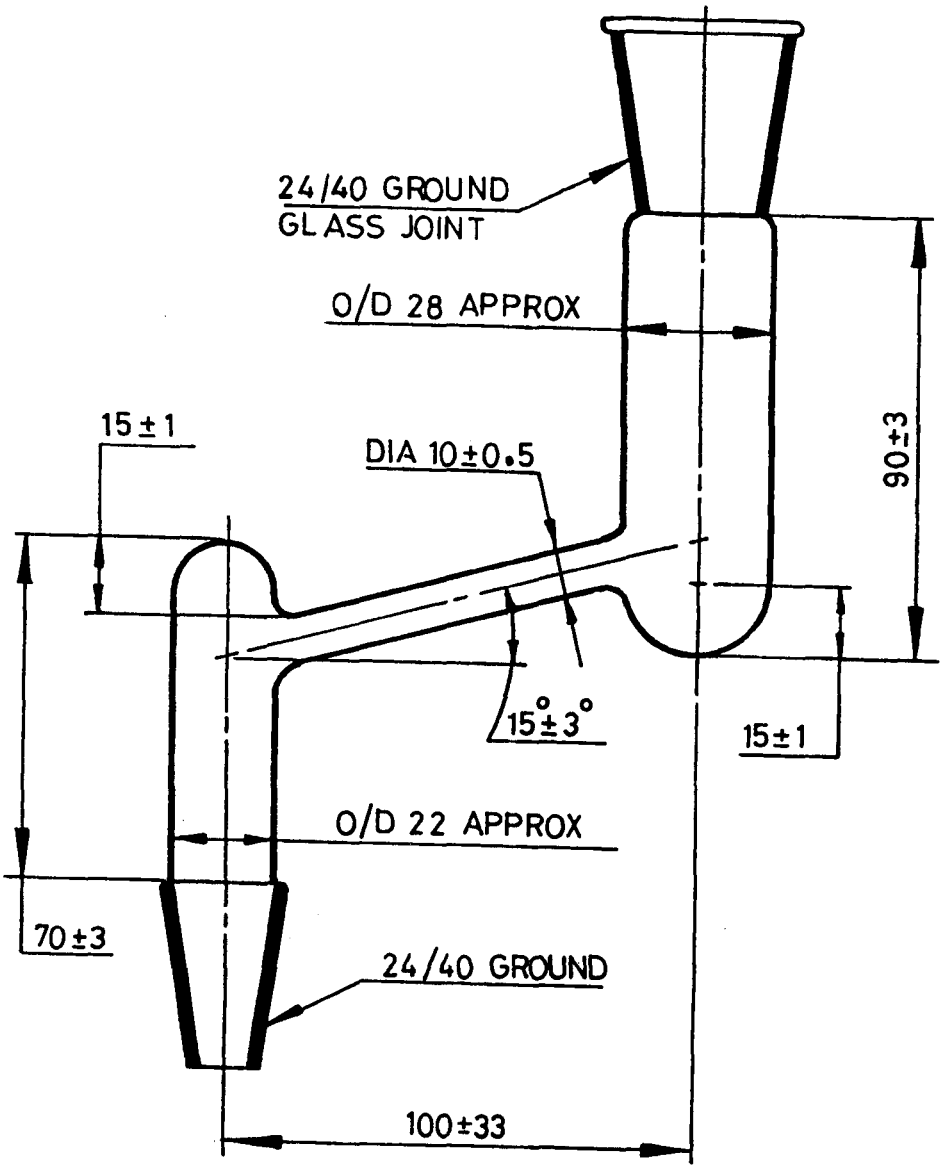
B-2.8 Thymol Blue Indicator Solution (10 g/l) — Mix 1 g of thymol blue indicator with 100 ml of ethyl alcohol.

B-3 PROCEDURE

B-3.1 Transfer to a 500-ml Erlenmeyer flask an amount of sample, weighed to the nearest 0.001 g, containing approximately 10 ± 1 g of non-volatile material. Add 150 ml of the potassium hydroxide ethylene glycol solution and swirl to disperse the sample. Add a boiling stone, attach a condenser and reflux on a hot plate for 2 h.

B-3.2 After refluxing, remove the flask from the hot plate and cool to room temperature under tap water. Add 100 ml of water and while cooling under tap water, add 40 ml of hydrochloric acid. Place on the hot plate again, reflux for 5 min and cool under tap water.

B-3.3 Transfer the sample quantitatively to a 1 litre separating funnel with the aid of a total of 150 ml of



All dimensions in millimetres.

FIG. 1 MOISTURE COLLECTION TRAP

water, followed by two 25 ml rinses with toluene. Shake, allow the layers to separate, and draw off the lower aqueous layers into a second 1 litre separating funnel. Extract with a third 50-ml portion of toluene. Draw off and discard the water layer. Combine the benzene extracts, and wash with three 50 ml portions of water. Measure the *p*H of the third water wash. If it is less than 3.8, repeat with a fourth water wash. Discard the wash waters.

B-3.4 Transfer the washed toluene extract to a weighed (to the nearest 0.001 g) 250-ml Erlenmeyer flask, with the aid of 25 ml of toluene. Evaporate the toluene on the steam bath, preferably with the aid of a gentle stream of inert gas to volume of approximately 20 ml. Add 5 ml of anhydrous ethyl alcohol and evaporate to dryness, to remove any water present by azeotropic distillation.

B-3.5 Cool and weigh to the nearest 0.001 g. To avoid oxidation, do not dry in an oven, also the retention of a small amount of toluene does not affect the final calculation.

B-3.6 Using an automatic pipette, accurately measure 50 ml of the esterification reagent into the flask. Connect the flask to the moisture collections trays and condenser, place on a hot plate heat to boiling and reflux for 20 min. At the end of heating period, allow the flask to cool somewhat, then remove and cool to room temperature.

B-3.7 Add 10 drops of thymol blue indicator solution and titrate with the alcoholic potassium hydroxide solution to a blue end-point.

B-3.8 Make a blank titration on 50 ml of the esterification solution, after refluxing in the same manner.

B-4 CALCULATION

B-4.1 In order to apply properly the esterification correction factors to the isolated rosin acids — fatty acids mixture, it is necessary first to calculate the percent of rosin acids in the dried toluene extract, and then to correct this value to the non-volatile sample basis.

Resin acids in dried toluene extract,
percent by mass $= [(A - B) N \times 30.24 \times 1.018] S - 0.3$
where

A = alcoholic potassium hydroxide solution required for titration of the sample, in ml;
B = alcoholic potassium hydroxide solution required for titration of blank, in ml;
N = normality of potassium hydroxide solution;
S = dried toluene extract, in g;
30.24 = molecular mass of abietic acid multiplied by 100 and divided by 1 000;
1.018 = experimentally determined factor to correct for slight esterification of resin acid; and
0.3 = experimentally determined factor to correct for unesterified fatty acids.

Rosin acids in alkyd vehicle,
non-volatile basis, percent $= (S \times Y)/(W \times T)$

where

S = mass of dried toluene extract, in g;
W = mass of original alkyd vehicle taken for analysis, in g;
T = non-volatile content of the vehicle, expressed as a decimal; and
Y = percent of resin acids in dried toluene extract.

NOTE — If it is desired to express the total rosin acids as commercial rosin, use 35.00 instead of 30.24 as the factor in the calculation.

ANNEX C

(*Clauses* 6.3.1.1, 6.3.1.2, 6.3.1.4 *and* 6.3.2)

TEST FOR DURABILITY

C-0 GENERAL

C-0.1 Outline of the Method

The durability of the material 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 the exposure by a suitable method of rating for various characteristics of the film of the material. Apart from this, the material is also evaluated by an accelerated weathering test wherein a prepared panel is subjected to controlled exposure to heat, light and water in the artificial weathering apparatus.

C-1 TEST PANELS

The panel shall be mild steel plate, 1.25 mm thick and free from surface defects, conforming to IS 513. Panels for the outdoor exposure test shall be 300 mm × 300 mm in size and for the accelerated weathering test 150 mm × 75 mm. The panels shall be cleaned as prescribed in IS 101 (Part 1/Sec 3) and the back and edges of the panels shall be protected with two coats of a suitable paint.

C-2 PREPARATION OF TEST PANELS

C-2.1 In the painting procedure outlined under **C-2.2**, the air drying of the film shall be done at temperature of 27 ± 2°C and at a relative humidity of 65 ± 5 percent.

C-2.2 The surface of the test panels to be exposed shall be prepared as follows, taking care that total dry film thickness (DFT) of the complete system shall be between 90 and 100 microns:

a) Apply one coat of ready mixed paint red oxide-zinc chromate (*see* IS 2074) by brushing to a minimum DFT of 25 microns and allow to air-dry for 24 h;
b) Rub down lightly with waterproof emery paper No. 280/320, wipe off the surface using a piece of clean and dry soft cloth and then apply by brushing one coat of the undercoating enamel conforming to this standard to a minimum DFT of 30 microns and allow to air-dry for 24 h;
c) Rub down, wet, with waterproof emery paper No. 280/320, wipe off the surface using a piece of clean and dry soft cloth and then apply by brushing one coat of the finishing enamel conforming to this standard to a minimum DFT of 20 microns and allow to air-dry for 24 h; and
d) Rub down, wet, with waterproof emery paper No. 280/320, wash and wipe off water and, when the surface is dry, apply by brushing a

second coat of the finishing enamel to a minimum DFT of 20 microns and allow to air-dry for 7 days before subjecting to exposure test.

NOTE — The primer, undercoat and the finishing enamels shall be from the same supplier.

C-3 NORMAL OUTDOOR EXPOSURE TEST

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

C-3.1 Expose in the open the test panels, prepared in the manner prescribed under **C-1** and **C-2** in duplicate at an angle of 45° facing south. Commence the exposure not earlier than the third week of January and not later than the first week of April.

C-3.1.1 Examine the condition of the exposed films at monthly, after 3 months, 6 months and 12 months for the following characteristics:

a) Gloss; and
b) Colour.

And after 12 months:

a) Checking, cracking and flaking;
b) Chalking; and
c) Spotting.

C-3.1.2 For the above examinations, wash the right hand half of the surface of the two test panels by pouring water and then wiping with a soft cloth or chamois leather (*see* IS 1017). Adequate time for cooling of the panels to room temperature shall be allowed prior to washing. Examine the same half of the test panels at each examination. As an aid in 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 test, examine the two halves of the test panels. The sample shall be considered satisfactory, if the material surface underneath as well as condition of the film in both the halves, the one washed periodically as well as the one washed only for the final examination is satisfactory by the method of evaluation described in **C-3.2**. Stray film failure, due to extraneous causes other than climate, shall be ignored.

C-3.2 Evaluation and Rating of Film Characteristics of Test Panel

C-3.2.1 The test panels before and after the specified periods of exposure tests shall be assessed for the various film characteristics as prescribed in **C-3.2.2** to **C-3.2.8**.

C-3.2.2 *Gloss*

Specular 60° head glossometer reading.

C-3.2.3 *Colour*

The colour of the test panel shall be compared against the stipulated shade as given in IS 5. The initial rating for a good colour match shall be 10. The colour retention on exposure shall be expressed and recorded as the abbreviation of the type of colour change followed by the numerical rating as given below:

Sl No.	*Numerical Value*	*Rating*	*Type of Colour Change*
(1)	(2)	(3)	(4)
i)	10	Good match	D-Darkening
ii)	9	Satisfactory	F-Fading
iii)	8 to7	Slight colour change	B-Blueing
iv)	6 to 5	Definite colour change	R-Reddening
v)	4 to 3	Bad colour change	Y-Yellowing
vi)	2 to 1	Very bad colour change	L-Loss of colour
vii)	0	Complete colour change	

C-3.2.4 *Freedom from Checking*

Freedom from checking shall be rated as 10 for no checking and 0 for most severe and complete checking. Intermediate ratings of 8, 6, 4 and 2 shall be done by matching with standard photographs.

C-3.2.5 *Freedom from Cracking*

Freedom from cracking shall be rated as 10 for no cracking and 0 for most severe and complete cracking. Intermediate ratings of 8, 6, 4 and 2 shall be done by matching with standard photographs.

C-3.2.6 *Freedom from Flaking*

Freedom from flaking shall be rated as 10 for no flaking and 0 for most severe and complete flaking. Intermediate ratings of 8, 6, 4 and 2 shall be done by matching with standard photographs.

C-3.2.7 *Freedom from Chalking*

Freedom from chalking shall be rated as 10 for no chalking and 0 for most severe and complete chalking. Intermediate ratings of 8, 6, 4 and 2 shall be done by matching with standard photographs.

C-3.2.8 *Freedom from Spotting*

Freedom from spotting shall be rated as follows:

Numerical Value	*Rating*
10	No spotting
9	Satisfactory
8-7	Slight spotting
6-5	Definite spotting
4-3	Bad spotting
2-1	Very bad spotting
0	Complete spotting

C-3.2.9 *Freedom from Blistering and Corrosion*

Freedom from blistering shall be rated as 10 for no blistering and 0 for complete failure in respect of blistering. Intermediate ratings for blister density F, M, MD, D (few, medium, medium-dense and dense) and blister sizes 8, 6, 4 and 2 shall be done by matching with standard photographs.

C-3.3 Evaluation of Exposed Films

C-3.3.1 The requirements of this test shall be taken to have been satisfied if performance in respect of the characteristics as noted in **C-3.2** is within the limits specified below:

Sl No.	*Characteristic*	*Exposure*	*Requirement*
(1)	(2)	(3)	(4)
i)	Gloss	After 3 months	The film shall have a minimum gloss retention of 55 percent of original value (except for colour categories 21, 22 and 23 where the minimum retention shall be 40 percent of the original)
		After 6 months	The film shall have a minimum gloss retention of 35 percent of original value (except for colour categories 21, 22 and 23 where the minimum retention shall be 25 percent and category 2 where retention shall be 50 percent of the original)
		After 12 months	The film shall have a minimum gloss retention of 20 percent of original value (except for colour categories 20, 21, 22 and 23 where the minimum gloss is not specified, for colour category 25 where it shall be 10 percent and for category 2 where retention shall be 50 percent of the original)
ii)	Colour	After 3 months	The film shall have a minimum rating of 8 (except for colour categories No. 12, 13, 14,16 and 27 where the minimum rating shall be 5)
		After 6 months	The film shall have a minimum rating of 6 (except for colour categories No. 12, 13, 14, 16 and 27 where the minimum rating shall be 4)
		After 12 months	The film shall have a minimum rating of 5 (except for colour categories No. 12, 13, 14, 16 and 27 where the minimum rating shall be 3)
iii)	Freedom from checking	After 12 months	Minimum rating of 8-7
iv)	Freedom from checking	After 12 months	Minimum rating of 9-8
v)	Freedom from flaking	After 12 months	Minimum rating of 10-9
vi)	Freedom from chalking	After 12 months	Minimum rating of 8-7
vii)	Freedom from spotting	After 12 months	Minimum rating of 7-6

C-3.3.2 *Freedom from Blisters and Corrosion*

The film shall remain generally free from blisters and the metal underneath shall show no sign of corrosion on exposure for 12 months. A few isolated blisters without any signs of corrosion underneath as well as one or two localized corrosion and/or rust spots shall not constitute a cause of failure.

C-3.4 Protection Against Corrosion

After exposure of the film is discontinued, examine for corrosion of the metal surface of the panel underneath by removing film at 5 different places, one in the centre and one each at 4 different places near the 4 corners about 50 mm away from the edges. The paint film shall be removed by solvent type paint remover. When the film is softened by the paint remover it shall be removed by gently rubbing with cotton swab or waste jute taking care to remove adhering film of primer and/or undercoating. After removal of the film, the exposed metal shall be covered by thick mineral oil or petroleum jelly. Localized corrosion and/or one or two rust spots shall not constitute a cause of failure. To satisfy the requirements of this standard, the metal surface shall be otherwise free from corrosion.

C-4 ACCELERATED WEATHERING TEST

C-4.1 Accelerated Weathering Apparatus

An artificial weathering apparatus of the xenon/QUV type for uniform and controlled exposure to the effects of heat, light and water.

C-4.2 Procedure

The panel for this test shall be prepared as described under **C-2.2**. Samples for registration shall be tested in duplicate in a suitable accelerated weathering apparatus (*see* **C-4.1**) and samples drawn from the bulk supply shall be tested in a similar manner. The exposed film shall be evaluated for gloss and various film properties as prescribed under **C-3.2**.

C-4.3 Evaluation of Exposed Films

The requirement of the test shall be taken to have been satisfied, if the performance in respect of the film characteristics as specified in **C-3.2** is within the limits specified below:

Sl No.	*Characteristic*	*Requirements*
(1)	(2)	(3)
i)	Gloss	The film shall have a minimum gloss retention of 50 percent of the original value
ii)	Colour	The film shall have a minimum rating of 8
iii)	Freedom from checking, cracking, flaking, chalking, spotting, blistering and corrosion	The film shall have a minimum rating of 8

ANNEX D

(*Clause* 6.4)

TEST FOR RESISTANCE TO ACID

D-0 GENERAL

D-0.1 Outline of the Method

A test panel coated with the enamel, after specified drying period, is immersed in a definite concentration of sulphuric acid for 24 h after which it is washed, dried and observed for performance.

D-1 PROCEDURE

Apply a coat of the finishing enamel, as specified under **2.2** of IS 101 (Part 6/Sec 1) on a 150 mm × 10 mm clean glass panel to give a dry film mass commensurate with the mass in kg/10 litres of the material. Protect the edges of the panel by applying a coat of wax. Allow the panel to air-dry in a horizontal position for 48 h under specified laboratory drying conditions [*see* IS 101 (Part 1/ Sec 3). Immerse the panel in a 2 percent (*m/v*) solution of concentrated sulphuric acid (relative density 1.84) (*see* IS 266) for 24 h at room temperature. Remove the panel, wash in running fresh water and allow to dry for an hour.

ANNEX E

(*Clause* 6.5)

TEST FOR RESISTANCE TO ALKALI

E-0 OUTLINE OF THE METHOD

The film of the material is tested with a solution of laundry soap followed by a solution of sodium carbonate, washed, dried and observed for performance.

E-1 PROCEDURE

E-1.1 Immerse a panel prepared as prescribed in Annex D in a 1 percent (*m/v*) solution of laundry soap (*see* Type 1 of IS 285) for half an hour at a temperature of 27 ± 2°C. Remove, wash in running water, dry for 1 h and examine the film and then subject it to test as prescribed under **E-1.2.**

E-1.2 Immerse the panel in a 2 percent (*m/v*) solution of sodium carbonate of analytical reagent grade (*see* IS 296) for half an hour at a temperature of 27 ± 2°C. Remove the panel, wash in running water, dry for 1 h and examine the film.

ANNEX F

[*Table* 2, *Sl No.* (xii)]

ACCELERATED STORAGE STABILITY TEST

F-1 PROCEDURE

F-1.1 Determine the viscosity of the paint at 27 ± 2°C and record the value in terms of efflux time.

F-1.2 Store 500 ml of the paint sample in a closed 500 ml container and keep at 60°C for 96 h. After the test duration, take out the container and allow it to cool to room temperature (27 ± 2°C) and then make the observations.

F-1.3 After the test, paint shall not gel, liver, curdle or change in efflux time by more than 20 percent of the original value and there shall be no evidence of seeding. The paint shall meet the drying time requirements and shall produce dry film that is uniform in appearance and free from streaking, mottling and seeding. Further, for finishing paint, change in gloss value shall not be more than 5 units from that of original value.

NOTE — Keep the paint sample in the oven and gradually increase the temperature to 60°C.

ANNEX G

(Foreword)

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